DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

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

Accredited by NBA

PERAMBALUR - 621212

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

B.Tech., INFORMATION TECHNOLOGY

CURRICULUM & SYLLABI

DEPARTMENT OF INFORMATION TECHNOLOGY

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

Discussed in BOS-4 meeting Dated: 12.08.2024 / IT Ratified & Approved in Academic Council

VISION AND MISSION OF THE INSTITUTUION

VISION

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

MISSION

M1 To develop eminent scholar with a lifelong, follow up of global standards by offering UG, PG and Doctoral Programmes.

M2 To pursue Professional and Career growth by collaborating mutually beneficial partnership with industries and higher institutes of research.

M3 To promote sustained research and training with emphasis on human values and leadership qualities.

M4 To contribute solutions for the need-based issues of our society by proper ways and means as dutiful citizen.

DEPARTMNET OF INFORMATION TECHNOLOGY

ABOUT THE DEPARTMENT

The department was established in the year 2001. It has highly qualified, committed, and research-oriented faculty members who share the mission and vision of the institution. The department was accredited by NBA in July 2024.

Inception in the year 2001, with the well-knit faculty demonstrating high professionalism puts the graduating engineers. The Department faculty members are specialized in software engineering, Data mining, Computer Networks, Soft Computing, Data Science, Network Security, Cyber Security, Big Data Analytics, Image Processing, we got autonomous status on 2020 and Re-accredited with 'A' Grade by NAAC. The curriculum is framed to cater to the requirements of both industry deployments for recent trends and research activities. Department got permanent affiliation from Anna University in the year 2012.

VISION

To cultivate ethical and knowledgeable IT professionals, researchers, and entrepreneurs while fostering excellence in Information Technology and related fields.

MISSION

M1 The department of Information Technology is committed to enhance students' knowledge and computing skills through state-of-the-art infrastructure.

M2 The department of Information Technology is committed to foster academic, employability, and research skills in Information Technology through innovative teaching methods

M3 The department of Information Technology is committed to motivate and equip students for higher education or entrepreneurial ventures through industry-institute interactions.

M4 The department of Information Technology is committed to cultivate leadership, professional communication skills, and ethical values through dedicated soft skills training for serving society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the B.Tech. in Information Technology program will:

PEO 1	Apply computing solutions to real-world problems in Information Technology (IT) and related interdisciplinary domains.
PEO 2	Pursue lifelong learning, staying updated in their profession, and acquiring additional qualifications to advance their career positions in the IT industry.
PEO 3	Demonstrate effective communication, interpersonal skills, and ethical conduct while collaborating in multidisciplinary settings, both as team members and leaders.

PROGRAM OUTCOMES (POs)

PO	Graduate Attribute
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**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.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**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.
PO5	**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.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**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.
PO12	**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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of B.Tech. program in Information Technology, the graduates will be able to:

PSO 1	Acquire appreciable knowledge in the areas of Programming languages, Web technologies, Database and Multimedia.
PSO 2	Design, develop and test application and research-oriented software to provide solutions to the Information Technology 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. Domain Knowledge	3	3	3	3	3	2	2				2	1	3	3
II. Career growth	2	2	2	2	3	3	3		3	3	3	3	3	3
III. Professional Behavior						3	3	3	3	3	2	2		

CURRICULUM OVERVIEW

Sl. No.	**Subject Area**	**Credits per semester**								**Credits Total**	**Percentage %**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1	Humanities and Social Sciences (HMS)	6	4	-	2	-	-	3	-	**15**	**9.0**
2	Basic Sciences (BS)	12	7	4	-	-	-	-	-	**23**	**13.9**
3	Engineering Sciences (ES)	5	7	3	-	-	-	-	-	**15**	**9.0**
4	Professional Core (PC)	-	5	15	19	10	13	8	-	**70**	**42.2**
5	Professional Elective (PE)	-	-	-	-	6	6	3	6	**21**	**12.7**
6	Open Elective (OE)	-	-	-	-	3	3	-	-	**6**	**3.6**
7	Employability Enhancement Courses (EEC)	-	2	-	-	-	-	3	10	**15**	**9.0**

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS), PERAMBALUR – 621 212
B.Tech. IT
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	HMS	3	0	0	45	3
3	U23MAT12	Matrices and Calculus	BS	3	1	0	60	4
4	U23PHT13	Physics for Engineers and Technologists	BS	3	0	0	45	3
5	U23CYT14	Chemistry for Engineering & Technology	BS	3	0	0	45	3
6	U23GET15	Problem Solving and PythonProgramming	ES	3	0	0	45	3
7	GE3152	தமிழர்மரபு / Heritage of Tamils	HS	1	0	0	15	1
PRACTICAL								
8	U23BSP11	Physics and Chemistry Laboratory	BS	0	0	4	60	2
9	U23GEP13	Problem Solving and Python ProgrammingLaboratory	ES	0	0	4	60	2
10	U23HSP12	English Laboratory	HMS	0	0	2	30	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	HMS	2	0	0	30	2
2	U23MAT22	Statistical and Numerical Methods	BS	3	1	0	60	4
3	U23PHT25	Physics for Information Sciences	BS	3	0	0	45	3
4	U23CST21	Programming in C	PC	3	0	0	45	3
5	U23EET23	Basic Electrical and Electronics Engineering	ES	3	0	0	45	3
6	U23ECT23	Digital Principles and SystemDesign	ES	3	1	0	60	4
7	GE3252	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	15	1
PRACTICAL								
8	U23CSP21	Programming in C Laboratory	PC	0	0	4	60	2
9	U23HSP22	Communication Laboratory	EEC	0	0	4	60	2

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MAT32	Discrete Mathematics	BS	3	1	0	60	4
2	U23ITT31	Computer Organization and Architecture	ES	3	0	0	45	3
3	U23ITT32	Data Structures	PC	3	0	0	45	3
4	U23ITT33	Database Management Systems	PC	3	0	0	45	3
5	U23ITT34	Object Oriented Programming	PC	3	0	0	45	3
PRACTICAL								
6	U23ITP31	Object oriented Programming Laboratory	PC	0	0	4	60	2
7	U23ITP32	Data Structures Laboratory	PC	0	0	4	60	2
8	U23ITP33	Database Management Systems Laboratory	PC	0	0	4	60	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	60	4
2	U23CST43	Operating System	PC	3	0	0	45	3
3	U23ITT43	Web Technologies	PC	3	0	0	45	3
4	U23CST44	Computer Networks	PC	3	0	0	45	3
5	U23GET41	Environmental Sciences and Engineering	HMS	2	0	0	45	2
PRACTICAL								
6	U23ITP41	Operating Systems Laboratory	PC	0	0	4	60	2
7	U23ITP42	Computer Networks Laboratory	PC	0	0	4	60	2
8	U23ITP43	Web Technology Laboratory	PC	0	0	4	60	2

SEMESTER V

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	45	3
2	U23CBT41	Foundations of Data Science	PC	3	0	0	45	3
3		Professional Elective - I	PE	3	0	0	45	3
4		Professional Elective - II	PE	3	0	0	45	3
5		Open Elective - I	OE	3	0	0	45	3
PRACTICAL								
7	U23CSP71	Cloud Computing Laboratory	PC	0	0	4	60	2
8	U23AIP42	Data Science Laboratory	PC	0	0	4	60	2

SEMESTER VI

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23ITT61	Big Data Analytics	PC	3	0	0	45	3
2	U23ITT62	Artificial Intelligence and Machine Learning	PC	3	0	0	45	3
3	U23CST64	Information Security	PC	3	0	0	45	3
4		Professional Elective - III	PE	3	0	0	45	3
5		Professional Elective - IV	PE	3	0	0	45	3
6		Open Elective - II	OE	3	0	0	45	3
PRACTICAL								
7	U23AIP52	Big Data Analytics Laboratory	PC	0	0	4	60	2
8	U23CSP42	Machine Learning Laboratory	PC	0	0	4	60	2

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CST62	Internet of Things	PC	3	0	0	45	3
2	U23GET61	Human Values and Ethics	EEC	2	0	0	30	2
3	U23ITT72	Software Engineering and Project Management	PC	3	0	0	45	3
4		Professional Elective - V	PE	3	0	0	45	3
5		Open Elective - Management	HMS	3	0	0	45	3
PRACTICAL								
6	U23CSP62	Internet of Things Laboratory	PC	0	0	4	60	2
7	U23ITP72	Mini Project	EEC	0	0	2	15	1

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Professional Elective - VI	PE	3	0	0	45	3
2		Professional Elective - VII	PE	3	0	0	45	3
PRACTICAL								
3	U23ITP81	Project Work	EEC	0	0	20	300	10

Verticals – I (Data Science)	Verticals – II (Full Stack Development of IT)	Verticals – III (Cloud Computing and Data Centre Technologies)	Verticals – IV (Cyber Security & Data Privacy)	Verticals – V (Creative Media)	Vertical – VI (Emerging Technologies)	Vertical – VII (Artificial Intelligence and Machine Learning)
Theory of Computation	Principles of Programming Languages	Data Warehousing	Digital and Mobile Forensics	Digital Marketing	Knowledge Engineering	Soft Computing
Neural Networks and Deep Learning	Advanced Java Programming	Cloud Virtualization	Internetworking with TCP/IP	Multimedia and Animation	Robotics Process Automation	Neural Networks and Deep Learning
Text and Speech Analysis	Full Stack Web Development	Cloud Services Management	Ethical Hacking	Video Creation and Editing	Quantum Computing	Text and Speech Analysis
Recommender Systems	UI and UX Design	Computational Bioinformatics	Modern Cryptography	UI and UX Design	Cyber Security	Augmented Reality/ Virtual Reality
Business Analytics	Software Testing and Automation	Storage Technologies	Cloud Security	Visual Effects	Optimization Techniques	Optimization Techniques
Computer Vision	Web Application Security	Software Defined Networks	Cryptocurrency and Blockchain Technologies	Game Development	Cryptocurrency and Blockchain Technologies	Cognitive Science
Social Network Security	DevOps	Stream Processing	Social Network Security	Multimedia Data Compression and Storage	3D Printing and Design	Ethics and AI
PredictiveAnalytics	Full Stack Mobile App Development	Security and Privacy in Cloud	Malware Analysis	Android Mobile Application Development	Game theory	Game theory

PROFESSIONAL ELECTIVE
VERTICALS – I (DATA SCIENCE)

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT51	Theory of Computation	PE	3	0	0	45	3
2	U23CSV13	Neural Networks and Deep Learning	PE	3	0	0	45	3
3	U23CSV14	Text and Speech Analysis	PE	3	0	0	45	3
4	U23CSV12	Recommender Systems	PE	3	0	0	45	3
5	U23CSV15	Business Analytics	PE	3	0	0	45	3
6	U23CSV17	Computer Vision	PE	3	0	0	45	3
7	U23CSV43	Social Network Security	PE	3	0	0	45	3
8	U23ITV18	Predictive Analytics	PE	3	0	0	45	3

VERTICALS – II (FULL STACK DEVELOPMENT OF IT)

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV28	Principles of Programming Languages	PE	3	0	0	45	3
2	U23ITV22	Advanced Java Programming	PE	3	0	0	45	3
3	U23ITV23	Full Stack Web Development	PE	3	0	0	45	3
4	U23CSV24	UI and UX Design	PE	3	0	0	45	3
5	U23CSV25	Software Testing and Automation	PE	3	0	0	45	3
6	U23CSV26	Web Application Security	PE	3	0	0	45	3
7	U23ITV27	DevOps	PE	3	0	0	45	3
8	U23ITV28	Full Stack Mobile App Development	PE	3	0	0	45	3

VERTICALS – 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	U23ITV31	Data Warehousing	PE	3	0	0	45	3
2	U23ITV32	Cloud Virtualization	PE	3	0	0	45	3
3	U23CSV23	Cloud Services Management	PE	3	0	0	45	3
4	U23ITV34	Computational Bioinformatics	PE	3	0	0	45	3
5	U23CSV34	Storage Technologies	PE	3	0	0	45	3
6	U23CSV35	Software Defined Networks	PE	3	0	0	45	3
7	U23CSV36	Stream Processing	PE	3	0	0	45	3
8	U23CBT73	Security and Privacy in Cloud	PE	3	0	0	45	3

VERTICALS – IV (CYBER SECURITY & DATA PRIVACY)

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23ITV41	Digital and Mobile Forensics	PE	3	0	0	45	3
2	U23ITV42	Internetworking with TCP/IP	PE	3	0	0	45	3
3	U23CBT63	Ethical Hacking	PE	3	0	0	45	3
4	U23CSV44	Modern Cryptography	PE	3	0	0	45	3
5	U23ITV45	Cloud Security	PE	3	0	0	45	3
6	U23CSV46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	45	3
7	U23CSV43	Social Network Security	PE	3	0	0	45	3
8	U23CBT81	Malware Analysis	PE	3	0	0	45	3

VERTICALS – V (CREATIVE MEDIA)

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV54	Digital Marketing	PE	3	0	0	45	3
2	U23CSV52	Multimedia and Animation	PE	3	0	0	45	3
3	U23AIV52	Video Creation and Editing	PE	3	0	0	45	3
4	U23CSV24	UI and UX Design	PE	3	0	0	45	3
5	U23CSV55	Visual Effects	PE	3	0	0	45	3
6	U23CSV56	Game Development	PE	3	0	0	45	3
7	U23CSV57	Multimedia Data Compression and Storage	PE	3	0	0	45	3
8	U23ITV57	Android Mobile Application Development	PE	3	0	0	45	3

VERTICALS – VI (EMERGING TECHNOLOGIES)

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	45	3
2	U23CSV61	Robotics Process Automation	PE	3	0	0	45	3
3	U23CSV64	Quantum Computing	PE	3	0	0	45	3
4	U23CSV63	Cyber Security	PE	3	0	0	45	3
5	U23ITV65	Optimization Techniques	PE	3	0	0	45	3
6	U23CSV46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	45	3
7	U23CSV66	3D Printing and Design	PE	3	0	0	45	3
8	U23ITV67	Game theory	PE	3	0	0	45	3

VERTICALS – 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	U23AIV13	Soft Computing	PE	3	0	0	45	3
2	U23CSV13	Neural Networks and Deep Learning	PE	3	0	0	45	3
3	U23CSV14	Text and Speech Analysis	PE	3	0	0	45	3
4	U23CSV51	Augmented Reality/ Virtual Reality	PE	3	0	0	45	3
5	U23ITV65	Optimization Techniques	PE	3	0	0	45	3
6	U23CSV58	Cognitive Science	PE	3	0	0	45	3
7	U23AIV56	Ethics and AI	PE	3	0	0	45	3
8	U23ITV67	Game theory	PE	3	0	0	45	3

OPEN ELECTIVES

COMMON TO ALL BRANCHES EXCEPT INFORMATION TECHNOLOGY

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
OPEN ELECTIVE I								
1	U23CST71	Cloud Computing	OE	3	0	0	45	3
2	U23CBT63	Ethical Hacking	OE	3	0	0	45	3
3	U23CSV52	Multimedia and Animation	OE	3	0	0	45	3
4	U23ITO14	Object Oriented Analysis and Design	OE	3	0	0	45	3
OPEN ELECTIVE II								
5	U23ITT72	Software Engineering and Project Management	OE	3	0	0	45	3
6	U23CST64	Information Security	OE	3	0	0	45	3
7	U23CSV46	Cryptocurrency and Blockchain Technologies	OE	3	0	0	45	3
8	U23CSV43	Social Network Security	OE	3	0	0	45	3

SEMESTER I

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

COURSE OBJECTIVES

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

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 communication in technical progression. Key characteristics of an effective communicator- listening, attitude modification, way of response with appropriate language and 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 JUDGEMENT9

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.

UNITV 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 would be able to:

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

TEXTBOOKS:

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. Aysha Viswamohan, "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.

