VELAMMAL

COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI – 625009.
(Autonomous)

(Accredited by NAAC with 'A' Grade and by NBA for 5 UG Programmes)

(Approved by AICTE and affiliated to Anna University, Chennai)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM and SYLLABUS

(I to VIII SEMESTER)

GOLDEN GOALS OF VET

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

VISION AND MISSION OF THE INSTITUTE

VISION OF VCET

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

MISSION OF VCET

Our aspirants are

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

VISION AND MISSION OF AI & DS DEPARTMENT

VISION

To emerge and sustain as academic excellence in Artificial Intelligence and Data Science to produce ethical professionals through innovative research and education.

MISSION

- To promote industry ready graduates by acquiring intelligent data analytical skills.
- To empower the graduates towards research and application-oriented knowledge for higher studies.
- To equip the graduates with entrepreneurship skills to serve the needs of society.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625009

(Autonomous)

B.Tech.- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CHOICE BASED CREDIT SYSTEM

REGULATIONS - 2021

BATCH: 2023 - 2027 & 2024 - 2028

CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER – I

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21IP101	Induction Programme *(Common to all B.E./B.Tech. Programmes)*	-	0	0	0	0
THEORY							
2.	21EN101	Professional English – I *(Common to all B.E./B.Tech. Programmes)*	HS	3	2	0	4
3.	21MA101	Matrices and Calculus *(Common to all B.E./B.Tech. Programmes)*	BS	3	2	0	4
4.	21PH101	Engineering Physics *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
5.	21CH101	Engineering Chemistry *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
6.	21CS101	Problem Solving and Python Programming. *(Common to all B.E./B.Tech. Programmes)*	ES	3	0	0	3
7.	21TA101	தமிழர் மரபு /Heritage of Tamils	HS	1	0	0	1
PRACTICAL COURSES							
8.	21CS102	Problem Solving and Python Programming Laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
9.	21PC101	Physics and Chemistry Laboratory *(Common to all B.E./B.Tech. Programmes)*	BS	0	0	4	2
Total Credits							**22**

SEMESTER- II

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21EN102	English – II *(Common to all B.E./B.Tech. Programmes)*	HS	3	0	0	3
2.	21MA103	Sampling Techniques and Numerical Methods *(Common to B.E. CSE/B.Tech. Programmes /B.E.ECE)*	BS	3	2	0	4
3.	21PH103	Physics for Information Science *(Common to B.E. CSE/B.Tech. Programmes)*	BS	3	0	0	3
4.	21ME101	Engineering Graphics *(Common to all B.E./B.Tech. Programmes)*	ES	2	0	2	3
5.	21EE104	Basic Electrical and Electronics Engineering for Information Science *(Common to B.E. CSE/B.Tech. Programmes)*	ES	3	0	0	3
6.	21AD101	Programming Paradigm in C	PC	3	0	0	3
7.	21CH103	Environmental Science *(Common to all B.E./B.Tech. Programmes)*	BS	2	0	0	2
8.	21TA102	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HS	1	0	0	1
PRACTICAL COURSES							
9.	21EM101	Engineering Practices Laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
10.	21AD102	Programming Paradigm in C Laboratory	PC	0	0	4	2
Total Credits							**26**

SEMESTER- III

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21MA203	Discrete Mathematics *(Common to B.E.CSE/B.Tech. Programmes)*	BS	3	2	0	4
2.	21AD201	Operating System Principles	PC	3	0	0	3
3.	21AD203	Data Structure Design using Python	PC	3	0	0	3
4.	21AD205	Principles of Artificial Intelligence	PC	3	0	0	3
THEORY WITH PRACTICAL COURSE							
5.	21AD206	Software Engineering Principles and Design	PC	2	0	2	3
PRACTICAL COURSES							
6.	21AD202	Operating System Principles Laboratory	PC	0	0	4	2
7.	21AD204	Data Structure Design using Python Laboratory	PC	0	0	4	2
Total Credits							**20**

SEMESTER- IV

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21MA208	Probability and Statistics *(Common to B.E.CSE/B.Tech. Programmes)*	BS	3	2	0	4
2.	21AD207	Analysis of Algorithms	PC	3	0	0	3
3.	21AD208	Database Design and Engineering	PC	3	0	0	3
4.	21AD210	Computer Networking Principles	PC	3	0	0	3
5.	21AD212	Principles of Machine Learning	PC	3	0	0	3
PRACTICAL COURSES							
6.	21AD209	Database Design and Engineering Laboratory	PC	0	0	4	2
7.	21AD211	Computer Networking Principles Laboratory	PC	0	0	4	2
8.	21AD213	Machine Learning Laboratory	PC	0	0	4	2
Total Credits							**22**

SEMESTER- V

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
		THEORY					
1.	21AD301	Deep Learning Techniques	PC	3	0	0	3
2.	21AD302	Data Science and Analytics	PC	3	0	0	3
3.	21AD304	Full Stack Development	PC	3	0	0	3
4.	21PADXX	Professional Elective I	PE	3	0	0	3
5.	21PADXX	Professional Elective II	PE	3	0	0	3
6.	21MCC01	Constitution of India	MC	1	0	0	0
7.		Internship**	EE	0	0	0	1
		PRACTICAL COURSES					
8.	21AD303	Data Science and Analytics Laboratory	PC	0	0	4	2
9.	21AD305	Full Stack Development Laboratory	PC	0	0	4	2
10.	21EN301	Professional Communication Laboratory *(Common to all B.E./B.Tech. Programmes)*	HS	0	0	2	1
		Total Credits					**21**

SEMESTER- VI

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21AD306	Natural Language Processing	PC	3	0	0	3
2.	21PADXX	Professional Elective III	PE	3	0	0	3
3.	21PADXX	Professional Elective IV	PE	3	0	0	3
4.	21XXXXX	Open Elective – I	OE	3	0	0	3
5.	21XXXXX	Open Elective – II	OE	3	0	0	3
6.	21MCC02	Essence of Indian Traditional Knowledge	MC	1	0	0	0
7.	21OCADXX	One Credit Course	EE	0	0	2	1
THEORY WITH PRACTICAL COURSE							
8.	21AD308	Computer Vision	PC	2	0	2	3
PRACTICAL COURSES							
9.	21AD307	Natural Language Processing Laboratory	PC	0	0	4	2
Total Credits							**21**

SEMESTER- VII

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21AD401	Data Visualization	PC	3	0	0	3
2.	21XXXXX	Open Elective – III	OE	3	0	0	3
3.	21XXXXX	Open Elective – IV	OE	3	0	0	3
PRACTICAL COURSES							
4.	21AD402	Data Visualization Laboratory	PC	0	0	4	2
5.	21AD403	Project Work 1	EE	0	0	4	2
Total Credits							**13**

SEMESTER- VIII

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
THEORY							
1.	21PADXX	Professional Elective – V	PE	3	0	0	3
2.	21PADXX	Professional Elective – VI	PE	3	0	0	3
PRACTICAL COURSE							
3	21AD404	Project Work-II	EE	0	0	20	10
Total Credits							**16**

****Industrial training for a period of minimum 2 weeks during the summer / winter vacation**

Total Credits: 161

SEMESTERWISE CREDIT DISTRIBUTION

Sem./Cat.	I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM	VIII SEM	Total Credits
HS	5	4	-	-	1	-	-	-	10
BS	12	9	4	4	-	-	-	-	29
ES	5	8	-	-	-	-	-	-	13
PC	-	5	16	18	13	8	5	-	65
PE	-	-	-	-	6	6	-	6	18
OE	-	-	-	-	-	6	6	-	12
EE	-	-	-	-	1	1	2	10	14
Total	22	26	20	22	21	21	13	16	**161**

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

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: COMPUTATIONAL INTELLIGENCE

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PAD01	Cognitive Computing	PE	3	0	0	3
2.	21PAD02	Recommender System	PE	3	0	0	3
3.	21PAD03	Distributed computing	PE	3	0	0	3
4.	21PAD04	Quantum Computing	PE	3	0	0	3
5.	21PAD05	Cloud Computing	PE	3	0	0	3
6.	21PAD06	Soft Computing Essentials	PE	3	0	0	3
7.	21PAD07	Generative AI	PE	3	0	0	3
8.	21PAD08	Fog Computing	PE	3	0	0	3

VERTICAL 2: CYBER INTELLIGENCE

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PAD17	Cyber Threat Analytics	PE	3	0	0	3
2.	21PAD18	IoT Security	PE	3	0	0	3
3.	21PAD19	Malware Analysis	PE	3	0	0	3
4.	21PAD20	Steganalysis	PE	3	0	0	3
5.	21PAD21	Biometric Security	PE	3	0	0	3
6.	21PAD22	Block Chain and Cryptocurrency	PE	3	0	0	3
7.	21PAD23	Information Security Management	PE	3	0	0	3
8.	21PAD24	Digital Forensics	PE	3	0	0	3

VERTICAL 3: ANALYTICAL INTELLIGENCE

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PAD25	Business Analytics	PE	3	0	0	3
2.	21PAD26	Predictive Analytics	PE	3	0	0	3
3.	21PAD27	Big Data Analytics	PE	3	0	0	3
4.	21PAD28	IoT Domain Analytics	PE	3	0	0	3
5.	21PAD29	Analytics in Cloud Computing	PE	3	0	0	3
6.	21PAD30	Multivariate Data Analysis	PE	3	0	0	3
7.	21PAD31	Geospatial Data Analysis	PE	3	0	0	3
8.	21PAD32	Time Series Analysis and Forecasting	PE	3	0	0	3

VERTICAL 4: COMPUTATIONAL THINKING FOR AI DESIGN

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PAD33	Robotics Process Automation	PE	3	0	0	3
2.	21PAD34	Reinforcement Learning	PE	3	0	0	3
3.	21PAD35	Foundations of Game Design and Development	PE	3	0	0	3
4.	21PAD36	Human Computer Interaction	PE	3	0	0	3
5.	21PAD37	GPU Architecture and Programming	PE	3	0	0	3
6.	21PAD38	Web and Social Media Analytics	PE	3	0	0	3
7.	21PAD39	AI in Finance	PE	3	0	0	3
8.	21PAD40	Artificial Neural Networks and Its Applications	PE	3	0	0	3