NPTEL

https://onlinecourses.swayam2.ac.in/cec24_lg08/preview

U23MAT12	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

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

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

UNIT I MATRICES 12

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

UNIT II DIFFERENTIAL CALCULUS 12

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

UNIT III MULTIVARIABLE CALCULUS 12

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

UNIT IV MULTIPLE INTEGRAL AND THEIR APPLICATIONS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

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

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

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

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

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

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

TEXTBOOKS:

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 Manicavacsagam 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 (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 for:

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

UNIT I ELASTICITY 9

Introduction- Elasticity - plasticity– Hooke's law - relationship between three Modulii of elasticity (Qualitative) – stress & strain diagram and its uses -Poisson's ratio - factors affecting elasticity - twisting couple of wire - Torsion Pendulum: theory and experiment. Beam: Internal bending moment – Cantilever: theory and experiment – Young's Modulus: uniform and non – uniform bending (Qualitative) – I-shaped girders- advantages and applications.

UNIT II ULTRASONICS 9

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

UNIT III MODERN PHYSICS 9

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

UNIT IV LASERS 9

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

UNIT V FIBER OPTICS AND APPLICATIONS 9

Optical Fiber: Structure - advantages- Principle [TIR]–Propagation Phenomena in optical fiber - Expression for Acceptance Angle and Numerical Aperture – Relation between Refractive Index of Core, Numerical Aperture and Fractional Index Change – Fabrication: Double Crucible Method -Types: Material, Mode, Refractive Index - Applications: Optical Fiber Communication System – fiber optic sensors (Displacement and pressure sensors) – Medical Endoscope.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXTBOOKS:

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” II Edition, Springer, 2010.
4. D.K. Bhattacharya, Poonam Tandon,” Engineering Physics”, Oxford HED Publishers, 2017.

REFERENCE BOOKS:

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

NPTEL Link

https://onlinecourses.swayam2.ac.in/nou25_ma02/preview

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

COURSE OBJECTIVES

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

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. Tofamiliarize 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 demineralisation 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, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2 emission and carbon foot print.

UNITV Energy Sources and Storage devices 9

Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; Electric vehicles-working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

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

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

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

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

CO6: Have the knowledgeof different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

COURSE OBJECTIVES

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

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

UNITV 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 would be able to

CO1: Describe algorithmic solutions to simple computational problems
CO2: Write and execute simple Python programs
CO3: Illustrate simple Python programs using conditionals and loops for solving problems
CO4: Explain the Concept of Files and exceptions
CO5: Apply simple Python programs for Read and write data from/to files in Python programs
CO6. Explain the concept of exceptions and handling

TEXTBOOKS:

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.

NPTEL Link

https://onlinecourses.swayam2.ac.in/cec25_ma02/preview

GE3152	தமிழர் மரபு/ HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India – Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE – ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

UNITV CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

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

TOTAL: 15 PERIODS

REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi – Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text book and Educational Services Corporation, Tamil Nadu)

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

COURSE OBJECTIVES

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

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 metry conductometry in the determination of impurities in aqueous solutions.

LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

COURSE OUTCOMES:

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

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

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

COURSE OBJECTIVES

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

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

LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs
CO3: Build programs in Python using conditionals and loops for solving problems
CO4: Apply functions to decompose a Python program
CO5: Construct compound data using Python data structures
CO6: Utilize Python packages in developing software applications

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 for:

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 to 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 predictions 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.	Headphone	**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 would be able to

CO1: Identify and comprehend complex academic texts.

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

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

CO4: Plan travelogue and construct paragraphs on various aspects.

CO5: Develop journal reading skills and small talk.

CO6: Utilizing technical terms and making power point presentations.

SEMESTER-II

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

COURSE OBJECTIVES

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

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 LECTURA 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 onesfavourite 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).

UNITV 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 would be able to

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

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

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

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

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

CO6: Making the students become virtuous presenters.

TEXTBOOKS:

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

REFERENCE BOOKS:

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

U23MAT22	STATISTICS AND NUMERICAL METHODS (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

1. This course aims at providing the necessary basic concepts of a few statistical tools and give procedures for solving different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of classifications of design of experiments in the field of agriculture.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 12

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

UNIT II DESIGN OF EXPERIMENTS 12

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

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

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

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1: Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2: Apply the basic concepts of classifications of design of experiments in the field ofagriculture.

CO3: Solve the algebraic and transcendental equations.

CO4: Understand the knowledge of numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering
problems.

CO5: Solve the ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

CO6: Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

COURSE OBJECTIVES

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

1. To make the students to understand the basics of crystallography and its importance in studying materials properties.
2. Toinstallknowledgeonphysicsofsemiconductors,determinationofchargecarriersanddevice applications.
3. To inculcate an idea of significance of new materials, nanostructures ensuing nano device applications.

UNIT I CONDENSED MATTER PHYSICS 9

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

UNIT II PHYSICS OF SEMICONDUCTOR 9

Introduction – Properties - IntrinsicSemiconductors–EnergyBandDiagram–DirectandIndirectBandGapSemiconductors–CarrierConcentrationinIntrinsicSemiconductors–ExtrinsicSemiconductors - Carrier Concentration in N-Type & P-Type Semiconductors – Variation ofCarrier Concentration with Temperature – Carrier Transport in Semiconductors: Drift, MobilityAndDiffusion– Hall EffectAndDevices.

UNIT III MODERN ENGINEERING MATERIALS 9

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

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

UNIT IV OPTOELECTRONICS AND DEVICES 9

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

UNIT V DIELCTRIC MATERIALS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Knowbasics ofcrystallographyanditsimportancefor variedmaterials properties.

CO2: Acquireknowledgeonbasicsof semiconductorphysics anditsapplicationsinvariousdevices.

CO3: Illustrate the SMA and metallic glasses.

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

CO5: Explain types of polarization and its mathematical expression

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

TEXT BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. G.W.Hanson.FundamentalsofNanoelectronics.PearsonEducation(IndianEdition),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.

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

COURSE OBJECTIVES

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

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 would be able to

CO1: Demonstrate knowledge on C Programming constructs
CO2: Implement small programming applications using arrays and strings
CO3: Implement modular applications in C using functions and pointers
CO4: Write programs in C using structures and unions
CO5: Illustrate sequential and random-access file processing using C program.
CO6: Explain the concept of Command line arguments

TEXT BOOKS:

1. ReemaThareja, "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.

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 for:

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, Instantaneouspower, real power, reactive power and apparent power, power factor – Steady state analysis of RLCcircuits (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)

UNITV 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 would be able to

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

TEXTBOOKS:

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

U23ECT23	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

1. Todesigndigitalcircuitsusingsimplified Booleanfunctions
2. Toanalyzeanddesign combinationalcircuits
3. Toanalyzeand designsynchronousandasynchronoussequentialcircuits
4. To understandProgrammableLogicDevices
5. Towrite HDL codeforcombinationaland sequentialcircuits

UNIT I BOOLEANALGEBRAANDLOGICGATES 12

NumberSystems -Arithmetic Operations-BinaryCodes-BooleanAlgebraandLogic Gates - Theorems andProperties ofBooleanAlgebra-BooleanFunctions-CanonicalandStandard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NANDandNORImplementations.

UNIT II COMBINATIONALLOGIC 12

Combinational Circuits – Analysis and Design Procedures – Binary Adder– Subtractor – DecimalAdder– MagnitudeComparator– Decoders –Encoders–Multiplexers – Demultiplexer.

UNIT III SYNCHRONOUSSEQUENTIALLOGIC 12

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

UNIT IV ASYNCHRONOUSSEQUENTIALLOGIC 12

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and FlowTables–Race freeStateAssignment–Hazards – Essential Hazards– Design of Hazard free circuits.

UNIT V MEMORYAND PROGRAMMABLELOGIC 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- **CO1:** SimplifyBooleanfunctionsusingKMap
- **CO2:** Explain the design and working of combinational circuits such as adders, comparators, decoders, and multiplexers.
- **CO3:** Describe the operation of flip-flops, counters, and shift registers in synchronous sequential circuits.
- **CO4:** Discuss the principles of asynchronous sequential circuit design and methods to avoid hazards.
- **CO5:** Illustrate the functions and applications of memory devices like RAM, ROM, PROM, and EEPROM.
- **CO6:** Summarize the structure and usage of programmable logic devices and programmable logic arrays.

TEXTBOOKS:

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

REFERENCE BOOKS:

1. John F.Wakerly,DigitalDesign PrinciplesandPractices,Fifth Edition,PearsonEducation,2017.
2. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition,CENGAGELearning,2013
3. DonaldD.Givone,DigitalPrinciplesandDesign,TataMcGrawHill,2003.

GE3252	தமிழரும்தொழில்நுட்பமும்/ 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 goldCoins as source of history – Minting of Coins – Beads making-industries Stone beads -Glass beads – Terracotta beads -Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu 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.

UNITV 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

REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi – Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department ofArchaeology& Tamil Nadu Textbook and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Textbookand Educational Services Corporation, Tamil Nadu)

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

COURSE OBJECTIVES

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

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

LIST OF EXPERIMENTS

1. I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion.
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers.
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	INTELbaseddesktopPCwithmin.8GBRAMand500 GBHDD,17”orhigherTFTMonitor,Keyboardandmouse	30
2.	Windows10 orhigheroperatingsystem/LinuxUbuntu20or higher	30
3.	DevC /EclipseCDT/CodeBlocks/CodeLite/equivalent opensourceIDE	30

COURSE OUTCOMES:

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

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

U23HSP22	COMMUNICATION LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

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	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 would be able to:

- **CO1 :** Distinguish their technical competency through language skill.
- **CO2 :** Predict context effectively in-group discussions held in a formal / semi-formal discussions.
- **CO3:** Understanding candidates' key characteristics.
- **CO4:** Finding personality traits by sharing and comparing thoughts and ability.
- **CO5:** Understanding the value of ethics(rules and regulations).
- **CO6:** Construct emails and effective job applications**.**

SEMESTER III

U23MAT32	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

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

UNIT I LOGIC AND PROOFS 12

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

UNIT II COMBINATORICS 12

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

UNIT III GRAPHS 12

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

UNIT IV ALGEBRAIC STRUCTURES 12

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

UNITV LATTICES AND BOOLEAN ALGEBRA 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the concept of elementary mathematical logical arguments.
CO2 : Apply basic counting techniques to solve combinatorial problems.
CO3: Identify the applications of Graph theory models and data structures.
CO4: Explain the concepts and properties of algebraic structures such as groups, rings and fields.
CO5: Extend the concepts of Boolean algebra in the area of lattices.
CO6: Apply the knowledge of argumental discrete mathematical problems.

TEXTBOOKS:

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.

U23ITT31	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To 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–Uni processors to multiprocessors; Instructions – operations and operands – representing instructions– Logical operations–control operations–Addressing and addressing modes

UNIT II ARITHMETIC OPERATIONS 9

ALU-Additionandsubtraction–Multiplication–Division–FloatingPointoperations–Subword 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

UNIT V MEMORYAND I/O SYSTEMS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics structure of computers, operations and instructions
CO2: Explain the design concepts of arithmetic and logic unit
CO3: Apply pipelined control units and the different types of hazards in the instructions
CO4: Interpret the concepts of parallel processing architectures
CO5: Summarize the fundamentals of memory system
CO6: Explain the concepts of I/O system

TEXTBOOKS:

1. David A. Patterson and JohnL.Hennessey, "Computer organization and design, Morgan Kauffman Elsevier, Fifth edition, 2014.
2. Structured Computer Organization, Andrew S.Tanenbaum "Structured Computer Organization" sixth Edition 2021.

REFERENCE BOOKS:

1. Carl Hamacher. V, Zvonko G.Varanesic and Safat G.Zaky, "Computer Organization ", 6th edition, Mc Graw-Hill Inc,2012.
2. William Stallings "Computer Organization and Architecture", 11th Edition, Pearson Education, 2006.
3. Vincent P.Heuring, Harry F.Jordan, "Computer System Architecture", 2nd Edition, Pearson Education, 2005.
4 Govindarajalu," Computer Architecture and Organization, Design Principles and Applications",1st edition, Tata McGraw Hill, NewDelhi,2005.

U23ITT32	DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I INTRODUCTION AND LINEAR DATA STRUCTURE – LIST 9

Introduction to Data structure, 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–RadixSort–Multilists.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues

UNIT III NON-LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

UNIT IV NON-LINEAR DATA STRUCTURES - GRAPHS 9

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

UNITV SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching–LinearSearch–BinarySearch.Sorting–Bubblesort–Selectionsort–Insertionsort– Shellsort –MergeSort–Hashing–HashFunctions–SeparateChaining–OpenAddressing– Rehashing– Extendible Hashing

TOTAL:45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be ableto

CO1: Describe linear data structures using array and linked list.
CO2: Apply various operations like stacks, queues in linear data structure.
CO3: Demonstrate non-linear data structures tree and its application.
CO4: Apply various algorithms and operations in graph
CO5: Apply searching, sorting and hashing techniques in data structures.
CO6: Interpret sorting algorithms for a given problem.

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition, Oxford University Press, 2011.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms",Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
3. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008

U23ITT33	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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 – Multiversion – 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.

UNITV ADVANCED TOPICS 9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1 : Construct SQL Queries using relational algebra.

CO2 : Design database using ER model and normalize the database

CO3: Construct queries to handle transaction processing and maintain consistency of the database

CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database

CO5: Outline the various storage and optimization techniques.

CO6: Explain the different advanced databases.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

U23ITT34	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I INTRODUCTION TO OOP AND JAVA 9

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

UNITV JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- **CO1:** Apply the concepts of classes and objects to solve simple problems
- **CO2:** Develop programs using inheritance, packages and interfaces.
- **CO3:** Make use of exception handling mechanisms and multithreaded model to solve real world problems
- **CO4:** Build Java applications with I/O packages, string classes, Collections and generics concepts
- **CO5:** Integrate the concepts of event handling
- **CO6:** Integrate JavaFX components and controls fordeveloping GUI based applications

TEXT BOOKS:

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

REFERENCE BOOKS:

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

U23ITP31	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

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

LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an 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 funds. Generate pay slips for the employees with their gross and net salary.
4. 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.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions
7. 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, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	Personal Computer	**30**
2.	Software: C / C++ / Equivalent complier	**30**

COURSE OUTCOMES:

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

- **CO1:** Design and develop java programs using object-oriented programming concepts
- **CO2:** Design Interfaces and develop application using Interfaces
- **CO3:** Develop simple applications using object-oriented concepts such as package, exceptions
- **CO4:** Implement multithreading, and generics concepts
- **CO5:** Create GUIs and event driven programming applications for real world problems
- **CO6:** Develop applications using generic programming and event handlings.

U23ITP32	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

1. To implement Linear and Non–Linear Data Structures
2. To understand the different Operations of SearchTrees
3. To implement Graph Traversal Algorithms
4. To get familiarized to Sorting and Searching Algorithms.

LIST OF EXPERIMENTS

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
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. Hashing–any two collision techniques.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	**Personal Computer**	**30**
2.	**Software: C / C++ Equivalent complier**	**30**

COURSE OUTCOMES:

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

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

U23ITP33	DATABASE MANAGEMENT SYSTEM LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to:

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.
6. To learn and implement important commands inSQL.

LIST OF EXPERIMENTS

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features
13. Case Study using any of the real life database applications from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management
    c) Cop Friendly App – Eseva
    d) Property Management – eMall
    e) Star Small and Medium Banking and Finance
    - Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
    - Apply Normalization rules in designing the tables in scope.
    - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
    - Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
    - Ability to showcase ACID Properties with sample queries with appropriate settings

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity
1.	Personal Computer	**30**
2.	Software: MYSQL/Oracle RDBMS and Equivalent complier	**30**

COURSE OUTCOMES:

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

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

SEMESTER IV

U23CST41	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

1. To understand and apply 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: Then a ïvestring-matchingalgorithm-Rabin-Karpalgorithm-Knuth-Morris-Prattalgorithm.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 would be able to

CO1: Analyze the efficiency of algorithms using various frameworks

CO2: Apply graph algorithms to solve problems and analyze their efficiency.

CO3: Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.

CO4: Make use of state space tree method for solving problems.

CO5: Solve problems using approximation algorithms and randomized algorithms.

CO6. Understand the concept of NP, NP- Complete and NP Hard Problems

TEXT BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, RonaldL.Rivestand Clifford Stein,"Introductionto Algorithms",3rd Edition,PrenticeHallofIndia,2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran – Computer Algorithms / C++‖ Orient Blackswan, 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.

U23CST43	OPERATING SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To 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.

UNITV 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 would be able to

CO1: Explain the overall view of the computer system and operating system
CO2 : Apply various scheduling algorithm to avoid and prevent deadlock
CO3: Compare and contrast various memory management schemes
CO4: Explain the functionality of file systems, I/O systems, and Virtualization.
CO5: Understand the building blocks of virtual machines and explain the virtualization
CO6: Compare iOS and Android OS

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", 7th Edition, Prentice Hall, 2018.

REFERENCE BOOKS:

4. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

U23ITT43	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I WEBSITE BASICS 9

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

UNIT II WEB DESIGNING 9

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

UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING 9

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

UNIT IV TYPESCRIPT 9

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

UNITV INTRODUCTION TO ANGULAR AND WEB APPLICATIONS FREAMEWORKS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Create simple Website by understand the basics

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

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

CO4: Demonstrate simple web pages using Typescript

CO5: Illustrate Servlets in web applications

CO6: Create simple database applications.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

U23CST44	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To 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

UNITV 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 would be able to

CO1: Learn Domain Name System and SNMP in the network

CO2: Compare the different transport layer protocols and their applicability based on user requirements

CO3: Understand the different services of network layer

CO4: Explain the concept of Routing and protocols

CO5: Explain how data flows from one node to another node with regard to data link layer

CO6: 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.

U23GET41	ENVIRONMENTAL SCIENCES AND ENGINEERING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

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

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 ECOSYSTEM AND BIODIVERSITY 9

Definition, Scope and importance of environment – Need for public awareness. Ecosystem Types 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.

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.

UNITV SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Development, GDP, Sustainability- 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-economic and technological change.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand a comprehensive understanding of the worlds biodiversity and the importance of its conservation.

CO2: Discover knowledge in ecological perspective and value of environment

CO3: Categorize different types of pollutions and their control measures.

CO4: Understand the significance of various natural resources and its management.

CO5: Learn global environmental problems and come out with best possible solutions.

CO6: Understand environmental laws and sustainable development.

TEXTBOOKS:

1. Benny Joseph, ‘ Environmental Science and Engineering ’ , Tata Mc Graw-Hill, New Delhi,2016.
2. Gilbert M. Masters, ‘ Introduction to Environmental Engineering and Science’ , 2nd edition, Pearson Education, 2004.
3. Allen, D. T. and Shonnard, D.R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
4. J. Manivel and A. Arunkumar, “ Environmental Science & Engineering ” R.K. Publishers, 1st Edition 2023

REFERENCE BOOKS:

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

U23ITP41	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

1. To learn Unix commands and shell programming
2. To implement various CPU Scheduling Algorithms
3. To implement Process Creation and Inter Process Communication.
4. To implement Deadlock Avoidance and Deadlock Detection Algorithms
5. To implement Page Replacement Algorithms
6. To implement File Organization and File Allocation Strategies

LIST OF EXPERIMENTS

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
    a) First Fit b) Worst Fit c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms
    a) FIFO b) LRU c) LFU
14. Implementation of the various File Organization Techniques
15. Implementation of the following File Allocation Strategies
    a) Sequential b) Indexed c) Linked

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	Hardware: Stand alone desktops	30
2.	Software: C / C++ / Java / Equivalent complier	30

COURSE OUTCOMES:

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

CO1: Illustrate the various CPU scheduling algorithms.
CO2: Apply deadlock avoidance and detection algorithms.
CO3: Implement semaphore concepts.
CO4: Create processes and implement IPC.
CO5: Analyze the performance of the various Page Replacement Algorithms
CO6: Implement File Organization and File Allocation Strategies

U23ITP42	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

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 tcp dump, netstat, ifconfig, ns look up and trace route.
2. Capture ping and trace route PDUs using a network protocol analyzer and examine.
3. HTTP web client program to download a web page using TCP sockets.
4. Applications using TCP sockets: like
   - Echo client and echo server
   - Chat
   - File Transfer
5. Simulation of DNS using UDP sockets.
6. Code simulating ARP/RARP protocols.
7. Study of Network simulator (NS)and Simulation of Congestion Control Algorithms using NS.
8. Study of TCP/UDP performance using Simulation tool.
9. Simulation of Distance Vector/Link State Routing algorithm.
10. Performance evaluation of Routing protocols using Simulation tool.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	Hardware: Standalone desktops	30
2.	Software: Network simulator like NS2/Glomo sim/OPNET/Packet Tracer /Equivalent	30

COURSE OUTCOMES:

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

CO1: Implement various protocols using TCP and UDP.
CO2: Compare the performance of different transport layer protocols.
CO3: Use simulation tools to analyze the performance of various network protocols.
CO4: Analyze various routing algorithms.
CO5: Implement error correction codes
CO6: Explain Network simulator (NS) and Simulate Congestion Control Algorithms using NS.

U23ITP43	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

1. To design interactive web pages using Scripting languages.
2. To learn server-side programming using servlets and JSP.
3. To develop web pages using XML/XSLT.

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML.
   - To embed an image map in a web page.
   - To fix the hot spots.
   - Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client-Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
   - To invoke servlets from HTML forms.
   - Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
   - For conducting on-line examination.
   - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Database.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity
1.	Hardware: Stand alone desktops	30
2.	Software: Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30

COURSE OUTCOMES:

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

CO1: Design simple web pages using mark-up languages like HTML and CSS

CO2: Create dynamic web pages using DHTML and java script that is easy to navigate and use.

CO3: Develop Program server-side web pages that have to process request from client side web pages.

CO4: Develop web data using XML and web pages using JSP.

CO5: Understand various web services and how these web services interact.

CO6: Develop web service using real-world scenario

SEMESTER – V

		L	T	P	C
U23CST71	**CLOUD COMPUTING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To understand the principles of cloud architecture, models and infrastructure
- To understand the concepts of virtualization and virtual machines
- To gain knowledge about virtualization Infra structure.
- To explore and experiment with various Cloud deployment environments.
- 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: Understand the concept of virtualization and its types.
CO3: Experiment with virtualization of hardware resources and Docker
CO4: Learn and deploy services on the cloud and set up a cloud environment
CO5: Explain security challenges in the cloud environment.
CO6: Illustrate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXTBOOKS:

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.

NPTEL LINK:

https://onlinecourses.nptel.ac.in/noc24_cs17/preview

U23CBT41	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce data science, its process, and key concepts.
- To explore data types, variables, and statistical descriptions.
- To study correlation, regression, and variable relationships.
- To learn data wrangling with Python libraries like Numpy and Pandas.
- To explore data visualization using Matplotlib, Seaborn, and Basemap.

UNIT I INTRODUCTION 9

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

UNIT II DESCRIBING DATA 9

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

UNIT III DESCRIBING RELATIONSHIPS 9

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

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9

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

UNIT V DATA VISUALIZATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Define the data science process.

CO2: Gain knowledge on relationships between data.

CO3: Explain the concepts of correlation and regression, including how to interpret scatter plots and the correlation coefficient

CO4: Use NumPy and Pandas for effective data manipulation and analysis.

CO5: Understand applying visualization Libraries in Python to interpret and explore data.

CO6: Use three-dimensional plotting data for data visualization.

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I).
2. RobertS.WitteandJohnS.Witte,"Statistics",EleventhEdition,WileyPublications,2017. (Units II and III).
3. JakeVanderPlas,"PythonDataScienceHandbook",O'Reilly,2016.(UnitsIVand V).

REFERENCE BOOKS:

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

NPTEL LINK:

https://onlinecourses.swayam2.ac.in/imb25_mg23/preview

U23CSP71	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

- To practice installing and configuring virtual machines with different OS flavors.
- To set up a C compiler in virtual machines and run simple programs.
- To create and launch web applications using Google App Engine.
- To simulate cloud scenarios and implement custom scheduling algorithms in Cloud Sim.
- To transfer files between virtual machines and use OpenStack for VM launch.

LIST OF EXPERIMENTS

1. Install Virtual box/VMware Workstation with different flavors of Linux or windows OS on top ofwindows7or8.
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 web applications.
5. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
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 try stack (Online Open stack Demo Version).
8. Install Hadoop single nodecluster and run simple applications like word count.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT / SOFTWARE FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	NTEL 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 would be able to

CO1: Configure various virtualization tools such as Virtual Box and VMware workstation.
CO2: Design and deploy a web application in a PaaS environment.
CO3: Learn how to simulate a cloud environment to implement new schedulers.
CO4: Install and use a generic cloud environment that can be used as a private cloud.
CO5: Manipulate large data sets in a parallel environment.
CO6: Install and use a single node cluster and run multiple applications.

U23AIP42	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

- To understand the techniques and processes of data science
- To apply descriptive data analytics
- To visualize data for various applications
- To understand inferential data analytics
- To analysis and build predictive models from data

LIST OF EXPERIMENTS

1. Study of Basic function in Excel
2. Study of Basic Data Science Libraries in Python
3. Working with Range Names and Tables
4. Cleaning Data with Text Functions
5. Cleaning Data containing Data Values
6. Working with VLOOKUP functions and Pivot Table.
7. Demonstration of Data Visualization in Excel.
8. Demonstration of Data Visualization in Python.
9. Importing Data from External Source Using Excel & Python
10. Creating a data model
11. Create a dashboard for a given requirement
12. Implement a data analytics for the real time data set

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Standalone Desktop	**30**
2.	Microsoft Excel	**30**
3.	Python 3	**30**

COURSE OUTCOMES:

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

CO1: Understand the real-world data and information.
CO2: Apply data science using excel & Python.
CO3: Design of mathematical model for problem solving
CO4: Interpret various tools and its advantages.
CO5: Illustrate the different opportunities in industries.
CO6: Apply data modelling for real-world applications.

SEMESTER – VI

		L	T	P	C
U23ITT61	**BIG DATA ANALYTICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To introduce big data concepts, storage, and high-performance architecture.
- To explore clustering and classification techniques like K-means and decision trees.
- To study association rules and collaborative recommendation systems.
- To understand stream memory concepts and real-time analytics applications.
- To explore NoSQL databases for big data management and data visualization using R.

UNIT I INTRODUCTION TO BIG DATA 9

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Use Cases- Perception & Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model.

UNIT II CLUSTERING AND CLASSIFICATION 9

Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions- Decision Trees - Overview of a Decision Tree - The General Algorithms& Evaluation Decision Trees in R - Bayes‘ Theorem - Naïve Bayes Classifier.

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV STREAM MEMORY 9

Introduction to Streams Concepts–Stream Data Model and Architecture-Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimatingmoments–CountingonenessinaWindow–DecayingWindow–Realtime Analytics Platform (RTAP) applications–Case Studies Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics.

UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9

NoSQL Databases: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding - Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize the evolution, characteristics, and technologies of big data analytics.

CO2: Explain the principles of various clustering and classification methodsand apply these techniques to real-world use cases

CO3: Understand different mining algorithms and recommendation systems for large volumes of data.

CO4: Perform analytics on data streams.

CO5: Illustrate NoSQL databases and management.

CO6: Illustrate statistical analysis and data visualization in R.

TEXTBOOKS:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2nd Edition 2014.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRCPress LLC, 2004.
2. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.
3. Dietmar Jannachand Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

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

COURSE OBJECTIVES

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

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

UNIT I PROBLEM SOLVING 9

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

UNIT II PROBABILISTIC REASONING 9

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

UNIT III SUPERVISED LEARNING 9

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

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

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

UNIT V NEURAL NETWORKS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

NPTEL LINKS:

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

U23CST64	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce information security concepts, models, and the security SDLC.
- To explore security investigation, business needs, and legal/ethical issues in security.
- To study risk management, access control mechanisms, and the confinement problem.
- To understand security policy, standards, and design for continuity.
- To explore physical security technologies, cryptography, and access control devices.

UNIT I INTRODUCTION 9

History, What is Information Security? Critical Characteristics of Information, NSTISSCSecurity 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/BS7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNITV 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 would be able to

CO1: Discuss the basics of information security.
CO2: Illustrate the legal, ethical and professional issues in information security.
CO3: Explain the basics of risk assessment and control.
CO4: Describe various security models, standards and frameworks.
CO5: Illustrate the tools that are used for security analysis.
CO6: Explain the access control mechanisms to safeguard information systems and prevent unauthorized access.

TEXTBOOKS:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2021.
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.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/cec22_cs15/preview

U23AIP52	BIG DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

- To implement Map Reduce programs for processing big data.
- To realize storage of big data using MongoDB.
- To analyze big data using machine learning techniques such as Decision tree classification and clustering

LIST OF EXPERIMENTS

1. Install,configureandrunpython, numPyandPandas.
2. Install, configureandrunHadoopandHDFS.
3. Visualize data using basic plotting techniques in Python.
4. Implement NoSQL Database Operations: CRUD operations, Arrays using Mongo DB.Implement Functions: Count–Sort–Limit–Skip–Aggregate using MongoDB.
5. Implement word count/frequency programs using Map Reduce.
6. Implement a Map Reduce program that processes a dataset.
7. Implement clusteringtechniquesusingSPARK.
8. Implement an application that stores big data in MongoDB/Pig using Hadoop/R

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Processbigdatausing Hadoopframework

CO2: Buildandapplylinearandlogisticregressionmodels.

CO3: Performdataanalysiswithmachinelearningmethods.

CO4: ApplyvariousNoSQLdatabaseoperations.

CO5: BuildapplicationsusingMongoDB.

CO6: Developapplicationsusing clusteringtechniques.

U23CSP42	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark datasets.
- To apply correlation and regression analytics on standard datasets.
- To present and interpret data using visualization packages in Python.
- Students will develop the ability to build and assess data

LIST OF EXPERIMENTS

1. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis basedon 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 dataset stored as a.CSVfile.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 ina.CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of the set wo 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 there is data set. Print both correct and wrong predictions. Java/Python ML library classes can be usedforthisproblem.
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

SlNo	Name of the Equipment / Software	Quantity
1.	INTEL based desktop PC with min.8GB RAM and 500 GBHDD, 17‖orhigher TFT Monitor, Keyboard and mouse.	30
2.	Windows10 or higher operating system/Linux Ubuntu 20 or higher	30
3.	Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh	
4.	Python3.9 or later, Anaconda Distribution, python editors, Jupyter/ PyCharm/equivalent	

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

CO1: Understandtheimplementationproceduresforthemachinelearningalgorithms.
CO2: Design Java/Python programs for various Learning algorithms.
CO3: Apply appropriate data sets to the Machine Learning algorithms
CO4: Apply Machine Learning algorithms to solve real world problems
CO5: Apply k-Nearest Neighbor algorithm to classify their is data set.
CO6: Apply non-parametric Locally Weighted Regression algorithm

SEMESTER – VII

		L	T	P	C
U23CST62	**INTERNET OF THINGS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To Identify the various IoT elements appropriate to the applications
- To Design a portable IoT using Arduino/Raspberry Pi incorporating cloud and analytics
- To understand the Elements of IOT
- To Learn about IoT Communication Models
- 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, "Internet of Things–Architecture and Design Principles", Mc Graw 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.

NPTEL Course

1. https://onlinecourses.nptel.ac.in/noc24_cs35/preview

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

COURSE OBJECTIVES

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

- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students' minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES **6**

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.
Reading Text: Excerpts from John Stuart Mills' On Liberty

UNIT II SECULAR VALUES **6**

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani.

UNIT III SCIENTIFIC VALUES **6**

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.
Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

UNIT IV SOCIAL ETHICS **6**

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.
Reading Text: Excerpt from 21 Lessons for the 21st Century by Yuval Noah Harari

UNIT V SCIENTIFIC ETHICS **6**

Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.
Reading Text: Excerpt from American Prometheus: The Triumph and Tragedy of J.Robert Oppenheimer by Kai Bird and Martin J. Sherwin.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand key democratic values like equality, freedom, and citizen participation in governance.

CO2: Comprehend secularism and religious tolerance, focusing on non-discriminatory practices in India

CO3: Learn scientific thinking, evidence-based approaches, and the importance of skepticism and rationalism.

CO4: Apply ethical reasoning to social issues, focusing on gender bias, discrimination, and inclusive practices.

CO5: Understand the importance of transparency and fairness in scientific endeavors for societal good.

CO6: Understand the ethical responsibilities of scientists in the application of their inventions.