VERTICAL 5: FULL STACK DEVELOPMENT & AI TOOLS

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1.	21PAD41	Video Creation and Editing	PE	3	0	0	3
2.	21PAD42	Essentials of UI and UX Design	PE	3	0	0	3
3.	21PAD43	Digital Marketing	PE	3	0	0	3
4.	21PAD44	Visual Effects	PE	3	0	0	3
5.	21PAD45	App Development	PE	3	0	0	3
6.	21PAD46	DevOps	PE	3	0	0	3
7.	21PAD47	Open Source Technologies	PE	3	0	0	3
8.	21PAD48	Enterprise Application Development	PE	3	0	0	3

OPEN ELECTIVES (OE) FOR EEE, CIVIL AND MECH (CUTTING EDGE TECHNOLOGIES)

Sl. No.	COURSE CODE	COURSE TITLE	Category	L	T	P	C
1	21OAD01	Artificial Intelligence and Machine Learning Fundamentals	OE	2	0	2	3
2	21OAD02	IoT Concepts and Applications	OE	2	0	2	3
3	21OAD03	Data Science Fundamentals	OE	2	0	2	3
4	21OAD04	Augmented Reality / Virtual Reality	OE	2	0	2	3

ONE CREDIT COURSES

Sl.No.	COURSE CODE	COURSETITLE	Category	L	T	P	C
1.	21OCAD01	Practical Machine Learning with Tensor Flow	EE	0	0	2	1
2.	21OCAD02	Practical Tableau	EE	0	0	2	1
3.	21OCAD03	Mastering Power BI	EE	0	0	2	1
4	21OCAD04	Introduction to Innovative Projects	EE	0	0	2	1

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER - I

21IP101	INDUCTION PROGRAMME *(Common to all B.E./B.Tech Programmes)*	L	T	P	C
		0	0	0	0

PRE-REQUISTIE:

Ability to understand the high frequency every day or job-related language and write simple connected text on topics which re familiar or of personal interest.

OBJECTIVES:

- This course aims at making students comfortable to the new environment and create a holistic outlook, and to create a desire to work for national needs and beyond.

This is a mandatory 2-week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over. The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers
And students, give a broader view of life, and build character. "

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts,

but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real-life activities rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity
Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules
This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People
Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area
A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations
They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities
About a week can be spent in introducing activities (games, quizzes, social interactions, small Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT

Students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their Knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity-based programme and therefore there shall be no tests / Assessments during this programme.

REFERENCES:

Guide to Induction program from AICTE

21EN101	PROFESSIONAL ENGLISH-1 (Common to all B.E./B.TECH. Programmes)	L 3	T 2	P 0	C 4

COURSE OBJECTIVES:

- To develop learner's skills in listening and responding effectively
- To apply basic grammar for better communication
- To employ reading passages for understanding vocabulary
- To construct logical sentences and participate in pair presentation, extempore
- To organize ideas for various compositions in writing

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	15

Listening – Listening for general information - Specific details **-** Conversation: Introduction to classmates **-** Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form; **Speaking -** Self Introduction; Introducing a friend; Conversation - Politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form; **Reading -** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails; **Writing -** Writing emails / letters introducing oneself; **Grammar -** Present Tense (simple, continuous); Question types: Wh/ Yes or No/ and Tags **Vocabulary -** Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts)

UNIT II	NARRATION AND SUMMATION	15

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities; **Speaking** - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews; **Reading** - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs; **Writing** - Guided writing - Paragraph writing Short Report on an event (field trip etc.); **Grammar** - Past tense (Simple, continuous); Subject-Verb Agreement; and Prepositions; **Vocabulary** - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	15

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products; **Speaking** - Picture description; Giving instruction to use the product; Presenting a product; and Summarizing a lecture; **Reading** - Reading advertisements, gadget reviews; user manuals; **Writing** - Writing definitions; instructions; and Product /Process description; **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect, Present and past perfect continuous tenses; **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	15

Listening - Listening to TED Talks; Scientific lectures; and educational videos; **Speaking** – Small Talk; Mini presentations and making recommendations; **Reading** - Newspaper articles; Journal reports - Non Verbal Communication (tables, pie charts etc,) **Writing** - Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode) **Grammar** - Articles; Pronouns - Possessive & Relative pronouns; **Vocabulary** - Collocations; Fixed / Semi fixed expressions

UNIT V	EXPRESSIONS	15

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions; **Speaking** - Group discussions, Debates, and Expressing opinions through Simulations & Role-play; **Reading** - Reading editorials; and Opinion Blogs; **Writing** - Essay Writing (Descriptive or narrative); **Grammar** - Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences; **Vocabulary** - Cause & Effect Expressions - Content vs. Function words.

	TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Listen and comprehend complex academic texts

CO2: Read and infer the denotative and connotative meanings of technical texts

CO3: Write definitions, descriptions, narrations and essays on various topics

CO4: Speak fluently and accurately in formal and informal communicative contexts

CO5: Express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University. English for Science & Technology. Cambridge University Press, 2021
2. Board of Editors, Department of English, Anna University. English for Engineers & Technologists. Orient Blackswan Private Ltd, 2020.
3. Board of Editors, Department of English, Anna University. Using English Orient Blackswan Private Ltd, 2017

REFERENCES:

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

21MA101	MATRICES AND CALCULUS (Common to all B.E. / B.Tech. Programmes)	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To make the students to apply functions of several variables technique to solve problems in many engineering branches.
- To make the students understand various techniques of integration.
- To prepare the student to use mathematical tools in evaluating multiple integrals and their applications.

UNIT I	MATRICES	12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT II	DIFFERENTIAL CALCULUS	12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	12

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

UNIT IV	INTEGRAL CALCULUS	12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT V	MULTIPLE INTEGRALS	12

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

	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

21PH101	ENGINEERING PHYSICS (Common to I Year B.E. / B.Tech. Students)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The main objectives of this course are:

- To illustrate the students effectively to achieve an understanding of mechanics.
- To infer the students to gain knowledge of electromagnetic waves and its applications.
- To explain the basics of oscillations, optics and lasers.
- To outline the importance of quantum physics.
- To relate the students towards the applications of quantum mechanics.

UNIT I	MECHANICS	9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum– double pendulum –Introduction to nonlinear oscillations.

UNIT II	ELECTROMAGNETIC WAVES	9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

UNIT III	OSCILLATIONS, OPTICS AND LASERS	9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave – sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference– Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV	BASIC QUANTUM MECHANICS	9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V	APPLIED QUANTUM MECHANICS	9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

	TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the importance of mechanics.

CO2: Extend their knowledge in electromagnetic waves.

CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Interpret the importance of quantum physics.

CO5: Summarize quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow, “An Introduction to Mechanics”, First Edition, McGraw Hill Education, 2017.
2. E.M.Purcell and D.J.Morin, “Electricity and Magnetism”, Third Edition, Cambridge University Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, “Concepts of Modern Physics”, Seventh Edition, McGraw-Hill, 2017.

REFERENCES

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

21CH101	ENGINEERING CHEMISTRY (Common to all B.E / B.Tech. Programmes)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**. Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II	NANOCHEMISTRY	9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials**: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers).

Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.

UNIT IV	FUELS AND COMBUSTION	9

Fuels: Introduction: Classification of fuels; **Coal and coke**: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Power alcohol and biodiesel.**

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

UNIT V	ENERGY SOURCES AND STORAGE DEVICES	9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3: Apply the knowledge of phase rule and composites for material selection requirements.

CO4: Recommend suitable fuels for engineering processes and applications.

CO5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhan Patrai 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", 12th Edition, S. Chand Publishing, 2018.

REFERENCES:

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

21CS101	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to all B.E./B.Tech Programmes)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To describe the basics of algorithmic problem solving.
- To solve problems using Python conditionals and loops.
- To illustrate Python functions and use function calls to solve problems.
- To make use of Python data structures - lists, tuples, and dictionaries to represent complex data.
- To explain 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, and 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-else-if-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT-IV	LISTS, TUPLES, DICTIONARIES	9

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

UNIT-V	FILES, MODULES, PACKAGES	9

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

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Make use of design approaches to solve computational problems.

CO2: Develop and execute basic Python programs using expressions and input/output statements.

CO3: Utilize strings, functions and control statements to develop real world problems.
CO4: Construct programs using Python data types like lists, tuples and dictionaries.
CO5: Prepare a Python application by incorporating files and exceptions.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher,“Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.
3. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc- Graw Hill, 2018.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, 1st Edition, Pearson Education, 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”, 3rd Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019

21CS102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY *(Common to all B.E./B.Tech Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To describe the basics of algorithmic problem solving.
- To solve problems using Python conditionals and loops.
- To illustrate Python functions and use function calls to solve problems.
- To make use of Python data structures - lists, tuples, and dictionaries to represent complex data.
- To explain input/output with files in Python.

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

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational Problems
CO2: Illustrate and execute basic Python programs using simple statements.
CO3: Build program for scientific problems using strings, functions and control statements.
CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications.
CO5: Experiment the python packages, files and exceptions for developing software applications

21PC101	PHYSICS AND CHEMISTRY LABORATORY (Common to I year B.E. / B.Tech., students)	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To explain the proper use of various kinds of physics laboratory equipment.
- To extend how data can be collected, presented and interpreted in a clear and concise manner.
- To infer problem solving skills related to physics principles and interpretation of experimental data.
- To summarize error in experimental measurements and techniques used to minimize such error.
- To translate the student as an active participant in each part of all lab exercises.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 7 Experiments)

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – Determination of the velocity of sound and compressibility of liquids
10. Post office box - Determination of Band gap of a semiconductor**.**
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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

CO1: Explain the functioning of various physics laboratory equipment
CO2: Relate the graphical models to analyze laboratory data
CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4: Explain Access, process and analyze scientific information.
CO5: Translate students to solve problems individually and collaboratively

REFERENCES:

1. "Physics Laboratory Manual", Department of Physics, Velammal College of Engineering & Technology, Madurai (2021)
2. P. Mani, "Physics Laboratory", Dhanam Publications, 2021.