TEXTBOOKS:

1. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.

REFERENCE BOOKS:

1. The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
2. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

U23ITT72	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand software engineering processes and agile development models.
- To explore software design concepts, including architectural and user interface design.
- To study software testing techniques and maintenance practices.
- To apply software project management techniques, including estimation and risk management.
- To understand stream activities in project execution and tracking.

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 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 III TESTING AND MAINTENANCE 9

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

UNIT IV 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.

UNIT V STREAM ACTIVITIES IN PROJECTS 9

Project Initiation – Project Planning – Execution and Tracking – Project Wind up – Concept of Process/Project Database.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the key activities in managing a software project.
CO2: Understand the concepts of requirements engineering and analysis Modelling.
CO3: Compare and contrast the various testing and maintenance.
CO4: Explain the process of performing analytics on data streams.
CO5: Make use of different phases in project management.
CO6: Utilize the stream activities in process/project database.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Ninth Edition, Mc Graw-Hill International Edition, 2020.
2. Ramesh Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.

REFERENCE BOOKS:

1. Pressman, Roger, "Software Engineering", A Practitioners approach". McGraw Hill, 1997.
2. Bob Hughes and Mike Cotterell, "Software Project Management".
3. Wheelwright and Clark, "Revolutionizing product development", The Free Press, 1993.

NPTEL Course

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

U23CSP62	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

- To learn the basics of Arduino and Raspberry Pi platforms with programming.
- To interface sensors like IR, PIR, soil moisture, ultrasonic, and gas leakage sensors with IoT devices.
- To explore environmental monitoring by measuring parameters like humidity, moisture, and rain.
- To implement control systems, such as using a relay switch to control an LED.
- To design and develop IoT-based mini projects like smart weather systems and smart parking systems.

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

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, Rasperrypi ,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 would 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 – VIII

		L	T	P	C
U23ITP81	**PROJECT WORK**	**0**	**0**	**20**	**10**

COURSE OBJECTIVES

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

- For gaining domain knowledge, and technical skills to solve potential business / research problems.
- Gather requirements and Design suitable software solutions and evaluate alternatives
- To work in small teams and understand the processes and practices in the 'industry.
- Implement, Test and deploy solutions for target platforms
- 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 would 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

VERTICALS – I (DATA SCIENCE)

		L	T	P	C
U23CBT51	**THEORY OF COMPUTATION**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To explore finite automata, their types, equivalence, NFA-DFA conversion.
- To study regular expressions, their equivalence to automata, the Pumping Lemma, and closure properties of regular languages.
- To study context-free grammars, pushdown automata, and their equivalence..
- To explore normal forms for CFG and the basics of Turing machines.
- To understand undecidable problems and the complexity of computational problems.

UNIT I AUTOMATA FUNDAMENTALS 9

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

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular Expressions – FA and Regular Expressions – Proving Languages not to beregular - 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.

UNITV UNDECIDABILITY 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Outline automata theory using Finite Automata.
CO2: Write regular expressions for any pattern.
CO3: Interpret context free grammar and Pushdown Automata.
CO4: Explain the Turing machine for computational functions.
CO5: Differentiate between decidable and undecidable problems.
CO6: Describe the characteristics of P, NP and NP Complete problems.

TEXTBOOKS:

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

REFERENCE BOOKS:

1. MichealSipser, "Introduction of the Theory and Computation",ThomsonBrokecole, 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

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview

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:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION **9**

NeuralNetworks-ApplicationScopeofNeuralNetworks-ArtificialNeuralNetwork:An Introduction- EvolutionofNeural Networks-BasicModelsofArtificialNeuralNetwork- Important Terminologiesof ANNs-SupervisedLearningNetwork.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS **9**

TrainingAlgorithms forPatternAssociation-Auto associativeMemoryNetwork-Hetero associative Memory Network-BidirectionalAssociativeMemory (BAM)-HopfieldNetworks-Iterative Auto associativeMemoryNetworks-TemporalAssociativeMemoryNetwork-Fixed Weight CompetitiveNets-KohonenSelf-OrganizingFeatureMaps-LearningVectorQuantization-Counter propagation Networks-Adaptive ResonanceTheory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS **9**

SpikingNeural Networks-ConvolutionalNeuralNetworks-DeepLearningNeuralNetworks-Extreme LearningMachineModel-Convolutional Neural Networks: TheConvolution Operation–Motivation– Pooling–VariantsofthebasicConvolutionFunction–Structured Outputs–Data Types–Efficient ConvolutionAlgorithms–NeuroscientificBasis– Applications:Computer Vision,Image Generation,ImageCompression.

UNIT IV DEEP FEEDFORWARD NETWORKS **9**

HistoryofDeep Learning-A ProbabilisticTheory ofDeep Learning- GradientLearning–Chain Rule andBackpropagation–Regularization:DatasetAugmentation–NoiseRobustness–Early Stopping, BaggingandDropout –batchnormalization-VC Dimensionand Neural Nets.

UNIT V RECURRENT NEURAL NETWORKS **9**

Recurrent Neural Networks: Introduction–Recursive Neural Networks– Bidirectional RNNs–Deep RecurrentNetworks–Applications:Image Generation,Image Compression,NaturalLanguage Processing. Complete Auto encoder, Regularized Auto encoder, Stochastic Encoders and Decoders, Contractive Encoders.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand Convolution Neural Network forimageprocessing.

CO2: Understandthebasicsofassociative memoryand unsupervisedlearningnetworks.

CO3: Know the CNN and its variants forsuitableapplications.

CO4: Understand the fundamental computations in deep learning and apply this knowledge to construct and train deep neural networks for a range of tasks.

CO5: Interpretautoencodersandgenerative modelsforsuitableapplications.

TEXTBOOKS:

1. IanGoodfellow,YoshuaBengio, Aaron Courville,"Deep Learning", MITPress,2016.
2. FrancoisChollet, "DeepLearningwith Python",SecondEdition, ManningPublications,2021.

REFERENCE BOOKS:

1. Aurelien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly,2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", SpringerInternational Publishing, 1st Edition, 2018.

NPTEL LINKS:

1 https://onlinecourses.nptel.ac.in/noc20_cs62/preview

2 https://onlinecourses.nptel.ac.in/noc24_ee146/preview

U23CSV14	TEXTANDSPEECHANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To cover text preprocessing and feature extraction techniques in natural language processing.
- To explore word embeddings, deep learning models, and text classification methods.
- To study question answering models and the design of dialogue systems.
- To understand text-to-speech synthesis, including normalization and deep learning approaches.
- To explore speech recognition techniques and acoustic modeling using HMM-based systems.

UNIT I NATURAL LANGUAGE BASICS 9

Foundationsofnaturallanguageprocessing–LanguageSyntaxandStructure-TextPreprocessing 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 –Fast Text 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 – chat bots – Design of dialogue systems – evaluating dialogue systems.

UNIT IV TEXT-TO-SPEECHSYNTHESIS 9

Overview-Text normalization-Letter-to-sound-Prosody, Evaluation-Signal processing-Concatenative and parametric approaches, Wave Net 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 would be able to

CO1: Explain existing and emerging deep learning architectures for text and speech processing**.**

CO2: Understand the deep learning techniques for NLP tasks, language behavior and machine translation**.**

CO3: Describeanswering models and coherence for text processing.

CO4: Understand question-answering systems, chat bots and dialogue systems.

CO5: Learn about the deep learning models for building speech recognition and text-to-speech systems.

CO6: Understand the applications using HMM and DNN systems and strings.

TEXTBOOKS:

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", A Press, 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.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs114/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs89/preview

U23CSV12	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce data mining methods for similarity and dimensionality reduction.
- To explore content-based systems, item and user profiles, and retrieval methods.
- To study collaborative filtering techniques, including user-based and item-based methods.
- To understand attacks on recommender systems and strategies for robust algorithms
- To explore evaluation methods, accuracy metrics, and design issues in recommender systems.

UNIT I INTRODUCTION 9

Introductionand basic taxonomyofrecommendersystems–Traditionalandnon-personalized RecommenderSystems–Overview ofdataminingmethodsforrecommendersystems-similarity measures-Dimensionalityreduction–SingularValueDecomposition(SVD).

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architectureofcontent-based systems- Itemprofiles, Representing item profiles, Methods forlearninguserprofiles, Similarity-basedretrieval,and Classification algorithms.

UNIT III COLLABORATIVE FILTERING 9

Asystematicapproach, Nearest-neighborcollaborativefiltering(CF),user-basedanditem-based CF,componentsofneighborhoodmethods(ratingnormalization,similarityweightcomputation, and neighborhoodselection.

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction–TypesofAttacks–Detectingattacksonrecommendersystems–Individualattack– Group attack–Strategiesforrobust recommenderdesign–Robust recommendationalgorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

EvaluatingParadigms –UserStudies –OnlineandOfflineevaluation–Goalsofevaluationdesign– DesignIssues–Accuracymetrics–LimitationsofEvaluation measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understandthebasicconceptsofrecommendersystems.

CO2: Illustratemachine-learninganddata-miningalgorithmsinrecommendersystems datasets.

CO3: Outline the Collaborative Filteringincarryingoutperformanceevaluationofrecommender systemsbasedon various metrics.

CO4: Describe types of attacks on recommender systems and their detection methods.

CO5: Identify and describe various evaluation paradigms used in recommender systems

CO6: Explain the goals and design issues associated with user studies for evaluating recommender systems.

TEXTBOOKS:

1. Charu C. Aggarwal,RecommenderSystems:TheTextbook, Springer,2016.
2. Dietmar Jannach ,Markus Zanker , Alexander FelfernigandGerhard Friedrich, RecommenderSystems: An Introduction, 1st ed., CambridgeUniversity Press (2011)

REFERENCEBOOKS:

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.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_ge35/preview
2. https://www.classcentral.com/course/swayam-recommender-systems-269764

U23CSV15	BUSINESSANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce the analytics lifecycle, from problem definition to deployment.
- To explore data warehouses, decision-making, and OLAP in business intelligence.
- To study forecasting, predictive analytics, and machine learning models.
- To explore HR and supply chain analytics, including demand prediction and planning.
- To examine marketing strategies, customer behavior analytics, and Power BI in sales.

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

AnalyticsandDataScience–AnalyticsLifeCycle–TypesofAnalytics–BusinessProblemDefinition – DataCollection–DataPreparation–Hypothesis Generation–Modeling–Validation and Evaluation– Interpretation–DeploymentandIteration.

UNIT II BUSINESS INTELLIGENCE 9

DataWarehousesandDataMart–KnowledgeManagement–TypesofDecisions–Decision MakingProcess–DecisionSupportSystems– Business Intelligence–OLAP–Analyticfunctions.

UNIT III BUSINESS FORECASTING 9

IntroductiontoBusinessForecastingandPredictiveanalytics–LogicandDataDrivenModels– DataMiningand Predictive AnalysisModeling–MachineLearningforPredictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

HumanResources –Planning andRecruitment –Training and Development - Supplychain network–PlanningDemand,InventoryandSupply–Logistics– AnalyticsapplicationsinHR&SupplyChain- ApplyingHRAnalyticstomakeapredictionofthedemandforhourlyemployees fora year.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behaviors –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 would be able to

CO 1: Explain the real-world businessproblemsandmodel with analytical solutions.
CO 2: IdentifythebusinessprocessesforextractingBusinessIntelligence.
CO 3: Describepredictiveanalyticsforbusinessforecasting.
CO 4: Describeanalyticsforsupplychain and logistics management.
CO 5: Use analyticsformarketingandsales.

TEXTBOOKS:

1. R.EvansJames,BusinessAnalytics,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.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc20_mg11/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs65/preview

U23CSV17	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To cover image formation, geometric transformations, and Fourier transforms.
- To explore feature detection, segmentation, and energy-based methods.
- To study feature alignment, motion estimation, and structure from motion.
- To examine 3D reconstruction, surface representations, and texture mapping.
- To explore image rendering techniques and recognition tasks like object and face detection.

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

ComputerVision–Geometricprimitivesandtransformations–Photometricimageformation–The digital camera-Point operators - Linear filtering - More neighborhood operators - Fourier transforms –Pyramidsandwavelets–Geometrictransformations–Globaloptimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Pointsandpatches–Edges–Lines–Segmentation–Activecontours–Splitandmerge–Mean shiftandmodefinding–Normalizedcuts–Graphcutsandenergy-basedmethods.

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

2Dand3D feature-basedalignment–Poseestimation–Geometricintrinsiccalibration– Triangulation– Two-framestructurefrommotion–Factorization–Bundleadjustment- Constrained structureandmotion–Translationalalignment–Parametric motion–Spline-based motion–Optical flow– Layered motion.

UNIT IV 3D RECONSTRUCTION 9

ShapefromX-Activerangefinding –Surfacerepresentations–Point-based representations-Volumetric representations –Model-based reconstruction – Recovering texture map.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolationLayereddepthimages–Light fieldsandLumigraphs–Environmentmattes– Video-based rendering-Objectdetection–Facerecognition–Instancerecognition–Category recognition–Context and scene understanding- Recognitiondatabasesandtestsets.

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 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

TEXTBOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, SecondEdition,2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, SecondEdition,2015.

REFERENCE BOOKS:

1. Richard HartleyandAndrewZisserman, Multiple ViewGeometryinComputer Vision, SecondEdition,CambridgeUniversityPress,March 2004.
2. Christopher M.Bishop;PatternRecognitionandMachineLearning,Springer, 2006
3. E.R. Davies,ComputerandMachineVision,FourthEdition,AcademicPress,2012.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. https://onlinecourses.nptel.ac.in/noc23_ee39/preview

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:

- To introduce the semantic web, social network analysis, and privacy/security concepts.
- To explore privacy concerns, security evolution, and anonymity in social networks.
- To study community detection and mining in social network data.
- To examine human behavior prediction, privacy, and trust in social networks.
- To explore access control, authentication, and identity management in social networks.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, what is Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts and challenges of security within social networks.

CO2: Describe the techniques for analyzing and evaluating social network data to identify and address security issues.

CO3: Illustrate effective security measures and protocols to protect social networks from various threats and vulnerabilities.

CO4: Examine privacy issues related to social networks and develop strategies to safeguard personal information and user privacy.

CO5: Utilize the tools and technologies for detecting and mitigating security threats in social network environments.

CO6: Learn about the security policies and frameworks relevant to social networks.

TEXTBOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j3.xSecond Edition ByJérôme Baton, RikVanBruggen, Packt publishing.
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

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.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc24_cs56/preview

U23ITV18	PREDICTIVE ANLAYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Understand the basics of predictive analytics, CRISP-DM process, and statistical tools for analysis.
- Learn data preparation techniques, feature selection, and handling missing data for predictive modeling.
- Explore predictive modeling techniques, including decision trees, regression, and neural networks, with model evaluation and optimization.
- Gain knowledge in time series analysis, forecasting methods, and ARIMA/LSTM modeling for trend and seasonality analysis.
- Study advanced topics such as deep learning, unsupervised learning, and ethical considerations in predictive analytics.

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics - The CRISP-DM Process Model for Predictive Analysis - The role of data in Predictive Analysis - Data Understanding - Data Visualization - The Value of Statistical Significance - Statistical concepts and tools for Predictive Analysis.

UNIT II DATA PREPARATION AND FEATURE SELECTION 9

Understanding the importance of data quality for Predictive Analysis - Data Preparation - Data pre-processing - Dealing with missing data and outliers - Feature selection/creation techniques - Exploratory data analysis for predictive modelling.

UNIT III PREDICTIVE MODELING TECHNIQUES 9

Introduction to Modeling - Descriptive Modeling- Data Preparation Issues with Descriptive Modeling - Predictive modeling techniques - Decision Trees - Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms - Parameter tuning and hyperparameter optimization - Evaluating model performance and metrics – Model Ensembles.

UNIT IV TIME SERIES ANALYSIS AND FORECASTING 9

Introduction to Time Series Analysis and Forecasting - Components of time series - Trend and Seasonality analysis – ARIMA, LSTM modeling and forecasting - Exponential smoothing techniques – Model Evaluation - Applications

UNIT V ADVANCED TOPICS IN PREDICTIVE ANALYSIS 9

Deep Learning and its applications in Predictive Analysis - Unsupervised Learning techniques - Clustering and Association Rule Mining - Ensemble Learning and Model Stacking techniques - Ethical and legal considerations in Predictive Analysis – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of predictive analytics, the CRISP-DM process, and the role of data and statistical tools..