21PC101	PHYSICS AND CHEMISTRY LABORATORY *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

The main objectives of this course are:

- To inculcate experimental skills to test basic understanding of water quality parameters such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical techniques such as pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles.
- To analyze the quality of coal sample using proximate analysis.

List of Experiments (Any 7 experiments)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate. (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel.
15. Proximate analysis of Coal.

COURSE OUTCOMES:

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

CO1: To analyze the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2: To determine the amount of metal ions through volumetric and spectroscopic techniques.
CO3: To analyze and determine the composition of alloys.
CO4: To learn simple method of synthesis of nanoparticles.
CO5: To quantitatively analyze the impurities in solution by electro analytical techniques.

Text Book:

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

21TA101 **தமிழர் மரபு** **L T P C**
1 0 0 1

அலகு I **மொழி மற்றும் இலக்கியம்**: **3**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை**: **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**: **3**

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

அலகு IV **தமிழர்களின் திணைக் கோட்பாடுகள்**: **3**

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER- II

21EN102	ENGLISH-II (Common to all B.E./B.TECH. Programmes)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- To prepare and write convincing job applications and effective reports.
- To demonstrate their speaking skills to make technical presentations and participate in group discussions.
- To apply their Listening skill which will help them comprehend lectures and talks in their areas of specialization
- To choose appropriate soft skills to suit the situation.

UNIT I	INTRODUCTION TO TECHNICAL ENGLISH	9

Listening - Factual and Academic speeches; **Speaking** - Asking for and giving directions - **Reading** - Technical texts from - Newspapers /websites; **Writing -** Statements - Definitions - issue based writing instructions - Checklists - Recommendations; **Vocabulary Development**- technical vocabulary; **Grammar** - Error spotting - Compound words; Soft **skills** - Leadership Skills.

UNIT II	READING AND STUDY SKILLS	9

Listening - Listening to longer technical talks and completing exercises based on them; **Speaking** - Describing a general process; **Reading** - Reading longer technical texts - Identifying the various transitions in a text - Paragraphing; **Writing** - Interpreting charts, graphs; **Vocabulary Development** - Vocabulary used in formal letters/emails and reports **Grammar -** Impersonal passive voice, numerical adjectives - **soft skills** – Teamwork.

UNIT III	TECHNICAL WRITING AND GRAMMAR	9

Listening - Listening to classroom lectures, talks on engineering /technology; **Speaking** - introduction to technical presentations; **Reading** - longer texts both general and technical, practice in speed reading; **Writing** - Describing a technical process; **Vocabulary Development** - Sequence words - Misspelled words; **Grammar** - Embedded sentences; **Soft skills** - Decision making.

UNIT IV	JOB APPLICATIONS	9

Listening - Listening to documentaries and making notes. **Speaking** - Mechanics of presentations; **Reading -** Reading for detailed comprehension; **Writing** - Email etiquette - job application - Cover Letter - Resume preparation(via email and hard copy) - Analytical essay writing - **Vocabulary Development -** finding suitable synonyms - paraphrasing; **Grammar** - clauses - If conditionals -**Soft skills** - Time Management.

UNIT V	GROUP DISCUSSION AND REPORT WRITING	9

Listening - TED talks; **Speaking** - Participating in a group discussion - **Reading** - Reading and understanding technical articles; **Writing** - Writing reports - Survey report, accident report and minutes of a meeting - **Vocabulary Development** - Verbal analogies; **Grammar** - reported speech; **Soft skills** - Conflict Resolution.

TOTAL: 45PERIODS

COURSE OUTCOMES:

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

CO1: Interpret by reading information in technical texts
CO2: Choose appropriate language to write convincing job applications, resume and reports
CO3: Formulate the technical ideas effectively in spoken and written forms
CO4: Analyze and understand spoken language in lectures and talks
CO5: Demonstrate basic soft skills in life

TEXT BOOKS:

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

REFERENCES:

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

21MA103	SAMPLING TECHNIQUES AND NUMERICAL METHODS (COMMON TO B.E. CSE, ECE & B.Tech. IT)	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- To provide necessary basic concepts in probability
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To understand the basic concepts of classification of design of experiments.
- To introduce the basic concepts of solving algebraic and transcendental equations using numerical techniques.
- 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.

UNIT I	PROBABILITY	12

Introduction-Sample Spaces and Events-Axioms of Probability-Interpretations and Properties of Probabilities-Conditional Probabilities-Baye's theorem- Independence.

UNIT II	TESTING OF HYPOTHESIS	12

Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, $\chi 2$ and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

UNIT III	DESIGN OF EXPERIMENTS	12

Introduction, aim, basic designs of experiments, one way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT IV	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12

Newton Raphson method –Method of False position- pivoting – Gauss Jordan methods – Iterative method: Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

UNIT V	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	12

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules, $3/8^{th}$ rule.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the concepts of Probability in Engineering problems.

CO2: Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and $\chi 2$ test.

CO3: Apply the basic concepts of classifications of design of experiments.

CO4: Solve the system of equations and the eigen value problems using iterative procedure.

CO5: Interpret the value of an unknown function at any interpolated point of the given tabulated values**.**

TEXT BOOKS:

1. JAY.L. Devore, "Probability and Statistics for Engineering and the Science", 9^{th} Edition, Cengage Learning, 2021.
2. Johnson. R.A., and Irwin Miller, John Freund, "Miller and Freund's Probability and Statistics for Engineers", 12^{th} Edition, Pearson Education, Asia, 2011.

3. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis", 7thEdition, Pearson Education, Asia, New Delhi, 2008.

REFERENCES:

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", 3rd Edition, Tata McGraw Hill, 2012.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill, New Delhi, 2007.
4. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.

21PH103	PHYSICS FOR INFORMATION SCIENCE (Common to B.E. CSE/B.Tech. Programmes)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To infer the importance in studying electrical properties of materials.
- To extend the students' knowledge in semiconductor physics.
- To illustrate knowledge on magnetic properties of materials.
- To summarize different optical properties of materials, optical displays and applications.
- To translate an idea of significance of Nano structures, quantum confinement, ensuing Nano device applications and quantum computing.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann-Franz law - Success and failures - Electrons in metals - Particle in a three-dimensional box - Degenerate states - Fermi- Dirac statistics - Density of energy states - Electron effective mass - Concept of hole.

UNIT II	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors - Energy band diagram - Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - extrinsic semiconductors - Carrier concentration in n-type & p-type semiconductors - Variation of carrier concentration with temperature - Variation of Fermi level with temperature and impurity concentration - Carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and devices - Ohmic contacts - Schottky diode.

UNIT III	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetic dipole moment - Atomic magnetic moments - Magnetic permeability and susceptibility - Magnetic material classification: diamagnetism - Paramagnetism - Ferromagnetism - Antiferromagnetism - Ferrimagnetism - Ferromagnetism: origin and exchange interaction saturation magnetization and Curie temperature - Domain Theory- M versus H behavior - Hard and soft magnetic materials - Examples and uses - Magnetic principle in computer data storage - Magnetic hard disc (GMR sensor).

UNIT IV	OPTICAL PROPERTIES OF MATERIALS	9

Classification of optical materials - carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode - solar cell - LED - Organic LED - Laser diodes - Optical data storage techniques.

UNIT V	NANODEVICES AND QUANTUM COMPUTING	9

Introduction - Quantum confinement - Quantum structures: quantum wells, wires and dots - Band gap of nanomaterials. Tunneling - Single electron phenomena: Coulomb blockade - Resonant- tunneling diode - single electron transistor - quantum cellular automata - Quantum system for information processing - quantum states - classical bits - quantum bits or qubits - CNOT gate - multiple qubits - quantum gates - advantage of quantum computing over classical computing (qualitative).

TOTAL: 45 PERIODS

COURSEOUTCOMES:

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

CO1: Demonstrate the classical and quantum electron theories, and energy band structures.
CO2: Infer knowledge on basics of semiconductor physics and its applications in various devices.
CO3: Summarize magnetic properties of materials and their applications in data storage.
CO4: Extend the functioning of optical materials for optoelectronics
CO5: Translate the basics of quantum structures towards quantum computing.

TEXT BOOKS:

1. Jasprit Singh, "Semiconductor Devices Basic Principles", First Edition (Indian Edition), Wiley, 2007.

2. S.O. Kasap, “Principles of Electronic Materials and Devices”, Fourth Edition (Indian Edition), McGraw Hill Education, 2020.
3. Parag K. Lala, “Quantum Computing: A Beginner's Introduction”, First Edition (Indian Edition) McGraw-Hill Education, 2020.

REFERENCES

1. Charles Kittel, “Introduction to Solid State Physics”, Indian Edition Wiley, 2019.
2. Y.B.Band and Y.Avishai, “Quantum Mechanics with Applications to Nanotechnology and Information Science”, First Edition, Academic Press, 2013.
3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, “Introduction to Nano electronics”, First Edition, Cambridge University.Press, 2008.
4. G.W. Hanson, “Fundamentals of Nano electronics”, Indian Edition, Pearson Education 2009.
5. B.Rogers, J.Adams and S.Pennathur, “Nanotechnology: Understanding Small Systems”, CRC Press, 2014.

21ME101	ENGINEERING GRAPHICS (Common to all B.E./B.Tech. Programmes)	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To sketch the projection of points, lines and planes.
- To sketch the projection of simple solids
- To sketch the projection of sectioned solids and development of lateral surfaces
- To sketch the isometric and perspective views of simple solids.
- To sketch the orthographic projection of various objects freehandly.

UNIT I	PROJECTIONS OF POINTS, LINES AND PLANE SURFACE	12

Importance of graphics in engineering applications – Use of drafting instruments - Lettering and dimensioning.

Introduction to Orthographic projections - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.

Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method. (Not for Examination)

UNIT II	PROJECTION OF SOLIDS	12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT III	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT IV	ISOMETRIC AND PERSPECTIVE PROJECTIONS	12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

UNIT V	FREEHAND SKETCHING	12

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Introduction to drafting packages and demonstration. (Not for examination).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Construct the orthographic projections of points, straight lines and plane surfaces.

CO2: Sketch the orthographic projections of simple solids

CO3: Sketch the orthographic projections of sectional solids and lateral surfaces of the solids.

CO4: Construct the isometric projections and perspective projections of simple solids.

CO5: Sketch the orthographic projection of objects using freehand.

TEXT BOOKS:

1. Natarajan K.V., “A text book of Engineering Graphics”, 31st Edition, Dhanalakshmi Publishers, Chennai, 2018.

2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, 15th Edition, New Age International (P) Limited, 2018.
3. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, 53rd Edition, Charotar Publishing House, 2014.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, 2nd Edition, Tata McGraw Hill Publishing Company Limited, 2013.
2. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, 2nd Edition, Oxford University, Press, New Delhi, 2015.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, 2nd Edition, Pearson, 2009.

21EE104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING FOR INFORMATION SCIENCE (Common to B.E. CSE/B.Tech. Programmes)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the basics of electric circuits and analysis.
- To summarize the basics of working principles and application of AC and DC machines.
- To interpret the domestic and industrial wiring.
- To demonstrate analog devices and their characteristics.
- To illustrate the application of operational amplifier.

UNIT I	ELECTRICAL CIRCUITS	9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws– Simple problems- Nodal Analysis, Mesh analysis. Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – (Simple problems only)

UNIT II	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and. Construction and Working Principle of DC motors, Back EMF equation, Types, Speed and Torque Equation, Transformer-Construction, Working principle and Three phase Alternator, Synchronous motor and Three Phase Induction Motor-construction, working principle and Applications (Qualitative Analysis)

UNIT III	DOMESTIC AND INDUSTRIAL WIRING	9

Lighting, provision of sockets-MCB- Selection of wires and cables-Protection-need for earthing, fuses, relay and circuit breakers. Load calculation, generation cost and Energy Tariff calculation for domestic and industrial loads- HT & LT wiring- Power factor correction.

UNIT IV	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing – Types, I-V Characteristics and Applications, Rectifier. (Qualitative Analysis)

UNIT V	OPERATIONAL AMPILIFIERS AND ITS APPLICATIONS	9

Operational amplifiers, Inverting and Non Inverting Amplifier, Summer, Differentiators, Integrator, Voltage to Current (V/I) and Current to Voltage (I/V) Converter, Multivibrator using 555timer IC.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Interpret the electric circuit parameters of simple DC Circuits.
CO2: Explain the working principle and applications of AC and DC machines.
CO3: Demonstrate the domestic and industrial wiring.
CO4: Describe the characteristics of analog electronic devices.
CO5: Summarize the basic concepts of operational amplifiers.

TEXT BOOKS

1. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
2. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
3. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
4. Allen J.Wood & brucef.wollen berg," Power generation ,operation and control", John wiley and sons,Inc,2016.

REFERENCES

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.

4. Badriram, B.H.Vishwakarma, “Power system protection and switchgear”, new age international Pvt Ltd publishers, second Edition 2011.

21AD101	PROGRAMMING PARADIGM IN C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C

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

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 AND DATA ANALYTICS	9

Files – Types of file processing: Sequential access, Random access- Command line arguments - Basics of data analytics-Types of analytics: descriptive, diagnostic, predictive, prescriptive -Data analytics lifecycle. Case study: Analyzing data using C programming

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge on C Programming constructs
CO2: Design and implement applications using arrays and strings
CO3: Develop and implement modular applications in C using functions.
CO4: Develop applications in C using structures and pointers.
CO5: Design applications using data analytics in C programming.

TEXT BOOKS:

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015
3. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013

REFERENCES:

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”, McGrawHill Education, 1996.

21CH103	ENVIRONMENTAL SCIENCE	L	T	P	C
	(Common to all B.E / B.Tech. Programmes)	2	0	0	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To appreciate the structure and function of an ecosystem and biodiversity
- To realize the environmental impacts of natural resources.
- To recognize causes, effects and control measures of different types of pollution.
- To comprehend the importance of disaster management, environmental ethics and values.
- To apprehend the important social issues and sustainable practices.

UNIT-I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	6

Multidisciplinary nature of environmental studies - ecosystem- general structure and function of an ecosystem- ecological succession-biodiversity-types-values of biodiversity- endangered and endemic species-red data book- hot spots of biodiversity-criteria- hot spots in India-threats to biodiversity (man-animal conflicts, habitat loss, poaching)-case studies-conservation of biodiversity- in-situ and ex-situ conservation.

UNIT-II	NATURAL RESOURCES AND ITS ENVIRONMENTAL IMPACTS	6

Natural resources-forest resource-ecological functions – causes, effects and control measures of deforestation-water resource-sources-conflict over water-dams benefits and problems-food resource-overgrazing- impacts of over grazing- impacts of modern agriculture-energy resource-environmental impacts of wind mills and solar panels- role of an individual in conservation of natural resources.

UNIT III	ENVIRONMENTAL POLLUTION AND CONTROL	6

Air pollution-causes, effects and control methods - water pollution- causes, effects-waste water treatment-soil pollution-causes, effects-solid waste management–e-waste- causes, effects and management-Pollution control acts-air(prevention and control of pollution) act,1981-water(prevention and control of pollution) act,1974- wildlife (protection) act,1972 - e-waste management rules,2016-case studies - role of an individual in control of pollution.

UNIT IV	DISASTER MANAGEMENT AND ENVIRONMENTAL ETHICS	6

Disaster management-causes, effects and management of- flood, landslide, earthquake and tsunami-case studies- environmental ethics- value education-traditional value systems in India-water conservation-rain water harvesting-watershed management.

UNIT V	SOCIAL ISSUES AND SUSTAINABLE PRACTICES	6

Unsustainable development- social issues-climate change-causes, effects and control measures-global warming-causes, effects and control measures-Acid rain-causes, effects and control measures-ozone layer depletion-causes, effects and control measures-nuclear accident and holocausts-EIA-Sustainable development-goals-target- green buildings- ISO 14000 series.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO 1: Explain the concept, structure and function of an ecosystem and biodiversity.
CO 2: Demonstrate the environmental impacts of natural resources.
CO 3: Select the suitable management method for pollution control.
CO 4: Practice the proper way of managing disaster with environmental ethics.
CO 5: Recognize social issues and adopt suitable sustainable practices.

Text Books:

1. Kaushik, A & Kaushik. C.P, “Environmental Science and Engineering”, 6th Edition, New Age International, 2018.

2. Garg S.K & Garg, Ecological and Environmental studies, Khanna Publishers, 2015.
3. Wright & Nebel, Environmental science towards a sustainable future, 12th Editon, Prentice Hall of India Ltd, 2015.

Reference Books:

1. Erach Bharucha, "Text book of Environmental studies for Undergraduate courses", 3rd Edition, UGC, 2021.
2. Ravi P. Agrahari, Environmental ecology, Biodiversity, climatic change & Disaster management, 1st Edition, McGraw Hill, 2020
3. Benney Joseph, "Environmental Science and Engineering", 1st Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

21TA102	தமிழரும் தொழில்நுட்பமும்	L T P C 1 0 0 1

அலகு I **நெசவு மற்றும் பானைத் தொழில்நுட்பம்**: 3

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

அலகு II **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III **உற்பத்தித் தொழில் நுட்பம்**: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV **வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்**: 3

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

அலகு V **அறிவியல் தமிழ் மற்றும் கணித்தமிழ்**: 3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

21EM101	ENGINEERING PRACTICES LABORATORY *(Common to all B.E / B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To draw pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- To demonstrate the basic switch board wiring, fluorescent lamp wiring and stair case wiring using various electrical components.
- To choose various joints in steel plates using arc welding work and machining various simple processes like turning, drilling, tapping in parts
- To build a tray out of metal sheet using sheet metal work.
- To develop electronic circuit and testing for soldering and desoldering using PCB board.

LIST OF EXPERIMENTS:

GROUP – A (CIVIL & ELECTRICAL)

PART – I

CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

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

WOOD WORK:

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

PART – II

ELECTRICAL ENGINEERING PRACTICES

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

GROUP – B (MECHANICAL & ELECTRONICS)

PART III

MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

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

BASIC MACHINING WORK:

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

ASSEMBLY WORK:

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

SHEET METAL WORK:

- Making of a square tray

FOUNDRY WORK:

- Demonstrating basic foundry operations.

PART IV

ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

- Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- Study elements of smart phone.
- Assembly and dismantle of computer / laptop

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Build various plumbing joints

CO2: Develop various carpentry joints.

CO3: Construct various wiring electrical joints in common household electrical wire work.

CO4: Construct various welded joints, sheet metal and basic machining operations

CO5: Develop the electronic circuit for soldering and testing using PCB board.

21AD102	PROGRAMMING PARADIGM IN C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- 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, Search and Sort
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function, Recursion
7. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
9. Files: reading and writing, File pointers, file operations, random access, processor directives.
10. Data Analytics: Reading the data from CSV file and Sorting the data.

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Develop programs in C using basic constructs

CO2: Develop programs in C using arrays

CO3: Develop applications in C using strings, pointers, functions

CO4: Develop applications in C using structures.

CO5: Develop applications in C using file processing and Data analytics

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER - III

21MA203	DISCRETE MATHEMATICS (COMMON TO B.E. CSE & B.Tech. IT)	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To understand the basic concepts of Combinatorics.
- To study about the properties and characters of different graphs.
- To familiarize the applications of algebraic structures.
- To identify the concepts and significance of lattices and Boolean algebra which arewidely 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 – 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

Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT IV	ALGEBRAIC STRUCTURES	12

Groups – Subgroups – Cyclic groups - Homomorphism – Normal Subgroup and Cosets – Lagrange's Theorem – Definitions and Examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	12

Partial ordering – Posets – Lattices as Posets – Properties of Lattices - Lattices as Algebraic Systems – Sub-Lattices – Some Special Lattices: Bounded, Modular, Distributive, Complemented.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Extend student's logical and mathematical maturity and ability to deal with abstraction.
CO2: Explain the basic concepts of Combinatorics.
CO3: Make use of the concept of graph theory in computer science and engineering.
CO4: Disseminate the applications of algebraic structures.
CO5: Examine the basic theorems and properties of Lattices and Boolean Algebra.

TEXT BOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2011.