CO2: Learn data preparation, pre-processing, and feature selection techniques for effective predictive modeling.

CO3: Explore predictive modeling techniques, including decision trees, regression models, neural networks, and model optimization

CO4: Learn the time series analysis methods, including ARIMA, LSTM modeling, and forecasting techniques

CO5: Understand the advanced predictive analysis techniques like deep learning, unsupervised learning, and model stacking.

CO6: Understand ethical and legal considerations in predictive analysis through practical case studies.

TEXTBOOKS:

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014.
2. Daniel T. Larose, Chantal D. Larose, "Data Mining and Predictive Analytics", Wiley, 2015.

REFERENCE BOOKS:

1. Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014

NPTEL LINKS:

1. https://archive.nptel.ac.in/courses/111/106/111106164/
2. https://onlinecourses.nptel.ac.in/noc23_ma46/preview

VERTICALS – II (FULL STACK DEVELOPMENT OF IT)

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

COURSE OBJECTIVES

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

- To study syntax, semantics, and parsing techniques in programming languages.
- To explore data types, scope, and control structures.
- To understand subprogram design, parameter passing, and scoping.
- To learn object-oriented programming, concurrency, and event handling.
- To explore functional and logic programming with languages like Scheme and Prolog.

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, DATATYPES AND BASICSTATEMENTS 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 SUBPROGRAMSANDIMPLEMENTATIONS 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–messagepassing–threads– statement level concurrency – exception handling – event handling.

UNIT V FUNCTIONALANDLOGICPROGRAMMINGLANGUAGES 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 would be able to

CO1: Understand syntax and semantics of programming languages.
CO2: Understand data, data types, and basic statements of programming languages.
CO3: Learn sub program constructs.
CO4: State object -oriented, concurrency, and event handling programming constructs and develop programs in Scheme, ML, and Prolog.
CO5: Use and adopt new programming languages.
CO6: Identify simple programs using functional programming languages to solve basic computational problems

TEXT BOOKS:

1. Robert W.Sebesta, "Concepts of Programming Languages", Twelfth Edition (Global Edition), Pearson, 2022.
2. MichaelL.Scott,"ProgrammingLanguagePragmatics",FourthEdition,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.

NPTEL LINKS:

1. https://archive.nptel.ac.in/courses/106/102/106102067/
2. https://www.nptelvideos.com/course.php?id=440

U23ITV22	ADVANCED JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn socket programming and RMI in Java.
- To explore JDBC and CRUD operations.
- To study J2EE architecture and web protocols.
- To understand servlet life cycle and session management.
- To learn JSP architecture and session handling.

UNIT I NETWORK PROGRAMMING IN JAVA 9

Networking Basics, Introduction of Socket, Types of Socket, Socket API, TCP-IP: Client/ Server Sockets, URL, UDP: Data grams, java.net package classes: Socket, Server Socket, Inet Address, URL, URL Connection, RMI Architecture, Client Server Application using RMI.

UNIT II JDBC PROGRAMMING 9

JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, Prepared Statement, Callable Statement), Exploring Result Set Operations, Batch Updates in JDBC, Creating CRUD Ap.

UNIT III J2EE AND WEB DEVELOPMENT 9

J2EE and Web Development J2EE Architecture Types, J2EE Containers, Types of Servers in J2EE Application, HTTP Protocols and API, Request Processing in Web Application, Web Application Structure, Web Containers and Web Architecture Models.

UNIT IV SERVLET APIANDOVERVIEW 9

Servlet Introduction, Servlet Life Cycle(SLC), Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with Servlet Context and Servlet Config Object, Attributes in Servlet, Response and Redirection using Request Dispacher and using send Redirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTP Session, Hidden Form Fields and URL Rewriting, Types of Servlet Event: Context Level and Session Level.

UNIT V JAVA SERVER PAGES 9

Introduction to JSP, Comparison with Servlet, JSP Architecture, JSP: Life Cycle, Scripting Elements, Directives, Action Tags, Implicit Objects, Expression Language(EL), JSP Standard Tag Libraries(JSTL), Custom Tag, Session Management, Exception Handling, CRUD Application.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain Java's networking classes to develop basic client-server applications.
CO2: Understand the architecture and functionality of JDBC to establish and manage database connections in Java applications.
CO3: IdentifyJ2EE architecture and web application structure to develop and deploy web-based applications.
CO4: Describe the Servlets lifecycle and configuration to manage HTTP requests and responses effectively in web applications.
CO5: Use the JSP architecture and lifecycle to develop and manage dynamic web content.
CO6: Show JSP elements and JSTL to create interactive and data-driven web applications.

TEXT BOOKS:

1. Hortsmann& Cornell, "CORE JAVA2 ADVANCED FEATURES, VOL II", Pearson Education, 2002.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly publishers, 2000.

REFERENCE BOOKS:

1. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 1999.
2. Java Server Programming, Java EE6 (J2EE 1.6), Black Book, Dreamtech, 2010.

NPTEL LINKS:

1. https://archive.nptel.ac.in/courses/106/105/106105191/
2. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

U23ITV23	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Learn full-stack components: Express, Angular, Node, MongoDB, React.
- Master **Node.js** basics, events, I/O, and HTTP.
- Understand **Mongo DB** setup and Node.js integration..
- Work with **Express** routes and **Angular** components.
- Build **React** apps with state, routing, and **Express**.

UNIT I BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework - User - Browser – Web server - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React.

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js.

UNIT III MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications.

UNIT IV EXPRESS AND ANGULAR 9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives.

UNIT V REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Web pack - Routing with React Router – Server-side rendering.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the various stacks available for web application development.
CO2: Use Node.js for application development.
CO3: Discuss applications with MongoDB.
CO4: Use the features of Angular and Express.
CO5: Explain React applications.
CO6: Compare REST APIs.

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018.
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

REFERENCE BOOKS:

1. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018.
2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018.

NPTEL LINKS:

1. https://www.coursera.org/courses?query=full%20stack%20web%20development
2. https://archive.nptel.ac.in/courses/106/106/106106156/.

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:

- To learn UI vs. UX, design thinking, and empathy.
- To understand UI principles, elements, and branding.
- Explore the UX process, research, and user needs.
- Master wire framing, prototyping, and testing.
- Learn research methods, personas, and user flows..

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 – Wire framing - Creating Wire flows - 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 AND INFORMATIONARCHITECTURE 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 would be able to

CO1: Explain UI for user applications.
CO2: Compare UX design of any product or application.
CO3: Use the UX skills in a product development.
CO4: State the sketching principles.
CO5: Understand the wireframe and prototype.
CO6: Use the role of research in the design process and how ideation contributes to effective 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, 2020.

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rdEdition,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.

NPTEL LINK:

1. https://nptel.ac.in/courses/124107008.

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

COURSE OBJECTIVES

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

- To learn software testing types, stages, and defect management.
- To understand test goals, strategy, and scheduling.
- Master test design, including boundary value and bug tracking.
- Explore performance, security, usability, and mobile testing.
- Learn Selenium automation and web testing.

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 would be able to

CO1: Understand the basic concepts of software testing and the need for software testing.
CO2: Compare test planning and different activities involved in test planning.
CO3: Use effective test cases that can uncover critical defects in the application.
CO4: Show the software testing using Selenium.
CO5: Identify wireframe and prototype.
CO6: Describe the testing using testing, XMLand packages.

TEXT BOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012.
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver3 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. Patton, Ron. Software testing. Pearson Education India, 2006.
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview

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

COURSE OBJECTIVES

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

- Learn web security, authentication, SSL/TLS, and input validation.
- Understand secure development and testing models.
- Learn API security and authentication..
- Explore vulnerability tools and penetration tests.
- Study hacking techniques and security 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 Micro service 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 would be able to

CO1: Understand and describe the fundamental concepts of web application security, including common vulnerabilities and threats.

CO2: Identify security risks in web applications, applying appropriate mitigation strategies.

CO3: Use secure coding practices to prevent web-based attacks such as XSS, SQL injection, and CSRF.

CO4: Summarize robust authentication, authorization, and session management techniques to enhance web application security.

CO5: Explain the usage of security testing tools and methodologies to assess the security posture of web applications.

CO6: Discuss the compliance with legal, ethical, and regulatory standards for secure web application development and deployment.

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. BryanSullivan,VincentLiu,WebApplicationSecurity:ABeginnersGuide,2012,The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS:

1. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
2. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs36 › preview

U23ITV27	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I INTRODUCTION TO DEVOPS 9

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

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand different actions performed through version control tools like Git.
CO2: Perform continuous integration and continuous testing and continuous deployment usingJenkins by building and automating test cases using Maven & Gradle.
CO3: Ability to perform automated continuous deployment.
CO4: Ability to do configuration management using Ansible.
CO5: Understand to leverage cloud-based DevOps tools using Azure DevOps.
CO6: Use Github Accounts and Azure pipelines.

TEXT BOOKS:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

REFERENCE BOOKS:

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

NPTEL LINK:

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

U23ITV28	FULL STACK MOBILE APP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn mobile app frameworks and tools.
- Master Kotlin basics and OOP.
- To understand Android apps, lifecycle, and intents.
- Work with preferences, databases, and location services.
- Explore advanced Android features like media and app monetization.

UNIT I INTRODUCTION 9

Introduction – Native and Hybrid Mobile Apps Frameworks – iOS with Swift – React Native with Javascript, Android with Kotlin, Flutter with Dart, Xamarin with C# - Tools – Android Studio, Xcode, Visual Studio Code.

UNIT II KOTLIN PROGRAMMING 9

Introduction to KOTLIN programming - Basics of Kotlin, Operations and Priorities, Decision Making. Loop Control, Data Structures (Collections), Functions, Object Oriented Programming: Inheritance, abstract, interface, super and this, visibility modifiers.

UNIT III INTRODUCTION TO ANDROID 9

Basics of an ANDROID application, introduction to manifest, externalizing resources, application lifecycle, ANDROID activities, Widgets: Button, TextView, ImageView, ProgressBar, ListView, EditText, Calendar, Date&Time, etc, Working with Intent and Files.

UNIT IV PREFERENCES, DATABASE AND CONTENT PROVIDER 9

Creating, saving and retrieving shares preferences, including static files as resources, Introducing ANDROID databases, Content values and cursors, working with SQLite databases, creating content providers, Using content providers, Native ANDROID Content providers. Introduction and addition of action bar, Menus and dialogs, drawable and gradients, using location-based services, selecting a location provider, finding your current location, and Creating map-based activities.

UNIT V ADVANCED ANDROID APP DEVELOPMENT 9

Introduction of recycle view and card view. Playing audio and video, manipulating raw audio, using camera to take pictures, recording video, adding media to media store, Hardware support for telephony, using telephony, introducing SMS and MMS, Signing and publishing applications, introduction to monetizing applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Full Stack mobile application development.
CO2: Illustrate the basic concepts of KOTLIN programming.
CO3: Explain the application user interfaces.
CO4: Understandinteractive applications using maps, location based services, UI/UX.
CO5: Use advanced Android components such as RecyclerView, CardView, and media handling to develop feature-rich mobile applications.
CO6: Compare Android applications with features such as SMS/MMS, media integration, and monetization strategies.

TEXT BOOKS:

1. Reto Meier, Ian Lake, "Professional Android, 4th Edition", 2018.
2. Beginning Android Development with Kotlin - Greg Lim – March – 2020.
3. Headfirst Kotlin, A Brain Friendly Guide – Dawn Griffiths, David Griffiths – Orilly – 2019.

REFERENCE BOOKS:

1. John Horton, Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming.
2. Frank Ableson, Robi Sen, Chris King, C. Enriq, Ortiz, "Android in Action, 3rd Edition, Manning Publications", 3rd Edition, 2011.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 3rd Edition, Big Nerd Ranch Guides, 2017.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/nou21_ge41/preview
2. https://www.mygreatlearning.com/mobile-app-development/free-courses

VERTICALS – III (CLOUD COMPUTNG AND DATA CENTRE TECHNOLOGIES)

U23ITV31	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I INTRODUCTION TO DATA WAREHOUSE 9

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

UNIT II ETL AND OLAP TECHNOLOGY 9

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

UNIT III META DATA, DATA MART AND PARTITION STRATEGY 9

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

UNIT IV DIMENSIONAL MODELING AND SCHEMA 9

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

UNIT V SYSTEM & PROCESS MANAGERS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

NPTEL LINKS:

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

U23ITV32	CLOUD VIRTUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce students to the foundational concepts, architecture, and service models of cloud computing
- To provide an in-depth understanding of virtualization, including its types, architecture, and role in enabling cloud computing.
- Familiarize students with key virtualization technologies like hypervisors, containers, virtual machines and dockers.
- To explore and experiment with various cloud software environments.
- To learn about datasecurity and storage 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 BASIC VIRTUALIZATION 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.

UNITV 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: Explain the concept of virtualization and its types.

CO3: Experiment with virtualization of hardware resources and Docker.

CO4: Equip students with knowledge of cloud deployment models and service management for cloud infrastructure.

CO5: Discuss security challenges in the cloud environment.

CO6: Identify and address common challenges in implementing and maintaining IAM systems

TEXTBOOKS:

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.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs18/preview

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

COURSE OBJECTIVES

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

- Introduce Cloud Service Management terminology, definition & concepts.
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- 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 Queuing, Change Management, Cloud Service Architecture.

UNIT III CLOUD SERVICE MANAGEMENT 9

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.

UNITV CLOUD SERVICE GOVERNANCE & VALUE 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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:

CO 5: Explain cloud-design skills to build and automate business solutions using cloud technologies.

CO 6: Extend Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.

TEXTBOOKS:

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.

NPTEL LINKS:

1. https://nptel.ac.in/courses/106105167
2. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cs62/

U23ITV34	COMPUTATIONAL BIOINFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce bioinformatics technologies, structural bioinformatics, and data integration systems.
- To explore data warehousing, data quality, and machine learning applications in bioinformatics
- To understand computational models and techniques for biological data analysis.
- To study motif detection, gene regulation, and visualization techniques for biological sequences.
- To learn about microarray technology and analysis for genome expression studies.

UNIT I INTRODUCTION **9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System

UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS **9**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

UNIT III MODELING FOR BIOINFORMATICS **9**

Hidden markov modeling for biological data analysis – Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

UNIT IV PATTERN MATCHING AND VISUALIZATION **9**

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNITV MICROARRAY ANALYSIS **9**

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the models for biological data.

CO2: Explain and implement data warehousing solutions for bioinformatics applications.

CO3: Learn the models of protein structures to understand their functions.

CO4: Discuss pattern matching techniques to protein and genomic data.

CO5: Usemicroarray technology for genomic expression study

CO6: Compare scientific data management systems by functionality and performance

TEXTBOOKS:

1. Yi-Ping Phoebe Chen Edition, "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2010

REFERENCE BOOKS:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2011.
2. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2013.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_bt06/preview

U23CSV34	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To explore information storage, data centers, cloud computing, and computing platform evolution.
- To study intelligent storage systems, RAID types, and storage device performance.
- To examine storage systems, Fibre Channel, IP SAN technologies, and virtualization.
- To understand backup methods, data deduplication, replication, and disaster recovery.
- To learn about storage security, threat management, and compliance.

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 & 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).

UNITV 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 would be able to

CO1: Understand the fundamentals of information storage management and various cloud infrastructure services and deployment models.

CO2: Explain the usage of advanced intelligent storage systems and RAID.

CO3: Interpret storage networking architectures, including SAN, storage subsystems, and virtualization.

CO4: Examine the different role in providing disaster recovery and remote replication technologies.

CO5: Discuss the security needs and security measures to be employed in information storage management.

CO6: Understand the processes for managing storage infrastructure.

TEXTBOOKS:

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 BOOKS:

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

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_bt06/preview

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 to:

- To introduce SDN architecture and its data, control, and application planes.
- To explore SDN data plane functions, OpenFlow, and control plane controllers.
- To understand SDN applications in traffic engineering, monitoring, and security.
- To study network virtualization, VLANs, and NFV concepts.
- To examine NFV infrastructure, virtualized functions, and orchestration..