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

REFERENCES:

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

21AD201	OPERATING SYSTEM PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics and functions of operating systems.
- To analyze Scheduling algorithms and process synchronization.
- To analyze various memory management schemes.
- To be familiar with I/O management and File systems.
- 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

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section problem – Peterson‘s solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – 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; Virtual Memory - Demand Paging – Copy on Write – Page Replacement – Allocation of frames -Thrashing.

UNIT-IV	I/O SYSTEMS	9

File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection

UNIT-V	VIRTUAL MACHINES AND MOBILE OS	9

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

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze various scheduling algorithms and process synchronization.

CO2: Explain deadlock, prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.

CO4: Explain the functionality of file systems I/O systems

CO5: Compare iOS and Android Operating Systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”ǁ, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi
3. William Stallings, "Operating Systems: Internals and Design Principles”, Seventh Edition, Prentice Hall,2011.

REFERENCES:

1. Andrew S.Tanenbaum,"Modern Operating Systems”, Second Edition, Addison Wesley,2001.
2. D M Dhamdhere, "Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw-Hill Education,2007.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Educationǁ,1996.

21AD203	DATA STRUCTURE DESIGN USING PYTHON	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To create and use classes, objects, methods, and inheritance in Python.
- To store and manipulate data using lists, dictionaries, and regular expressions in Python.
- To learn about the Arrays and Linked list data structures in Python.
- To implement Stack and Queues in Python
- To Perform Search operation in Graphs and Trees.

UNIT-I	OOPS CONCEPTS	9

Class, object, constructors, types of variables, types of methods. Inheritance: single, multiple, multi-level, hierarchical, hybrid, Polymorphism: with functions and objects, with class methods, with inheritance, Abstraction: abstract classes.

UNIT II	DATA STRUCTURES	9

Definition, Linear Data Structures, Non-Linear Data Structures, Python Specific Data Structures: List, Tuples, Set, Dictionaries, Comprehensions and its Types, Strings, slicing, Searching -Linear Search and Binary Search, Sorting - Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT-III	ARRAYS&LINKED LIST	9

Arrays - Overview, Types of Arrays, Operations on Arrays, Arrays vs List. Linked Lists – Implementation of Singly Linked Lists, Doubly Linked Lists, and Circular Linked Lists.

UNIT-IV	STACK&QUEUES	9

Stacks - Overview of Stack, Implementation of Stack (List & Linked list), Applications of Stack

Queues: Overview of Queue, Implementation of Queue (List & Linked list), Applications of Queues, Priority Queues.

UNIT-V	GRAPHS&TREES	9

Graphs -Introduction, Directed vs Undirected Graphs, Weighted vs Unweighted Graphs, Representations, Breadth First Search, Depth First Search. Trees - Overview of Trees, Tree Terminology, Binary Trees, Tree Traversals, Binary Search Trees, AVL Trees.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret the concepts of Object-Oriented Programming as used in Python.

CO2: Implement Searching and sorting in Python.

CO3: Identify the operation of Array and Linked list in Python.

CO4: Demonstrate the applications of Stack and Queues in Python.

CO5: Represent the searching algorithms in Graphs and Trees in Python.

TEXTBOOKS:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures and Algorithms in Python” (An Indian Adaptation), Wiley, Second Edition, 2021.
2. Dr. Basant Agarwal, Benjamin Baka, “Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7”, Packet Publishing, 2nd Edition, 2018.
3. Narasimha Karumanchi, “Data Structures and Algorithmic Thinking with Python”, Kindle Edition, First Edition, 2015.

REFERENCES:

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press, Second Edition,2023
2. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer, First Edition 2015.
3. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, First Edition, 2011.

21AD205	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To identify the basic concepts and principles of artificial intelligence and intelligent systems.
- To develop intelligent agents that can make decisions in uncertain environments.
- To solve the search algorithms for real-world problems.
- To make use of knowledge representation systems for real-world problems.
- To build machine learning algorithms to real-world problems.

UNIT-I	INTRODUCTION TO AI AND INTELLIGENT SYSTEMS	9

Definition, Scope, and History of AI-Turing Test and its Implications, Intelligent Agents and their Classifications, Structure of Intelligent Agents, Applications of Intelligent Systems.

UNIT-II	PROBLEM SOLVING	9

Problem Representation and State-Space Search - Uninformed Search Algorithms- BFS, DFS, UCS, Informed Search Algorithms - A* Algorithm and Heuristics.

UNIT-III	SEARCH IN COMPLEX ENVIRONMENTS	9

Adversarial Search - Games, Optimal Decisions in Games, The Minimax Algorithm, Alpha-BetaPruning, and Constraint Satisfaction Problems (CSP), Backtracking Search for CSPs.

UNIT-IV	KNOWLEDGE REPRESENTATIONAND REASONING	9

Propositional and Predicate Logic, Resolution and Inference Rules, Semantic Networks and Frames, Ontologies and Knowledge Graphs.

UNIT-V	MACHINE LEARNING	9

Introduction to Machine Learning and its Types, Supervised Learning - Regression, Classification, Unsupervised Learning - Clustering, Dimensionality Reduction.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Build artificial intelligence techniques to solve real-world problems.
CO2: Make use of search algorithms to solve problems in a state-space.
CO3: Select adversarial search techniques to make optimal decisions in games.
CO4: Construct knowledge representation in propositional and predicate logic.
CO5: Choose machine learning techniques to classify data and cluster data.

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, 4th Edition, Pearson Education, 2021.
2. Ethem Alpaydin, “Introduction to Machine Learning”, 4thEdition, MIT Press, 2020.
3. Saikat Dull, S. Chandramouli, Das, “Machine Learning”,1st Edition, Pearson,2018.

REFERENCES:

1. Deepak Khemani, “Artificial Intelligence”, 2ndEdition, TataMcGrawHillEducation,2013.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”,1stEdition, McGrawHill,2008.
3. PatrickH.Winston,"ArtificialIntelligence",3rdEdition, PearsonEducation,2006.

21AD206	SOFTWARE ENGINEERING PRINCIPLES AND DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the concepts of software process.
- To gain knowledge about analysis and design.
- To acquire knowledge on developing UML diagrams.
- To know about software testing and project execution.
- To learn about agile development methodology.

UNIT-I	SOFTWARE PROCESS AND DEVELOPMENT	6

Software engineering concepts – Development activities – Software lifecycle models –Classical waterfall –Iterative waterfall – Prototyping – Evolutionary –Spiral – Win Win Spiral model – Prototyping model –Increment model – RAD model – Specialized process models – The rational unified process

UNIT-II	SOFTWARE REQUIREMENTS ANALYSIS, DESIGN CONCEPTS AND PRINCIPLES	6

Software Requirement Analysis & Design - Functional and non-functional – Software requirement document – Requirement engineering process – Feasibility studies – Functional and behavioral models - Structured analysis and data dictionary–Design process and concepts–Design heuristic – Architectural design – Mapping data flow into a software architecture –Data design – User interface design – Real time software design.

UNIT-III	OBJECT ORIENTED ANALYSIS AND DESIGN	6

Introduction to OOAD with OO Basics — Unified Process - UML Diagrams – Static, Dynamic & Implementation Diagrams.

UNIT-IV	SOFTWARE TESTING & PROJECT MANAGEMENT	6

Taxonomy of software testing – Types of S/W testing – Black box testing – White box testing – Regression testing – Unit testing – Integration testing – Validation testing – System testing – Software cost estimation – Function point models – COCOMO Model – Delphi method –Project planning – Project scheduling – Risk management – Software configuration management.

UNIT-V	AGILE SOFTWARE DEVELOPMENT AND SCRUM FRAMEWORK	6

Fundamentals of Agile Process Methods – Values – Principles – stakeholders – Challenges – Agile Manifesto and Principles - Agile project management – Design and development practices in Agile projects - User Stories – Agile Testing – Scrum Framework - Scrum Practices – Applying Scrum – Need of scrum – working of scrum – Advanced Scrum Applications – Scrum and the Organization – scrum values – Scrum case study – Tools for Agile project management.

30 PERIODS

PRACTICAL EXERCISES:	**30 PERIODS**

I. Do the following exercises for any one project given in the list of sample projects.

1. Development of problem statement.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents (Test Cases).
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
6. Draw relevant State Chart and Activity Diagrams for the same system.

II. Use agile methodology and scrum framework for any one project (Write User Stories and develop sprints)

Sample Projects:

Online Course Registration
Airline/Railway reservation system
e-book management system
Recruitment system
Passport automation system.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply software engineering principles for software development
CO2: Use software requirement specification and design software according to the specification.
CO3: Use UML diagram to design project deliverables.
CO4: Apply different testing and manage the software.
CO5: Implement Agile Scrum for software projects

TEXTBOOKS:

1. Roger S. Pressman, “Software Engineering: A practitioner’s Approach”, McGraw-Hill International Edition, Seventh Edition, 2014.
2. Craig Larman, “Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.
3. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Pearson Education Limited, First Edition, 2013

REFERENCES:

1. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language‖, Third edition, Addison Wesley, 2003.
2. Ian Sommerville, “Software engineering”, Pearson Education Limited, Ninth Edition, 2012
3. James F.Peters and Witold Pedrycz, “Software Engineering, An Engineering Approach”, Wiley-India, Third Edition, 2007

21AD202	OPERATING SYSTEM PRINCIPLES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To install windows operating systems.
- To understand the basics of UNIX command and shell programming.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement various memory allocation methods.
- To be familiar with File Organization and File Allocation Strategies

LIST OF EXPERIMENTS

1. Installation of windows operating system
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphore
7. Write C programs to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Define and implement UNIX Commands.

CO2: Compare the performance of various CPU Scheduling Algorithms.

CO3: Compare and contrast various Memory Allocation Methods.

CO4: Define File Organization and File Allocation Strategies.

CO5: Implement various Disk Scheduling Algorithms.

21AD204	DATA STRUCTURE DESIGN USING PYTHON LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the Oops concept in Python
- To implement search and sorting algorithms in Python
- To learn about the Linked lists and arrays in Python
- To implement Stack and Queue operations in Python
- To define various Tree and Graph structures in Python.