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 – OpenFlow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, 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 – OpenFlow 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 would be able to

CO1: Understand the key concepts, principles, and architecture of Software Defined Networking (SDN)

CO2: Identify the functions of the data plane and control plane.

CO3: Explain the key concepts of SDN architecture, the role of the SDN controller, and key communication protocols

CO4: Illustrate various techniques of network function virtualization.

CO5: Understand management and orchestration techniques to optimize NFV environments.

CO6: Discuss various use cases of SDN and NFV.

TEXTBOOKS:

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.

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/106/108/106108058/

U23CSV36	STREAM PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce data processing, analytics, and stream processing concepts.
- To explore big data infrastructure, real-time analytics, and stream processing solutions.
- To study various data models, query languages, and relationships in databases.
- To understand event processing using Apache Kafka, its APIs, and components.
- To learn real-time processing using Spark Streaming, including fault tolerance and streaming operations.

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.

UNITV 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 would be able to

CO1: Understand the fundamentals of data processing and its challenges

CO2: Describe the current research trends in data-stream processing.

CO3: Learn the suitability of stream mining algorithms for data stream systems.

CO4: Use stream processing systems, services and applications.

CO5: Remember the structured streaming concepts, including dataset creation, schema inference, and partitioning.

CO6: Outline the appropriate architecture and frameworks based on the specific needs of real-time data processing applications.

TEXTBOOKS:

1. "Streaming Systems: The What, Where, When and How of Large-Scale Data Processing", Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication 2018.
2. "Designing Data-Intensive Applications", Martin Kleppmann, O'Reilly Media 2016.

REFERENCE BOOKS:

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

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/102/106/102106022/

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 to:

- To introduce cloud security principles, including confidentiality, integrity, and cryptography.
- To explore security design, data protection strategies, and encryption in cloud environments.
- To study access control, authentication, and identity management in cloud systems.
- To understand cloud security design patterns like cloud bursting, geo-tagging, and secure resource access.
- To examine proactive monitoring, auditing, and incident management for cloud security.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - 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.

UNITV MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the key concepts, issues, and principles related to security and privacy in cloud computing.

CO2: Identify and classify different types of security threats and vulnerabilities specific to cloud environments and cloud-based services.

CO3: Describe the secure cloud infrastructure through access control methods, including user identification, authentication and role-based access control

CO4: Discuss the various risks audit and monitor mechanisms in the cloud.

CO5: Explain proactive monitoring skills to detect and address security issues.

CO6: Use the various architectural and design considerations for security in the cloud.

TEXTBOOKS:

1. Raj Kumar Buyya, James Broberg, andrzejGoscinski, "Cloud Computing", Wiley 2013.
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2011.

REFERENCE BOOKS:

1. Mark C. Chu-Carroll, "Code in the Cloud", CRC Press, 2011.
2. "Mastering Cloud Computing Foundations and Applications Programming", Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi 2012.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview

VERTICAL – IV (CYBER SECURITY & DATA PRIVACY)

		L	T	P	C
U23ITV41	**DIGITAL AND MOBILE FORENSICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To introduce digital forensics and its process.
- To explore digital crime and evidence collection methods.
- To understand digital forensic readiness for law enforcement and enterprises.
- To study iOS device forensics, security, and tools.
- To examine Android device forensics, tools, and security.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT IV iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the knowledge on digital forensics.
CO2: Know about digital crime and investigations.
CO3: Be forensic ready.
CO4: Identify digital evidence from iOS devices.
CO5: Identify the digital from Android devices.
CO6: Learn the Oxygen Forensics.

TEXT BOOKS:

1. Andre Arnes, "Digital Forensics", Wiley, 2018. 2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.
2. Andre Arnes, "Digital Forensics", Wiley, 2018.

REFERENCE BOOKS:

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

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

U23ITV42	INTERNETWORKING WITH TCP/IP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn IP addressing, routing, and protocols.
- To understand TCP services, header, and connection management.
- To study IP routing and error processing.
- To explore TCP data structures and segment formatting.
- To learn about TCP timers, flow control, and congestion management.

UNIT I INTRODUCTION **9**

Internetworking concepts and architecture model – Classful Internet address – CIDR –Sub netting and Super netting – AARP – RARP- IP- IP Routing – ICMP – IPV6.

UNIT II TCP **9**

Services – header – connection establishment and termination – interactive data flow – bulk data flow – timeout and retransmission – persist timer – keep alive timer – futures and performance.

UNIT III IP IMPLEMENTATION **9**

IP global software organization – routing table – routing algorithms – fragmentation and reassembly – error processing (ICMP) – Multicast Processing (IGMP).

UNIT IV TCP IMPLEMENTATION I **9**

Data structure and input processing – transmission control blocks – segment format – comparison – finite state machine implementation – Output processing – mutual exclusion – computing the TCP Data length.

UNIT V TCP IMPLEMENTATION II **9**

Timers – events and messages – timer process – deleting and inserting timer event – flow control and adaptive retransmission – congestion avoidance and control – urgent data processing and push function.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the IP addressing schemes and network protocols.
CO2: Describe the fundamentals of network design and implementation.
CO3: Learn with the network management issues.
CO4: Use the TCP protocol at initial Level.
CO5: Remember the TCP protocol to the next Level.
CO6: Discuss the TCP protocol to the Next level and its functions.

TEXT BOOKS:

1. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocols and Architecture", Vol 1 and 2, Vth Edition, 2006.
2. W. Richard Stevens "TCP/IP Illustrated" Vol 1.2003.

REFERENCE BOOKS:

1. Forouzan, "TCP/IP Protocol Suite" Second Edition, Tata MC Graw Hill, 2003.
2. W.Richard Stevens "TCP/IP Illustrated" Volume 2, Pearson Education 2003.

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/106/105/106105183/

U23CBT63	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn ethical hacking, penetration testing, and network security layers.
- To study foot printing, reconnaissance, and network scanning.
- To explore enumeration and vulnerability analysis techniques.
- To understand web and wireless network hacking methods.
- To learn about firewalls, IDS, and network protection tools.

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 would be able to

CO1: Remember the knowledge on basics of computer based vulnerabilities
CO2: Understand on different foot printing, reconnaissance and scanning methods.
CO3: Discuss the enumeration and vulnerability analysis methods
CO4: Compare hacking options available in Web and wireless applications.
CO5: Show the options for network protection.
CO6: Use ethical hacking to expose the vulnerabilities.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://archive.nptel.ac.in/courses/106/105/106105217/

U23CSV44	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand symmetric/asymmetric cryptography and semantic security.
- To study attack models like CPA, CCA, and NM-CPA
- To explore provable security, hash functions, and pseudo-random generators.
- To learn the Luby-Rackoff construction and its application in block ciphers.
- To understand MACs, public key signature schemes, and Shamir's secret sharing.

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 in distinguish ability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext 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 PSEUDORANDOM PERMUTATION 9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES 9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: 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 would be able to

CO1: Use the basic principles of cryptography and general cryptanalysis.
CO2: Learn the concepts of symmetric encryption and authentication.
CO3: Identify the use of public key encryption, digital signatures, and key establishment.
CO4: Understand the cryptographic algorithms to compose build and analyze simple cryptographic solutions.
CO5: Use of Message Authentication Codes.
CO6: Explain the Analyzing Cryptographic Protocols.

TEXT BOOKS:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag,2015.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition),2003.

REFERENCE BOOKS:

1. Shaffi Goldwasser and MihirBellare, 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, 2019.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs03 › preview

U23ITV45	CLOUD SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn cloud computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To explore the Identity, Access control in Cloud
- To study security design patterns for cloud access control and interfaces.
- To learn monitoring, auditing, and management for cloud security.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation.

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, IdentityFederation - Identity providers and service consumers - Storage and network access controloptions - OS Hardening and minimization - Verified and measured boot - Intruder Detection andprevention.

UNIT IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the cloud concepts and fundamentals.
CO2: Learnsecurity design principles for cloud computing and virtualization
CO3: Use cloud security controls, including access management, incident response, and auditing techniques.
CO4: Understand various risks ,audit and monitoring mechanisms in the cloud.
CO5: Show monitoring and management strategies to detect, respond to, and mitigate security threats in cloud environments.
CO6: Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:

1. Winkler, Vic JR. Securing the Cloud: Cloud computer Security techniques and tactics. Netherlands, First edition, 2011.
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.

REFERENCE BOOKS:

1. Daniel Drescher, "Blockchain Basics", First Edition, A press, 2017.
2. Handbook of Research on Block chain Technology published by Elsevier Inc. ISBN: 9780128198162, 2020.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc21_cs15 › preview

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 to:

- To understand blockchain, its structure, and cryptography.
- To learn about Bitcoin, cryptocurrency, and transactions.
- To explore Bitcoin consensus, PoW, and alternatives.
- To study Hyperledger Fabric and Ethereum architecture.
- To explore blockchain applications in various industries.

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

CO1: Show emergingabstractmodelsforBlockchainTechnology.

CO2: Identify major research challenges and technical gaps existing between theory and practice incryptocurrencydomain.

CO3: Summarize conceptual understanding of the function of Block.

CO4: Learn hyper ledgerFabricandEthereumplatformtoimplementtheBlockchain Application.

CO5: Show various new applications of block chain.

CO6: Compare block chain based solutions and write smart contract using Ethereum.

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Fourth edition,2023.
2. Andreas Antonopoulos, "Mastering Bit coin: Unlocking Digital Cryptocurrencies", O'Reilly, 2017.

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.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs44 › preview

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 to:

- To learn about the Semantic Web, social networks, and privacy/security.
- To explore privacy, security, and anonymity concerns in social networks.
- To study community detection and data mining in social networks.
- To understand human behavior prediction and privacy in social networks.
- To learn access control and identity management in social networks.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts and challenges of security within social networks.

CO2: Remember the techniques for analyzing and evaluating social network data to identify and address security issues.

CO3: Understand effective security measures and protocols to protect social networks from various threats and vulnerabilities.

CO4: Examine privacy issues related to social networks and develop strategies to safeguard personal information and user privacy.

CO5: Utilize the tools and technologies for detecting and mitigating security threats in social network environments.

CO6: Learn security policies and frameworks relevant to social networks.

TEXT BOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j3.xSecond Edition ByJérôme Baton, RikVanBruggen, Packt publishing.

REFERENCE BOOKS:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc24_cs56/preview

U23CBT81	MALWARE ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn basic malware analysis techniques and tools.
- To study advanced static analysis methods and anti-analysis techniques.
- To explore live malware analysis, tracing, and evasion techniques.
- To understand malware functionality, persistence, and injection methods.
- To analyze Android malware using static and dynamic tools

UNIT I INTRODUCTIONAND BASIC ANALYSIS **9**

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots

UNIT II ADVANCED STATIC ANALYSIS **9**

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions..Portable Executable File Format. The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques.

UNIT III ADVANCED DYNAMIC ANALYSIS **9**

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging.

UNIT IV MALWARE FUNCTIONALITY **9**

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection

UNITV ANDROID MALWARE ANALYSIS **9**

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the executable formats, Windows internals, and APIs
CO2: Learn techniques and concepts to unpack, extract, and decrypt malware.
CO3: Use the reverse-engineering of malware and anti-malware analysis techniques.
CO4: Discuss the proficiency with industry-standard malware analysis tools.
CO5: Learn the various malware sample tools.
CO6: Explain the skills to carry out static and dynamic malware techniques.

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, 2012.

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.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs36 › preview

VERTICAL – V (CREATIVE MEDIA)

		L	T	P	C
U23CSV54	**DIGITAL MARKETING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- Understand digital marketing fundamentals, evolution, and business impact.
- Learn website design, development, and optimization for an effective online presence.
- Leverage social media for brand awareness, audience engagement, and traffic.
- Use email marketing to nurture leads and boost customer engagement.
- Explore affiliate marketing and manage brand reputation online.

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 optimization - 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.

UNITV 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 would be able to

CO 1: Learn the role and importance of digital marketing.
CO 2: Compare, how digital marketing can be utilized by organizations.
CO 3: Learn key elements of a digital marketing strategy.
CO 4: Discuss, how the effectiveness of a digital marketing campaign can be measured.
CO 5: Explain advanced practical skills in common digital marketing tools.
CO 6: Learn about various strategies in digital marketing.

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education. First edition (July 2017)
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.

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview

U23CSV52	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Introduce multimedia fundamentals, elements, and challenges in distributed systems.
- Explore multimedia file formats, color models, and data formats for web/media.
- Understand multimedia authoring tools for editing, 3D modeling, and presentations.
- Study animation principles, including 2D, 3D, and advanced methods.
- Explore multimedia applications in big data, cloud computing, streaming, and security.

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 AUTHORING 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: Key frame, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNITV 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

CO1: Explain multimedia components, challenges, and technologies for effective learning.
CO2: Describe multimedia file formats and color models for images, audio, video, and web.
CO3: Compare 2D and 3D creative and interactive presentations for multimedia applications.
CO4: Use different standard animation techniques for 2D, 2 1/2 D, 3D applications.
CO5: Understand the complexity of multimedia applications.
CO6: Learn about Virtual reality and Augmented reality.

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).

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.

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/117/105/117105083/

U23AIV52	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Understand the evolution of filmmaking and risks in digital video editing.
- Explore storytelling, editing styles, and media management in digital video.
- Learn capturing, importing, and exporting digital video and audio formats
- Master Final Cut Pro for editing, audio management, and advanced techniques.
- Gain hands-on experience with Avid Xpress DV for editing and project management.

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 STORY TELLING 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.

UNITV 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 would be able to

CO1: Understand the strengths and limitations of nonlinear editing.
CO2: Identify the infrastructure and significance of storytelling.
CO3: Use suitable methods for recording to CDs and VCDs.
CO4: Address the core issues of advanced editing and training techniques.
CO5: Learn projects using advanced Tools.
CO6: Explaincompany-oriented expectations regarding applications.

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.

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/cec21_ge17/preview

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 to:

- Explore UI/UX design principles, focusing on user empathy.
- Understand visual principles, UI elements, and branding in UI design.
- Learn UX methodology, research tools, and aligning user needs with business goals.
- Develop skills in wireframing, prototyping, usability testing, and iteration.
- Study research, ideation, and information architecture techniques for effective design.

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 – Wire framing - Creating Wire flows - 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..

UNITV RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand user-centered design, focusing on usability, accessibility, and research.
CO2: Learn UI design principles and interaction behaviors for user-friendly interfaces.
CO3: Use user personas based on research tools and methods.
CO4: Explore wireframing, prototyping, and usability testing for UI design.
CO5: Align designs with branding guidelines for a consistent user experience.
CO6: Gain expertise in research, design, ideation, and 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.

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

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview

U23CSV55	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Understand animation principles and VFX techniques.
- Explore CGI, photorealism, 3D modeling, color grading, HDRI, and lighting.
- special effects like props, scaled models, animatronics, and particle effects.
- Learn advanced VFX methods like motion capture and camera reconstruction.
- Master compositing techniques (chroma keying, alpha compositing) using tools like Blender, Natron, and GIMP

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, pyro techniques, Schüfftan process, Particle effects – wind, rain, fog, fire.

UNIT IV VISUAL EFFECTS TECHNIQUES 9

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

UNITV 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 would be able to

CO1: Use animation in 2D / 3D following the principles and techniques.
CO2: Use CGI, color and light elements in VFX applications.
CO3: To Utilize special effects using any of the state of the art tools.
CO4: Learn popular visual effects techniques using advanced tools.
CO5: Use compositing tools for creating VFX for a variety of application.
CO6: Gain proficiency in industry-standard VFX software such as Adobe After Effects, Nuke, Blender, or similar tools, to execute complex visual effects tasks.

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, 2019.

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: IndustryStandardVFXPracticesandProcedures",ThirdEdition,2020.andGames", Routledge, 1st Edition, 2022.

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/107/101/107101001/

U23CSV56	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Understand 2D/3D graphics for game design, including transformation and animation.
- Explore game design principles character development, storyboarding
- Study game engine concepts: rendering, collision detection, AI, and algorithms.
- Learn about gaming platforms and frameworks like Pygameand mobile development.
- Develop interactive 2D/3D games using Pygame, including avatars and multiplayer.