LIST OF EXPERIMENTS

11. Write a program to implement Inheritance.
12. Write a program for Linear Search and Binary search.
13. Write a program to implement Bubble Sort and Selection Sort.
14. Write a program to implement Merge sort and Quick sort.
15. Write a program to implement Stacks and Queues.
16. Write a program to implement Singly Linked List.
17. Write a program to implement Doubly Linked list.
18. Write a program to implement Circular Linked list.
19. Write a program to implement Binary Search Tree.
20. Write a program to implement BFS & DFS.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the Oops Concepts.
CO2: Interpret the data structure concepts.
CO3: Implement Array and Linked list operations.
CO4: Make use of Stack and Queue in real world applications.
CO5: Understand the application of Trees and Graphs.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER- IV

21MA208	PROBABILITY AND STATISTICS B.Tech. AI & DS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

The main objectives of this course are:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I	PROBABILITY AND RANDOM VARIABLES	12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II	TWO - DIMENSIONAL RANDOM VARIABLES	12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III	TESTING OF HYPOTHESIS	12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV	DESIGN OF EXPERIMENTS	12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V	STATISTICAL QUALITY CONTROL	12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO2: Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.

CO3: Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO4: Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
CO5: Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXTBOOKS:

1. Johnson. R.A., Miller. I.R and Freund. J.E, & quot; Miller and Freund's Probability and Statistics for Engineers & quot;, Pearson Education, Asia, 9 th Edition, 2016.
2. Milton. J. S. and Arnold. J.C., & quot; Introduction to Probability and Statistics & quot;, Tata Mc Graw Hill, 4th Edition, 2007.
3. John E. Freund, & quot; Mathematical Statistics & quot;, Prentice Hall, 5th Edition, 1992.

REFERENCES:

1. Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12 th Edition, 2020.
2. Devore. J.L., & quot; Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5 th Edition, Elsevier, 2014.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., " Schaum's Outline of Theory and Problems of Probability and Statistics & quot;, Tata McGraw Hill Edition, 4 th Edition, 2012.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., & quot; Probability and Statistics for Engineers and Scientists & quot;, Pearson Education, Asia, 9 th Edition, 2010.

21AD207	ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT-I	INTRODUCTION	9

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

UNIT-II	GRAPH ALGORITHMS	9

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	9

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	9

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	9

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

TOTAL :45 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will 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: Use the state space tree method for solving problems.

CO5: Solve problems using approximation algorithms and randomized algorithms

TEXT BOOKS:

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

REFERENCES:

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.

21AD208	DATABASE DESIGN AND ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To design database using ER model and SQL.
- To apply functional dependencies and normalization concept in real time problems.
- To acquire knowledge on transactions, file organization and query processing.
- To understand basic data engineering concepts.
- To analyze the principle of data architecture and storage.

UNIT-I	INTRODUCTION AND DATABASE DESIGN	9

Database System – Purpose – Views of Data – System Structure - Models – Relational Model – ER Model - SQL Fundamentals & Features.

UNIT-II	NORMALIZATION	9

Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies & Fourth Normal Form – Join Dependencies & Fifth Normal Form.

UNIT-III	TRANSACTION AND IMPLEMENTATION TECHNIQUES	9

Transaction – ACID properties – Schedules – Serializability – Concurrency Control – Locking Protocol – Two Phase Locking – Deadlock - RAID – File Organization - Indexing and Hashing - Query Processing.

UNIT-IV	FUNDAMENTALS OF DATA ENGINEERING	9

Fundamentals Data Engineering, Data Engineering Lifecycle, Data Engineering vs. Data Science, Data Engineering Skills and Activities, Business and Technical Responsibilities.

UNIT-V	DATA ARCHITECTURE AND STORAGE	9

Principles of Data Architecture, Types of Data Architecture -Data Warehouse, Data Lake, Cloud vs. On-Premises Storage, Data Storage Systems, Distributed Storage, Object Storage, Data Platforms and Data Catalogs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify entities, attributes and their relationship, prepare ER model and use basics of SQL to write query.

CO2: Use functional dependencies, normal forms to design and normalize a database.

CO3: Summarize interleaved operations of transaction, file organization strategies, parsing and execution of SQL Statements.

CO4: Understand and summarize basics of data engineering concepts.

CO5: Analyze the principles governing Data Architecture and Storage in different applications.

TEXTBOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, Tata McGraw Hill, 2021.
2. Joe Reis, Matt Housley, “Fundamentals of Data Engineering”, 1st Edition, O’Reilly Media, 2022.
3. Brian Shive, “Data Engineering”, First Edition, Kindle Edition, 2013.

REFERENCES:

1. Paul Crickard, “Data Engineering with Python”, First Edition, Packet, 2020.
2. Hamid Mahmood Qureshi, Hammad Sharif, “Snowflake Cookbook: Techniques for building modern cloud data warehousing solutions”, 1st Edition, Kindle Edition, 2021.
3. Andreas Kretz, “The Data Engineering Cookbook”, The Data Engineering Academy, 2019.

21AD210	COMPUTER NETWORKING PRINCIPLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basic fundamental concepts, functionalities of physical layer
- To understand the functionalities of data link layer.
- To learn the concepts in transport layer and application layer.
- To learn the fundamentals of cryptography.
- To understand the application layer security standards and real time security practices.

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9

Data Communication – Networks – Network Types – TCP/IP model – OSI model – Layers – Physical layer –Topology – Transmission media – Switched Communications Networks – Circuit Switching – Packet Switching – Comparison of Circuit Switching and Packet Switching.

UNIT II	DATA LINK AND NETWORK LAYER	9

Error Detection and Correction – Hamming Code, CRC, Checksum– Flow control mechanism – Sliding Window Protocol – GoBack– N – Selective Repeat – Multiple access Aloha – Slotted Aloha – CSMA, CSMA/CD – Multiple Access Networks (IEEE 802.3), Token Ring(IEEE 802.5) and Wireless Networks (IEEE 802.11, 802.15) – IP addressing – Internet Protocol – ARP – RARP – IGMP – ICMP – Routing algorithms – Link State Routing – OSPF – Distance Vector Routing – RIP – DHCP

UNIT III	TRANSPORT AND APPLICATION LAYER	9

TCP and UDP– Congestion Control–Effects of Congestion–Traffic Management–TCP Congestion Control–Congestion Avoidance Mechanisms–Queuing Mechanisms– QoS Parameters - Domain Name System (DNS) – E–mail – SMTP – IMAP – POP3 – File Transfer Protocol – HTTP – SNMP.

UNIT IV	NETWORK SECURITY	9

OSI Security Architecture – Security Attacks, Services, Mechanism, Model – Symmetric Ciphers – Substitution and Transposition Techniques - Steganography – Block Cipher and DES – Key Distribution – Public Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Message Authentication and Hash Functions – SHA – Digital Signature – DSS.

UNIT V	APPLICATION LAYER SECURITY AND PRACTICES	9

Electronic Mail Security: Pretty Good Privacy, S/MIME - Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations - Blockchains, Cloud Security and IoT security.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Outline OSI model and the features of physical layer.

CO2: Make use of data link layer features to calculate error codes and apply protocols for the given network.

CO3: Compare congestion effects in a network and understand the concepts of application layer protocols.

CO4: Illustrate examples for cryptography techniques.

CO5: Apply security practices for real time applications.

TEXT BOOKS:

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, Fifth Edition, 2013

2. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.
3. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education, 2018.

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kauffmann Publishers Inc., Third Edition, 2011
2. William Stallings, “Data and Computer Communication”, Pearson Education, Sixth Edition, 2000.
3. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.

21AD212	PRINCIPLES OF MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the concepts of machine learning
- To explore the different supervised learning techniques
- To learn different aspects of unsupervised learning algorithm
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT-I	INTRODUCTION TO MACHINE LEARNING	9

Introduction to Machine Learning (ML), Essential Concepts of ML, Types of Learning, Machine Learning Methods based on Time, Dimensionality, Linearity and Non Linearity, Early Trends in Machine Learning, Data Understanding Representation and Visualization.

UNIT-II	SUPERVISED LEARNING ALGORITHMS	9

Linear, Non-Linear, Multi-Class and Multi-Label Classification, Support Vector Machine, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

UNIT-III	UNSUPERVISED LEARNING	9

Clustering, Nearest Neighbor Models, K-Means, Hierarchical Clustering, KD Trees. Dimensionality Reduction, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis.

UNIT-IV	LEARNING METHODS	9

Introduction, Naïve Bayes Algorithm, Maximum Likelihood, Maximum Apriori, Bayesian Belief Networks, Probabilistic Modelling of Problems, Inference in Bayesian Belief Networks, Probability Density Estimation, Sequence Models, Markov Models, Hidden Markov Models.

UNIT-V	NEURAL NETWORKS AND DEEP LEARNING	9

Neural Networks, Biological Motivation, Perceptron, Multi-Layer Perceptron, Feed Forward Network, Back Propagation, Activation and Loss Functions, Limitations of Machine Learning, Deep Learning, Convolution Neural Networks, Recurrent Neural Networks, Use Cases.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of machine learning.
CO2: Build supervised learning models.
CO3: Construct unsupervised learning algorithms.
CO4: Implement Probabilistic Modelling for an application and analyze the results.
CO5: Understand the functions of neural network and deep learning**.**

TEXTBOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition, 2017
3. Stephen Marsland, “Machine Learning: An Algorithmic Perspective, “Second Edition”, CRC Press, 2014.

REFERENCES:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, Second Edition, MIT Press, 2018.
2. Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
3. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.

21AD209	DATABASE DESIGN AND ENGINEERING LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain knowledge on basic commands of database.
- To execute constraints, views, sequence and synonyms.
- To understand execution of nested queries, procedures and functions.
- To be familiar with front end tool and database connectivity.
- To create simple datasets and implement visualization.

LIST OF EXPERIMENTS

1. Database Development Life cycle:
    - Problem definition and Requirement analysis
    - Scope and Constraints
2. Implement the database using SQL Data Definition with Constraints.
3. Query the database using SQL Manipulation and Control Statements.
4. Implementation Views, Sequences and Synonyms.
5. Query the database using Set Operators, Nested Queries and Join Queries.
6. Querying/Managing the database using SQL Programming
   - Stored Procedures/Functions
   - Constraints and security using Triggers
7. Database Design using ER Modeling, Normalization and Implementation for any application.
8. Database Connectivity with Front End Tools.
9. Case Study using Real Time Application – Collection of data – Create Dataset for the Application.
10. Create data visualization for any real time application.

Hardware: Standalone Desktops
Software: Oracle, NetBeans, VisualStudio, any open source tool for visualization

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Use DDL, DML & DCL commands to experiment the creation of database.
CO2: Create an application to execute Views, Sequence and Synonyms.
CO3: Test a database application using nested queries and join queries.
CO4: Construct simple codes to execute functions and procedures.
CO5: Design an application using ER diagram, normalization and create simple dataset.

21AD211	COMPUTER NETWORKING PRINCIPLES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn network commands and implement flow control, error correction mechanisms
- To learn socket programming
- To implement and analyze various network protocols
- To learn different cipher techniques
- To implement the algorithms RSA, Diffie-Hellman and DSS.

LIST OF EXPERIMENTS

1. Implement commands like tcpdump, netstat, ifconfig, nslookup and traceroute, ping and traceroute
2. Implement error correction technique.
3. Implementation of socket programs using TCP & UDP
4. Simulation of sliding window protocols
5. Implementation of ARP/RARP
6. Implementation of routing protocols
7. Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher
8. Implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
10. Implement the SIGNATURE SCHEME – Digital Signature Standard.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Implement various networking commands

CO2: Implement error correction codes

CO3: Implement network and application layer protocols using sockets.

CO4: Develop code for classical Encryption Techniques to solve the problems.

CO5: Build cryptosystems by applying symmetric and public key encryption algorithms.

21AD213	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To Understand the fundamental concepts of Machine Learning and its significance
- To build supervised learning models.
- To construct unsupervised learning models.
- To Introduce and implement the Naïve Bayes algorithm for probabilistic classification.
- To identify the working principles of neural network including the back propagation algorithm.

LIST OF EXPERIMENTS

1. Implement loading and exploring a machine learning dataset
2. Demonstrate various data pre-processing techniques for a given dataset.
3. Implement a support vector machine (SVM) model.
4. Develop Logistic Regression Model for a given dataset
5. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample
6. Implement Naïve Bayes Classification in Python.
7. Implement Random Forest ensemble method on a given dataset.
8. Implement a principal component analysis (PCA) algorithm.
9. Implement a k-nearest neighbors (KNN) classifier.
10. Build Artificial Neural Network model with back propagation on a given dataset.

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Identify and apply the appropriate machine learning algorithm for a given problem.
CO2: Evaluate the Supervised learning models preprocessed through various feature engineering algorithms.
CO3: Implement and apply dimensionality reduction techniques such as principal component analysis.
CO4: Design and apply the Naive Bayes algorithm, maximum likelihood, and maximum a posteriori estimation.
CO5: Understand the basic concepts of neural network model and design the same.

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SEMESTER- V

21AD301	DEEP LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamental techniques and principles of Neural Networks
- Identify and apply appropriate deep learning architectures for analyzing the data for a variety of problems.
- To analyze deep learning concepts with Convolutional Neural Network case studies
- To Implement different deep learning algorithms
- To study of an advanced deep learning technique

UNIT-I	INTRODUCTION TO DEEP LEARNING & NEURAL NETWORKS	9

Historical context and motivation for deep learning - Fundamentals of Neural Networks - Comparison of Biological and Artiicial Neurons - Perceptron –Model of Artificial Neuron – Feedforward neural networks - Deep networks -Regularizing a deep network, Model Exploration - Hyper parameter tuning.

UNIT-II	DEEP LEARNING ARCHITECTURES	9

Machine Learning and Deep Learning - Representation Learning - Width and Depth of Neural Networks - Activation Functions: RELU – LRELU – ERELU -Unsupervised Training of Neural Networks - Restricted Boltzmann Machines -Auto Encoders - Deep Learning Applications.

UNIT-III	CONVOLUTIONAL NEURAL NETWORK	9

Introduction to convolution neural networks: stacking, striding and pooling -Applications like image, and text classiication - Architectural Overview -Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet - AlexNet – Applications.

UNIT-IV	SEQUENCE MODELING: RECURRENT NETS	9

Unfolding computational graphs - Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder - Decoder sequence to sequence architectures -Deep Recurrent Networks.

UNIT-V	ADVANCED DEEP LEARNING TECHNIQUES	9

Deep Belief Networks – Deep Boltzman Machine – Deep Associative Memory networks – Generative Neural Networks – Deep fake Technology –Case Study on designing deep learning solutions for identifying fake fingerprints, fake images and videos.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Demonstrate the basic concepts, fundamental learning techniques and layers.
CO2: Analyze and evaluate, in the context of a case study, the advantages and disadvantages of deep learning neural network architectures and other approaches.
CO3: Design convolutional networks for handwriting and object classification from images or video.
CO4: Design recurrent neural networks for sequence modeling.
CO5: Build, train and apply fully connected deep neural networks.

TEXT BOOKS:

1. Simon Haykin, “Neural Networks, A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman, 2001.
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

3. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc,2015.

REFERENCES:

1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
2. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, 2015.
3. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers,2013.

21AD302	DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain knowledge in the basic concepts of Data Analysis
- To understand the concept and types of the analytics
- To explore the skills of Big Data Analytics
- To acquire knowledge in data interpretation and visualization techniques
- To understand the role of data analytics in Business Intelligence

UNIT-I	INTRODUCTION TO DATA SCIENCE	9

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

UNIT-II	FOUNDATION OF DATA ANALYTICS	9

Introduction, Evolution, Concept and Scopes, Data, Big Data, Metrics and Data classification, Data Reliability & Validity, Problem Solving with Analytics, Different phases of Analytics in the business and Data science domain, Descriptive Analytics, Predictive Analytics and Prescriptive Analytics, Different Applications of Analytics in Business, Text Analytics and Web Analytics, Skills for Business Analytics, Concepts of Data Science, Basic skills required for understanding Data Science.

UNIT-III	BIG DATA ANALYTICS	9

Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment. Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools.

UNIT-IV	EXPLORATORY DATA ANALYSIS	9

Data visualization using matplotlib, seaborn libraries, creating graphs (bar/line/pie/boxplot/histogram, etc.), summarizing data, descriptive statistics, univariate analysis (distribution of data), bivariate analysis (cross tabs, distributions and relationships, graphical analysis).

UNIT-V	LEARNING SQL WITH BUSINESS ANALYTICS	9

Learning SQL query structure with examples, Data management and query system OLTP and OLAP and Their data models, Data warehousing, ETL and data integration Dashboard creation using Tableau, Concepts of Business intelligence (BI), the relevance of BI in application to analytics industry and different domains.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Apply the skills of data inspecting and cleansing.
CO2: Classify data analytics techniques and compare with various applications.
CO3: Understand how various libraries used for data visualization.
CO4: Handle data using primary tools used for data science in Python.
CO5: Apply analytics tools for data describing and visualization.

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Sciencell, Manning Publications, 2016. (first two chapters for Unit I)

2. Jesus Rogel-Salazar, 'Advanced Data Science and Analytics with Python',CRC Press Taylor and Francis Group,1st Edition , 2020.
3. BIG DATA and ANALYTICS, Seema Acharya, SubhasininChellappan, Wiley publications.2nd Edition, reprint 2019.

REFERENCES:

1. 'Fundamentals of mathematical statistics', S. C Gupta, V.K. Kapoor, Sultan Chand and Sons, 2014.
2. 'Elements of Statistical Learning'- Hastie, Tibshirani, Friedman; Springer;2011.
3. 'Data Science from Scratch' – Grus; Google Books;2015.

21AD304	FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain knowledge on Interactive Web Page development.
- To learn about Programming servers using Node.js.
- To study client-side applications with React.
- To understand the Type script and use it.
- To study the deployment of web applications.

UNIT-I	HTML5, CSS AND JAVASCRIPT	9

HTML: Tags – structuring document – web page –Make it Prettier with CSS–Loading background images –Organizing files. JavaScript – Variables–Controlling HTML and CSS–Organizing JavaScript code

UNIT-II	SERVER SIDE – NODE.JS	9

Server–Side Action: Node and NPM – JavaScript Runtimes and Building Servers – Node Installation – NPM – NPM Commands – Initializing a New NPM/Node Project – Adding Dependencies – Semantic Versioning – Node Web Server – Advanced Node and NPM: package.json – other commands – Node: Standard Modules

UNIT-III	CLIENT–SIDE – REACT	9

Client–Side Adventures: React – History – Components – Props – Memory State – Style – Advanced React – JSX – Compile JSX – Put It All Together– Default Props – Typing Props – Component Lifecycle

UNIT-IV	TYPESCRIPT AND WEBPACK	9

TypeScript: Jumping into the Deep End – Configuring TypeScript Compilation – Types : String – Number – Boolean –Arrays – Tuples –Enums– Function – Object –Null, Void, and Undefined – Custom Type Aliases – Union Types – TypeScript == ES6 Features –Advanced TypeScript : Interfaces – Namespaces and Modules – Decorators – Third– Party Libraries – Debugging TypeScript Apps–Webpack : Bundle, and How Do I Make One–Webpack in detail – Getting Started with Webpack– Using Modules – Wither TypeScript

UNIT-V	APPLICATION DEPLOYMENT	9

MailBagServer: Basic Requirements – Setting Up the Project – Starting Point: main.ts–ServerInfo.ts– Time to Send the Mail – Time to Get the Mail – Reach Out and Touch Someone – NoSQL–NeDB– Testing– MailBagClient: Basic Requirements – Setting Up the Project – Starting Point: index.html –Redux: main.tsx – Configuration – Worker for All Seasons – Cavalcade of Components.Docker– Containers and Containerization – Installing Docker– Key Docker Commands – Creating Your Own Image – Deploying to Docker Hub – Wrapping Up MailBag

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Design Interactive Web Pages using HTML and CSS.
CO2: Develop server side coding with Node.js
CO3: Design client side applications with React
CO4: Use Typescript for web programming applications
CO5: Develop the server and client for any applications and deploy using containers

TEXT BOOKS:

1. Frank Zammetti, “Modern Full–Stack Development”, Apress, 2020
2. BRex van der Spuy “Foundation Game Design with HTML5 and JavaScript” Apress / friends of ED,2012

3. W. P. Petersen, P. Arbenz, “Introduction to ParallelComputing”, Oxford University Press, 2004.

REFERENCES:

1. PawełCzarnul, “Parallel Programming for ModernHigh PerformanceComputing “, CRC Press, 2018
2. Cyrus Dasadia, AmolNayak, “MongoDB Cookbook”, Packt Publishing , 2016
3. KrasimirTsonev, “Node.js by Example”, Packt Publishing, 2015

21AD303	DATA SCIENCE AND ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
- To prepare data for data analysis through understanding its distribution.
- To expose on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and Regression Model.