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 – 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.

UNITV 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 would be able to

CO1: Explain the concepts of 2D and 3D Graphics.
CO2: Understand the applicability of the game design documents.
CO3: Explain rendering, sorting, and pathfinding algorithms in game engine design.
CO4: Survey different gaming environments and frameworks.
CO5: Discuss simple game in Pygame.
CO6: Explain various algorithms used in game development.

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.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview

U23CSV57	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Understand data compression basics, including lossless/lossy techniques, Huffman, and arithmetic coding.
- Explore lossless image compression (JPEG, CALIC) and prediction for image transmission.
- Study video compression (motion compensation, H.261, MPEG).
- Learn disk placement techniques (statistical, striping, replication) for storage optimization.
- Understand disk scheduling and feasibility for efficient request management.

UNIT I BASICS OF DATA COMPRESSION 9

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

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.

UNITV 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 would be able to

CO1: Understand the basics of text, Image and Video compression.
CO2: Understand the various compression algorithms for multimedia content.
CO3: Explain the applications of various compression techniques.
CO4: Use knowledge on multimedia storage on disks.
CO5: Understand scheduling methods for request streams.
CO6: Know about the constraints on storage systems.

TEXTBOOKS:

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, 2019.

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/cec21_ge17/preview

U23ITV57	ANDROID 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:

- Understand Android, install tools, and build basic apps.
- Learn about components, contexts, activities, services, and intents.
- Design UIs using layouts, drawing, and animations.
- Test, publish apps, and manage preferences and resources.
- Use APIs for data storage, networking, telephony, and deployment

UNIT I MOBILE PLATFORM AND APPLICATIONS 9

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial MobileOperating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone M-Commerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

UNIT II INTRODUCTION TO ANDROID 9

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, AndroidInstallation, Building you First Android application, Understanding Anatomy of Android Application,Android Manifest file.

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS 9

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services,Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, UsingIntent Filter, Permissions.

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA 9

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Workingwith Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Takeand Process Pictures.

UNITV ANDROID APIs AND DEPLOYING ANDROID APPLICATION 9

Using Android Data and Storage APIs, Managing data usingSqlite, Sharing Data betweenApplications with Content Providers, Using Android Networking APIs, Using Android Web APIs,Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify various concepts of mobile programming that make it unique from programming forother platforms

CO2: Create, test and debug Android application by setting up Android development

CO3: Demonstrate methods in storing, sharing and retrieving data in Android applications

CO4: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces

CO5: Create interactive applications in android using databases with multiple activities includingaudio, video and notifications and deploy them in marketplace.

CO6: Understand the projects on deploying android application.

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd Edition.(2011).
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big NerdRanch Guide", 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

REFERENCE BOOKS:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010.
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2019.
3. Android Application Development All in one for Dummies by Barry Burd,Edition:I,2020.

NPTEL LINK:

1. https://archive.nptel.ac.in/course.html

VERTICAL – VI (EMERGING TECHNOLOGIES)

		L	T	P	C
U23CSV67	**KNOWLEDGEENGINEERING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To understand reasoning under uncertainty using probabilistic and fuzzy methods.
- To explore knowledge engineering methodologies for problem solving and agent development.
- To study ontology design, development, and feature representation.
- To apply reasoning with ontologies and rules for hypothesis analysis.
- To explore machine learning concepts and rule learning for generalization.

UNIT I INTRODUCTION 9

Introduction –Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities– SubjectiveBayesianview–BeliefFunctions–BaconianProbability–Fuzzy Probability– Uncertaintymethods-Evidence-basedreasoning–IntelligentAgent–Mixed-InitiativeReasoning – Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING 9

ConventionalDesignandDevelopment–Developmenttoolsand ReusableOntologies– Agent Designand DevelopmentusingLearning Technology –Problem Solvingthrough Analysisand Synthesis–Inquiry-drivenAnalysisandSynthesis–Evidence-basedAssessment– Believability Assessment– Drill-Down Analysis,Assumption-BasedReasoning, andWhat-IfScenarios.

UNIT III ONTOLOGIES– DESIGNAND DEVELOPMENT 9

ConceptsandInstances–GeneralizationHierarchies–ObjectFeatures–DefiningFeatures– Representation–Transitivity – Inheritance–ConceptsasFeature Values –OntologyMatching. Designand Development Methodologies –Steps in Ontology Development – Domain UnderstandingandConceptElicitation–Modeling-BasedOntology Specification.

UNIT IV REASONIING WITH ONTOLOGIESAND RULES 9

ProductionSystemArchitecture–Complex Ontology-basedConcepts–ReductionandSynthesis rules andtheInferenceEngine –Evidence-based hypothesisanalysis– Rule andOntology Matching–PartiallyLearned Knowledge–Reasoningwith PartiallyLearned Knowledge.

UNIT V LEARNINGAND RULE LEARNING 9

Machine Learning–Concepts–Generalization andSpecializationRules–Types – Formal definition ofGeneralization.Modeling,LearningandProblemSolving–Rulelearningand Refinement –Overview–Rule Generationand Analysis–HypothesisLearning.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: LearnthebasicsofKnowledge Engineering.
CO2: Explore the methodologies andmodeling for AgentDesign andDevelopment.
CO3: Understand about the design anddevelopontologies.
CO4: To know the reasoningwith ontologies andrules.
CO5: To grasp the essential oflearningandrule learning.
CO6: To learn the rule generation and analysis in hypothesis learning.

TEXT BOOKS:

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.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc25_cs07/preview
2. https://onlinecourses.swayam2.ac.in/ntr25_ed18/preview

U23CSV61	ROBOTICS PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand the emergence and benefits of Robotic Process Automation (RPA) and its components.
- To explore workflow creation and decision-making through sequence, flowchart, and control flow in automation.
- To learn app integration, recording, scraping, and data handling techniques in RPA.
- To study exception handling, debugging, and code management techniques for RPA projects.
- To understand deployment, maintenance, and orchestration of RPA bots using management tools.

UNIT I INTRODUCTION TOROBOTIC PROCESSAUTOMATION 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, and 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,Ui Explorer, Handling Event.

UNIT III APP INTEGRATION,RECORDINGANDSCRAPING 9

App Integration, Recording, Scraping, Selector,WorkflowActivities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLINGAND 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 DEPLOYMENTAND 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 would be able to know the

- **CO1:** Understand the key distinctions between RPA and existing automation techniques and platforms.
- **CO2:** Ui Path to design control flows and workflows for the target process.
- **CO3:** Explore the recording, web scraping and process mining by automation.
- **CO4:** Use UI Path Studio to detect, and handle exceptions in automation processes.
- **CO5:** Illustrate the use of Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.
- **CO6:** Explain the error handling and debugging in RPA.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packet 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, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, 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 RPAA CompleteGuide ",2020.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc21_me32/preview
2. https://onlinecourses.swayam2.ac.in/ntr25_ed51/preview

U23CSV64	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To Understand quantum computing basics, including complex numbers and quantum mechanics.
- To Explore quantum gates, circuits, and error correction.
- To Study quantum algorithms like Deutsch's, Deutsch-Jozsa, and Grover's.
- To Learn quantum information theory, including data compression and coding.
- To Explore quantum cryptography, including Shor's algorithm and key distribution.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superposition's.

UNIT II QUANTUM GATES AND CIRCUITS 9

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

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UNIT III QUANTUM ALGORITHMS 9

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY 9

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY 9

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able

CO1: To learn the basics of quantum computing.
CO2: Understand the background of Quantum Mechanics.
CO3: Describe various computation models and their use.
CO4: Model the circuits using quantum computation, environments and frameworks.
CO5: Know the quantum operations such as noise and error–correction.
CO6: Explain the private key cryptography.

TEXTBOOKS:

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 Mermen, "Quantum Computer Science: An Introduction", Cambridge University.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc25_ch19/preview
2. https://onlinecourses.nptel.ac.in/noc25_ph10/preview

U23CSV63	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand cyber security, cybercrime history, and cyber laws.
- To study malicious attacks, vulnerabilities, and countermeasures.
- To explore reconnaissance tools, scanning, and social engineering techniques.
- To learn intrusion detection systems and techniques like Snort.
- To study firewalls, intrusion prevention systems, and their configurations.

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 would be able to

CO 1: Explain the basics of cyber security, cyber-crime and cyber law.
CO 2: Learn various types of attacks and learn the tools to launch the attacks.
CO 3: Explore various tools to perform information gathering.
CO 4: Identify the intrusion techniques to detect intrusion.
CO 5: Discuss intrusion prevention techniques to prevent intrusion.
CO 6: To grasp the essential of Unified Threat Management Products.

TEXT BOOKS:

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

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)

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/nou25_cs04/preview
2. https://onlinecourses.swayam2.ac.in/nou25_ge21/preview

U23ITV65	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand linear programming, graphical methods, and the simplex method.
- To explore integer programming, branch and bound methods, and transportation problems.
- To study project scheduling, CPM, PERT, and cost considerations in project management.
- To learn classical optimization theory, unconstrained and constrained optimization problems.
- To analyze queuing theory, system characteristics, and single/multiple service channel models.

UNIT I LINEAR MODELS 9

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP-Simplex Method-Two-Phase method.

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 9

Integer programming: Branch and bound method- Transportation and Assignment problems – Traveling sales man problem.

UNIT III PROJECT SCHEDULING 9

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV CLASSICAL OPTIMIZATION THEORY 9

Unconstrained problems–necessary and sufficient conditions- Newton- Raphson method, Constrained problems–equality constraints–inequality constraints-Kuhn-Tucker conditions**.**

UNIT V QUEUING MODELS 9

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline,Single channel models, multiple service channels.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the Formulate and solve linear programming problems (LPP).
CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.
CO3: Use the solution to network problems using CPM and PERT techniques.
CO4: Learn to optimize the functions object to the constraints.
CO5: Identify and solve problems under Markovian queuing models.
CO6: Explain Queuing system and multiple service channels.

TEXTBOOKS:

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

REFERENCE BOOKS:

1. ND Vohra, Quantitative Techniques in Management, Tata Mc Graw Hill, 4th Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt. Ltd. NewDelhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc25_ma59/preview
2. https://onlinecourses.nptel.ac.in/noc25_me60/preview

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 to:

- To explore blockchain fundamentals, cryptographic hash functions, and blockchain models.
- To understand Bitcoin, cryptocurrency creation, payments, and the Bitcoin network.
- To study Bitcoin consensus mechanisms, Proof of Work, and alternative consensus models.
- To learn about Hyperledger Fabric architecture, Ethereum network, and Solidity programming.
- To analyze blockchain applications in smart contracts, DApps, and various industries.

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

CO1: Show emergingabstractmodelsforBlockchainTechnology.

CO2: Identify major research challenges and technical gaps existing between theory and practice incryptocurrencydomain.

CO3: Summarize conceptual understanding of the function of Block.

CO4: Learn hyper ledgerFabricandEthereumplatformtoimplementtheBlockchain Application.

CO5: Show various new applications of block chain.

CO6: Compare block chain based solutions and write smart contract using Ethereum.

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2023.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2017.

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.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs44 › preview

U23CSV66	3D PRINTINGAND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand design considerations, 3D modeling, and file formats in 3D printing.
- To explore the different 3D printing processes, materials, and material selection for various applications.
- To study inkjet technology and its use in 3D printing, including material formulation and fabrication techniques.
- To examine laser technology in 3D printing, including light sources, optics, and printing machines.
- To analyze industrial applications of 3D printing in fields like healthcare, biotechnology, and manufacturing.

UNIT I INTRODUCTION 9

Introduction; Design considerations–Material,Size,Resolution,Process; Modellingand viewing-3D; Scanning; Model preparation –Digital;Slicing;Software; Fileformats.

UNIT II PRINCIPLE 9

Processes–Extrusion, Wire,Granular,Lamination,Photopolymerization;Materials-Paper, Plastics,Metals,Ceramics,Glass, Wood,Fiber,Sand,BiologicalTissues,Hydrogels,Grapheme; Material Selection-Processes, applications,limitations;

UNIT III INKJETTECHNOLOGY 9

Printer-WorkingPrinciple,PositioningSystem,printhead,Printbed,Frames,Motioncontrol; PrintheadConsiderations–ContinuousInkjet,Thermal Inkjet,PiezoelectricDrop-On-Demand; MaterialFormulationforjetting;Liquidbasedfabrication–Continuous jet,Mulitjet;Powderbased fabrication–Colourjet.

UNIT IV LASER TECHNOLOGY 9

LightSources–Types,Characteristics;Optics–Deflection,Modulation;Materialfeedingandflow – Liquid, powder; Printingmachines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT V INDUSTRIALAPPLICATIONS 9

ProductModels,manufacturing–Printedelectronics,Biopolymers,Packaging,Healthcare,Food, Medical,Biotechnology, Displays;Futuretrends;

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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: Outline and examine the basic concepts of 3D printing technology
CO 6: Outline 3D printing workflow

TEXTBOOKS:

1. Christopher Barnatt,3DPrinting: TheNextIndustrial Revolution,CreateSpace Independent PublishingPlatform,2013.
2. IanM.Hutchings, GrahamD. Martin, InkjetTechnologyfor Digital Fabrication,JohnWiley&Sons, 2013.

REFERENCE BOOKS:

1. Chua,C.K., LeongK.F.andLimC.S.,Rapidprototyping:Principles and applications, secondedition,WorldScientific Publishers, 2010.
2. Ibrahim Zeid, MasteringCADCAMTataMcGraw-Hill PublishingCo.,2007.
3. Joan Horvath,Mastering3D Printing,APress,2014.

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed01/preview
2. https://onlinecourses.swayam2.ac.in/ntr24_ed17/preview

U23ITV67	GAME THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce the basics of game theory, rational choice, and its applications in various fields.
- To study games with perfect information, including Nash equilibria and zero-sum games.
- To explore games with imperfect information and Bayesian games, focusing on strategies and equilibria.
- To understand non-cooperative game theory, analyzing optimality, equilibria, and strategy solutions.
- To examine mechanism design, social choice, and protocols for strategic agents in decision-making systems.

UNIT I INTRODUCTION 9

Introduction—Makingrationalchoices:basicsofGames—strategy—preferences—payoffs — Mathematicalbasics —Game theory—RationalChoice—Basicsolutionconcepts-non-cooperativeversuscooperativegames—Basiccomputationalissues— findingequilibria andlearningin games-Typicalapplicationareas forgametheory (e.g.Google'ssponsoredsearch, eBayauctions,electricity trading markets).

UNIT II GAMES WITH PERFECTINFORMATION 9

GameswithPerfectInformation—Strategicgames—prisoner'sdilemma,matchingpennies-Nashequilibria—mixedstrategyequilibrium—zero-sum games.

UNIT III GAMES WITH IMPERFECTINFORMATION 9

GameswithImperfectInformation—BayesianGames—MotivationalExamples—General Definitions—Informationaspects—Illustrations—ExtensiveGameswithImperfect— Information—Strategies —NashEquilibrium—RepeatedGames—ThePrisoner's Dilemma— Bargaining.

UNIT IV NON-COOPERATIVE GAME THEORY 9

Non-cooperativeGameTheory—Self-interestedagents—Gamesinnormalform—Analyzing games:fromoptimalitytoequilibrium—ComputingSolutionConceptsofNormal—FormGames — ComputingNashequilibriaoftwo-player,zero-sum games—ComputingNashequilibriaoftwo-player,general- sumgames —Identifyingdominatedstrategies.

UNIT V MECHANISMDESIGN 9

AggregatingPreferences—SocialChoice—FormalModel—Voting—Existenceofsocial functions — Rankingsystems — Protocols for Strategic Agents: Mechanism Design —Mechanismdesign withunrestrictedreferences.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discussthe notionstrategicgameandequilibriaandidentifythecharacteristicsof main applications of these concepts.

CO2: Understand theuseof NashEquilibriumforotherproblems.

CO3: Identifykeystrategicaspectsandbasedonthesebeabletoconnectthemtoappropriate gametheoreticalconceptsgivena real-world situation.

CO4: Identifysome applicationsthat needaspectsofBayesian Games.

CO5: Explain thetypicalVirtual Businessscenario usingGametheory.

CO6: To grasp the essential of mechanism designs with unrestricted references.

TEXTBOOKS:

1. M.J. Osborne,AnIntroduction toGameTheory.Oxford University Press, 2012.
2. M.Machler,E.Solan,S. Zamir,GameTheory,Cambridge University Press,2013.

VERTICAL – VII(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

		L	T	P	C
U23AIV13	**SOFT COMPUTING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

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

Supervised Learning Neural Networks – perceptrons – Back propagation -Multilayer Perceptrons Unsupervised Learning Neural Networks –Kohonen Self-Organizing Networks.

UNIT III GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function-Geneticoperators-Crossover–Mutation-FitnessFunction–Maximizing function.

UNIT IV NEURO FUZZY MODELING 9

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.

UNITV APPLICATIONS 9

Modeling a twoinput 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 the course the students would 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: Summarize various models using modeling techniques
CO5: Explain AR applications in different domains
CO6: Explain 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.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/nos24_ge12/preview
2. https://onlinecourses.swayam2.ac.in/aic20_sp17/preview

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:

- To gain an overview of neural networks and the fundamentals of supervised learning.
- To learn about neural network training algorithms and models for pattern association and self-organizing networks.
- To study advanced neural networks and deep learning models and their applications in computer vision.
- To study deep learning history, theory, and techniques and batch normalization.
- To learn about recurrent neural networks, autoencoders and their regularizations.

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-Autoassociative Memory Network Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS **9**

Spiking Neural Networks- Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation –Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuro scientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV DEEP FEEDFORWARD NETWORKS **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Back propagation - Regularization: Dataset Augmentation – Noise Robustness - Early Stopping, Bagging and Dropout-batch normalization-VC Dimension and Neural Nets.

UNITV RECURRENT NEURAL NETWORKS **9**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Auto encoder, Stochastic Encoders and Decoders, Contractive Encoders.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Outline the Convolution Neural Networks for image processing.
CO2: Understand the basics of associative memory and unsupervised learning networks.
CO3: Interpret CNN and its variants for suitable applications.
CO4: Explain the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
CO5: Inference auto encoders and generative models for suitable applications.
CO6: Simplify the application of image generation and natural language processing.

TEXT BOOKS:

1. Ian Good fellow, 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. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
3. Learn Keras for Deep Neural Networks, JojoMoolayil, Apress,2018.
4. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs89/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs74/preview

U23CSV14	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To cover text preprocessing and feature extraction techniques in natural language processing.
- To explore word embeddings, deep learning models, and text classification methods.
- To study question answering models and the design of dialogue systems.
- To understand text-to-speech synthesis, including normalization and deep learning approaches.
- To explore speech recognition techniques and acoustic modeling using HMM-based systems.

UNIT I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure- Text Pre processing 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 – Fast Text 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, Wave Net and other deep learning-based TTS systems.

UNITV 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 would be able to

CO1: Explain existing and emerging deep learning architectures for text and speech processing**.**

CO2: Understand the deep learning techniques for NLP tasks, language behavior and machine translation**.**

CO3: Describeanswering models and coherence for text processing.

CO4: Understand question-answering systems, chat bots and dialogue systems.

CO5: Learn about the deep learning models for building speech recognition and text-to-speech systems.

CO6: Understand the applications using HMM and DNN systems and strings.

TEXT BOOKS:

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.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs114/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs89/preview

U23CSV51	AUGMENTED REALITY/ VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To impart the fundamental aspects and principles of AR/VR technologies
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- 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.

UNITV 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 would be able to

CO1: Understand the basic concepts of AR and VR.
CO2: Understand the tools and technologies related to AR/VR.
CO3: Know the working principle of AR/VR related Sensor devices.
CO4: Explain various applications of VR.
CO5: Describe AR/VR applications in different domains.
CO6: Interpret the concepts of annotation and navigation.

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. Panchenko, Liubov F., Tetiana A. Vakaliuk, and Kateryna V. Vlasenko. "Augmented reality books: Concepts, typology, tools." CEUR Workshop Proceedings, 2020.
2. Verma, Jitendra Kumar, and Sudip Paul, eds. Advances in Augmented Reality and Virtual Reality. Springer, 2022.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/nou24_ge37/preview
2. https://onlinecourses.swayam2.ac.in/ntr24_ed76/preview
3. https://onlinecourses.swayam2.ac.in/nou24_ge37/preview

U23ITV65	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To formulate and solve linear programming problems.
- To introduce integer programming techniques and optimization strategies for solving complex transportation and assignment problems.
- To introduce the principles of project scheduling, emphasizing the use of network diagrams, floats, CPM, and PERT for effective project management.
- To introduce foundational concepts in classical optimizationfor solving constrained and unconstrained problems.
- To 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 PROJECTSCHEDULING 9

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV CLASSICAL OPTIMIZATION THEORY 9

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

UNIT V QUEUINGMODELS 9

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Formulate and solve linear programming problems.

CO2: Explain integer programming methods and their application in transportation and assignment problems.

CO3: Explain project scheduling concepts, including network diagrams, floats, and cost implications in CPM and PERT.

CO4: Describe the necessary and sufficient conditions for solving unconstrained optimization problems using classical methods.

CO5: Identify and solve problems under Markovian queuing models.

CO6: Discuss Queuing system and multiple service channels.

TEXT BOOKS:

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. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/aic22_ge30/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs86/preview
3. https://onlinecourses.nptel.ac.in/noc24_ee122/preview

U23CSV58	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- 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 PROGRAMMINGLANGUAGE 9

Web PPL Language – Syntax – Using Java script Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration.

UNIT IV INFERENCE MODELSOF 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 would be able to

CO1: Understand the underlying theory behind cognition.
CO2: Connect to the cognition elements computationally.
CO3: Understand the applicability of mathematical functions through Web PPL.
CO4: Discuss applications using cognitive inference model.
CO5: Illustrate applications using cognitive learning model.
CO6: Outline the hierarchical models and mixture models

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Noah D. Goodman, Andreas Stuhlmuller, "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/.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_me82/preview
2. https://onlinecourses.nptel.ac.in/noc24_hs177/preview
3. https://onlinecourses.nptel.ac.in/noc24_hs110/preview

U23AIV56	ETHICS AND AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- 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 ROBO ETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS **9**

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

UNITV 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 the course the students would be able to

CO1: Learn about morality and ethics in AI

CO2: Acquire the knowledge of real time application ethics, issues and its challenges.

CO3: Understand the ethical harms and ethical initiatives in AI

CO4: Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi- Autonomous Systems

CO5: Understand the concepts of Robo ethics and Morality with professional responsibilities.

CO6: Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOKS:

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield, "The ethics of artificial intelligence: Issues and initiatives", EPRS European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCE BOOKS:

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.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/nou24_ge87/preview
2. https://onlinecourses.swayam2.ac.in/cec24_mg14/preview

U23ITV67	GAME THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce the notion of a game, its solutions concepts, and other basic notions.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory.
- To draw the connections between game theory, computer science, and economics.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- 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.

UNITV 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 the course the students would be able to

CO1: Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.

CO2: Discuss the use of Nash Equilibrium for other problems.

CO3: Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.

CO4: Identify some applications that need aspects of Bayesian Games.

CO5: Understand the applicability of a typical Virtual Business scenario using Game theory.

CO6: Learn about the societal issues in AI with National and International Strategies on AI.

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. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
4. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.
5. William Spaniel, "Game Theory 101: The Complete Textbook", CreateSpace Independent Publishing, 2011.

REFERENCE BOOKS:

1. Barron, Emmanual N. Game theory: an introduction. John Wiley & Sons, 2024.
2. Prisner, Erich. Game theory through examples. Vol. 46. American Mathematical Soc., 2014.

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs109/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg77/preview

OPEN ELECTIVE – I

		L	T	P	C
U23CST71	**CLOUD COMPUTING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

- To understand the principles of cloud architecture, models and infrastructure
- To understand the concepts of virtualization and virtual machines
- To gain knowledge about virtualization Infrastructure..
- To explore and experiment with various Cloud deployment environments.
- 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: Understandthedesignchallengesinthecloud.
CO2: Understandthe conceptofvirtualizationanditstypes.
CO3: Experimentwithvirtualizationofhardwareresourcesand Docker
CO4: Learn and deploy services on the cloud and set up a cloud environment
CO5: Explain security challenges in the cloud environment.
CO6: Illustrate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXTBOOKS:

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.

NPTEL LINK:

https://onlinecourses.nptel.ac.in/noc24_cs17/preview

U23CBT63	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn ethical hacking, penetration testing, and network security layers.
- To study foot printing, reconnaissance, and network scanning.
- To explore enumeration and vulnerability analysis techniques.
- To understand web and wireless network hacking methods.
- To learn about firewalls, IDS, and network protection tools.

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

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS **9**

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

UNIT IV SYSTEM HACKING **9**

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

UNIT V NETWORK PROTECTION SYSTEMS **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Remember the knowledge on basics of computer based vulnerabilities
CO2: Understand on different foot printing, reconnaissance and scanning methods.
CO3: Discuss the enumeration and vulnerability analysis methods
CO4: Compare hacking options available in Web and wireless applications.
CO5: Show the options for network protection.
CO6: Use ethical hacking to expose the vulnerabilities.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://archive.nptel.ac.in/courses/106/105/106105217/

U23CSV52	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce the fundamentals of multimedia, its elements, and challenges in distributed multimedia systems.
- To explore various multimedia file formats, color models, and data formats for web and media.
- To understand multimedia authoring tools, including various editing, 3D modeling, and interactive presentation creation.
- To study the principles and techniques of animation, including 2D, 3D, and advanced animation methods.
- To explore multimedia applications in big data computing, cloud computing, multimedia streaming, and security.

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 AUTHORING 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: Key frame, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNITV 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

CO1: Explain multimedia components, challenges, and technologies for effective learning.
CO2: Describe multimedia file formats and color models for images, audio, video, and web.
CO3: Compare 2D and 3D creative and interactive presentations for multimedia applications.
CO4: Use different standard animation techniques for 2D, 2 1/2 D, 3D applications.
CO5: Understand the complexity of multimedia applications.
CO6: Learn about Virtual reality and Augmented reality.

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).

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.

NPTEL LINK:

1. https://archive.nptel.ac.in/courses/117/105/117105083/

U23ITO14	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand the fundamentals of object modeling.
- To understand and differentiate Unified Process from other approaches through class diagram
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification.

UNIT I UNIFIED PROCESS AND USECASE DIAGRAMS 9

Introduction to OOAD with OO Basics-Unified Process–UML diagrams–Use Case-Case study–the Next Gen POS system, Inception-Use case Modeling–Relating Use cases–Include, extend and generalization–When to use Use-cases.

UNIT II STATIC UML DIAGRAMS 9

Class Diagram—Elaboration–Domain Model–Finding conceptual classes and description classes– Associations– Attributes–Domain model refinement – Finding conceptual class Hierarchies–Aggregation.

UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams–UML interaction diagrams-System sequence diagram–Collaboration diagram– When to use Communication Diagrams - State machine diagram and modeling –When to use State Diagrams-Activity diagram– When to use activity diagrams. Implementation Diagrams - UML package diagram - When to use package diagrams- Component and Deployment Diagrams–When to use Component and Deployment diagrams.

UNIT IV DESIGN PATTERNS 9

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion –Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral –Strategy–observer–ApplyingGoFdesignpatterns–Mappingdesigntocode.

UNIT V TESTING 9

Object Oriented Methodologies– Software Quality Assurance–Impact of object orientation on Testing–Develop Test Cases and Test Plans.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the software design with UML diagrams.

CO2: Discuss the class diagram, Associations and aggregation.

CO3: Identify the various scenarios based on software requirements.

CO4: Remember the UML based software design into pattern-based design using design patterns.

CO5: Understand the various testing methodologies for OO software.

CO6: Discuss about the Software Quality Assurance and Test Plans.

TEXT BOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
2. Ali Bahrami-Object Oriented Systems Development-McGraw Hill International Edition-1999.

REFERENCE BOOKS:

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley,1995.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.

NPTEL LINKS:

1. https://archive.nptel.ac.in/courses/106/105/106105153/
2. https://onlinecourses.nptel.ac.in/noc19_cs48/preview

U23ITT72	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To learn software processes, models, and agile methodologies like Extreme Programming.
- To explore software design concepts, including architectural and user interface design.
- To study software testing techniques and maintenance practices.
- To apply software project management techniques, including estimation and risk management.
- To understand stream activities in project execution and tracking.

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 SOFTWARE DESIGN 9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client Server - Tiered - Pipe and filter- User interface design-Case Study.

UNIT III TESTING AND MAINTENANCE 9

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

UNIT IV 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.

UNIT V STREAM ACTIVITIES IN PROJECTS 9

Project Initiation – Project Planning – Execution and Tracking – Project Wind up – Concept of Process/Project Database.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the key activities in managing a software project.
CO2: Understand the concepts of requirements engineering and analysis Modelling.
CO3: Compare and contrast the various testing and maintenance.
CO4: Explain the process of performing analytics on data streams.
CO5: Make use of different phases in project management.
CO6: Utilize the stream activities in process/project database.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Ninth Edition, Mc Graw-Hill International Edition, 2020.
2. Ramesh Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.

REFERENCE BOOKS:

1. Pressman, Roger, "Software Engineering", A Practitioners approach". McGraw Hill, 1997.
2. Bob Hughes and Mike Cotterell, "Software Project Management".
3. Wheelwright and Clark, "Revolutionizing product development", The Free Press, 1993.

NPTEL Course

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

U23CST64	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To introduce information security concepts, models, and the security SDLC.
- To explore security investigation, business needs, and legal/ethical issues in security.
- To study risk management, access control mechanisms, and the confinement problem.
- To understand security policy, standards, and design for continuity.
- To explore physical security technologies, cryptography, and access control devices.

UNIT I INTRODUCTION 9

History, What is Information Security? Critical Characteristics of Information, NSTISSCSecurity 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/BS7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNITV 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 would be able to

CO1: Discuss the basics of information security.
CO2: Illustrate the legal, ethical and professional issues in information security.
CO3: Explain the basics of risk assessment and control.
CO4: Describe various security models, standards and frameworks.
CO5: Illustrate the tools that are used for security analysis.
CO6: Explain the access control mechanisms to safeguard information systems and prevent unauthorized access.

TEXTBOOKS:

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.

NPTEL LINKS:

1. https://onlinecourses.swayam2.ac.in/cec22_cs15/preview

U23CSV46	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

- To understand blockchain, its structure, and cryptography.
- To learn about Bitcoin, cryptocurrency, and transactions.
- To explore Bitcoin consensus, PoW, and alternatives.
- To study Hyperledger Fabric and Ethereum architecture.
- To explore blockchain applications in various industries.

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

CO1: Show emergingabstractmodelsforBlockchainTechnology.

CO2: Identify major research challenges and technical gaps existing between theory and practice incryptocurrencydomain.

CO3: Summarize conceptual understanding of the function of Block.

CO4: Learn hyper ledgerFabricandEthereumbplatformtoimplementtheBlockchain Application.

CO5: Show various new applications of block chain.

CO6: Compare block chain based solutions and write smart contract using Ethereum.

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, " 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.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc22_cs44 › preview

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:

- To introduce the semantic web, social network analysis, and privacy/security concepts.
- To explore privacy concerns, security evolution, and anonymity in social networks.
- To study community detection and mining in social network data.
- To examine human behavior prediction, privacy, and trust in social networks.
- To explore access control, authentication, and identity management in social networks.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, what is Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts and challenges of security within social networks.

CO2: Describe the techniques for analyzing and evaluating social network data to identify and address security issues.

CO3: Illustrate effective security measures and protocols to protect social networks from various threats and vulnerabilities.

CO4: Examine privacy issues related to social networks and develop strategies to safeguard personal information and user privacy.

CO5: Utilize the tools and technologies for detecting and mitigating security threats in social network environments.

CO6: Learn about the security policies and frameworks relevant to social networks.

TEXTBOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2012.
2. Borko Furht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2013.
3. Learning Neo4j3.xSecond Edition ByJérôme Baton, RikVanBruggen, Packt publishing.

REFERENCE BOOKS:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc24_cs56/preview