	LIST OF EXPERIMENTS	9

1. Create an empty and a full NumPy array.
2. Program to remove rows in Numpy array that contains non-numeric Values.
3. Program to build an array of all combinations of two NumPy arrays.
4. Program to add a border around a NumPy array.
5. Program to compare two NumPy arrays.
6. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
7. Write a Pandas program to get the first 3 rows of a given DataFrame.
8. Write a Python program to draw a line with suitable label in the x axis, y axis and a title.
9. Write a Python program to draw line charts of the financial data of Alphabet Inc. between October 3, 2016 to October 7, 2016.
10. The table below gives the values of runs scored by Virat Kohli in last 25 T-20 matches. Represent the data in the form of less than type cumulative frequency distribution:

45	34	50	75	22
56	63	70	49	33
08	14	39	86	52
92	88	70	56	50
57	45	42	12	39

11. Program to find the sum and average of n integer numbers.
12. Program to find the variance and standard deviation of set of elements.
13. Program to plot a normal distribution in python.
14. Program to plot a Correlation and scatter plots.
15. Program for Linear Regression and Logistic Regression.
16. Mini project on real time applications

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly,bokeh

TOTAL:60 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Develop relevant programming abilities.
CO2: Demonstrate knowledge of statistical data analysis techniques
CO3: Exhibit proficiency to build and assess data-based models.
CO4: Demonstrate skill in Data management & processing tasks using Python.
CO5: Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

TEXT BOOKS:

1. Jake VanderPlas, —Python Data Science Handbook‖, O'Reilly, 2016.
2. Allen B. Downey, —Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press,2014.
3. Data Science from Scratch: First Principles with Python, Second Edition by Joel Grus,2019.

21AD305	FULL STACK DEVELOMENT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain knowledge on Interactive Web Page development
- To learn about Programming servers using Node.js
- To study client side applications with React
- To understand the Type script and use it
- To study the deployment of web applications

LIST OF EXPERIMENTS

1. Design Webpages for any given application
2. Write Server side programming with Node.js
3. Perform Email applications using Nodemailer Module
4. Write custom applications with Node.js and Mongo DB
5. Use React components, JSX, Class, Prop, Events
6. Write custom applications Forms with React
7. Use Type script for enhancing web application
8. Apply useCallback, use State, use Effect, useRef Hook of React to applications
9. Use Web Pack for Application
10. Bind server and client side and deploy as a deliverable application
11. Deploy applications to Docker Hub

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Design Interactive Web Pages

CO2: Develop server side coding with Node.js

CO3: Develop application using Mango DB.

CO4: Design client side applications with React and Typescript

CO5: Develop web applications and deploy.

21EN301	PROFESSIONAL COMMUNICATION LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- To demonstrate communication skills that can lead to improved interpersonal relationships.
- To plan to set and achieve goals with focus.
- To organize themselves in work life to face the professional set up with confidence.
- To interpret ideas and participate in group discussion with positive attitude.
- To develop their confidence and help learners to attend interviews successfully.

UNIT I	COMMUNICATION AND PROFESSIONAL ETIQUETTES	6

•Importance and Types of Communication Verbal communication -Presentation skills- Non-Verbal communication - Personal Appearance, Posture, Gestures, Facial Expressions, Eye Contact and Space Distancing - Professional Etiquette

UNIT II	GOAL SETTING AND MOTIVATION	6

Short term and Long term Goals- Strategies to set and achieve goals- Motivation

UNIT III	TIME AND STRESS MANAGEMENT	6

Importance of Time - Time Management Skills - Sources of Stress - Managing Stress - Analysis of the Case Studies on time and stress management

UNIT IV	GROUP DISCUSSIONS AND POSITIVE ATTITUDE	6

Group Discussions - Leadership Qualities - Decision Making - Problem Solving - Negotiation Skills - Positive Attitude

UNIT V	RESUME MAKING AND INTERVIEW SKILLS	6

Preparing Resume - E - Resume - Covering Letter – Job Application through email - Career Portfolio - Types of Interviews - Mock Interviews

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate effective communication skills through presentations.
CO2: Utilize their knowledge of motivation in setting and achieving goals.
CO3: Examine time and stress management.
CO4: Formulate their ideas into an effective communication in formal contexts.
CO5: Develop a well-composed resume and face interviews confidently.

TEXT BOOKS:

1. Dhanavel S P, “English and Soft Skills”, First Edition , Orient BlackSwan Ltd, Hyderabad : 2012.
2. Dr. Tobin Porterfield & Bob Graham ,“The 55 Soft Skills That Guide Employee and Organizational Success,” Mason – West Publishing House , (January 4, 2018)
3. Prashant Sharma, “Soft Skills Personality Development for Life Success, “ BPB Publications, New Delhi, January 2018.

REFERENCES:

1. M. Ashraf Rizvi, “Effective Technical Communication,” Tata McGraw Hill Education Pvt. Ltd. New Delhi, 2016.
2. Mohan Krishna & Meera Banerji, “Developing Communication Skills,” First Edition, Trinity Press, 2017.
3. N. Krishnaswami& T. Sriraman, “Creative English for Communication,”Third edition, Laxmi Publications Private Limited, 2017.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER- VI

21AD306	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamentals behind the Language processing and perform word level analysis.
- To examine the NLP models and interpret algorithms for classification of NLP sentences by using both the traditional, symbolic and the more recent statistical approach.
- To understand the fundamentals of discourse analysis, inference, and knowledge representation.
- To understand the morphology, syntax, semantics, and pragmatics of the major language levels as described algorithmically for use in information retrieval and machine translation applications.
- To learn about the uses of natural language processing application and how to use fundamental algorithms in this area.

UNIT-I	INTRODUCTION TO NLP	9

Introduction to various levels of Natural Language Processing (NLP), Ambiguities and Computational challenges in processing various natural languages. Introduction to real life applications of NLP such as Spell and Grammar Checkers, Information Extraction, Question Answering, and Machine Translation.

UNIT-II	SYNTAX ANALYSIS	9

Context Free Grammars, Grammar Rules for English, Top-Down Parsing, Bottom-Up Parsing, Ambiguity, CKY Parsing, Dependency Parsing, Earley Parsing - Probabilistic Context-Free Grammars.

UNIT-III	SEMANTIC ANALYSIS	9

Representing Meaning, Lexical Semantics, Word Senses, and Relation between Senses, Word Sense Disambiguation, Word Embeddings, Word2Vec, CBOW, Skip-gram and GloVe, Discourse Segmentation, Text Coherence, Discourse Structure.

UNIT-IV	LANGUAGE MODELS	9

The role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models, Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM).

UNIT-V	NLP APPLICATION (Chatbot)	9

Introduction to Chatbot Applications, Retrieval based- Conversation based, Information Extraction and its approaches, Information Retrieval, Semantic Search and Evaluation, Question Answering, Summarization, Extractive Vs Abstractive Summarization, Machine Translation.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Understand the concept of NLP and illustrate its real time application.
CO2: Illustrate the methods of syntax analysis, such as probabilistic context-free grammars.
CO3: Use semantics and discourse analysis methods to NLP and perform comparative study.
CO4: Compare language modelling techniques based on the structure of the language.
CO5: Demonstrate recent applications that use Natural Language Processing approaches.

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin “Speech and Language Processing”, 3rd edition, Prentice Hall, 2009.
2. C.Manning and H.Schutze, —Foundations of Statistical Natural Language Processingll, MIT Press. Cambridge, MA, 1999.
3. NitinIndurkhya, Fred J. Damerau “Handbook of Natural Language Processing”, Second Edition, CRC Press, 2010.

REFERENCES:

1. Rothman, Denis. Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more. Packt Publishing Ltd, 2021.
2. James Allen “Natural Language Understanding”, Pearson Publication 8th Edition. 2012.
3. Tom Hoobyar, Tom Dotz, Susan Sanders, “NLP: The Essential Guide to Neuro-Linguistic Programming”, 2013.

21AD308	COMPUTER VISION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the concepts of image formation and processing.
- To understand feature detection and feature matching.
- To understand the basics of feature-based alignment and motion estimation.
- To execute 3D reconstruction.
- To learn about image based rendering and recognition.

UNIT-I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	6

Computer Vision - Geometric primitives and transformations - Photometric image formation – The digital camera - Point operators - Linear filtering - More neighborhood operators – Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT-II	FEATURE DETECTION, MATCHING AND SEGMENTATION	6

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT-III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION	6

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment – Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion – Optical flow - Layered motion.

UNIT-IV	3D RECONSTRUCTION	6

Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT-V	IMAGE-BASED RENDERING AND RECOGNITION	6

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition – Category recognition - Context and scene understanding- Recognition databases and test sets.

30 PERIODS

PRACTICAL EXERCISES:	30 PERIODS

1. OpenCV Installation and working with Python
2. Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection.
3. Image Annotation – Drawing lines, text circle, rectangle, ellipse on images.
4. Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection.
5. Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment.
6. Image segmentation using Graphcut / Grabcut
7. Camera Calibration with circular grid.
8. Pose Estimation

9. 3D Reconstruction – Creating Depth map from stereo images.
10. Object Detection and Tracking using Kalman Filter, Camshift

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Summarize theories and methods of image processing and computer vision.
- Apply image processing techniques in OpenCV.
- Apply feature-based image alignment, segmentation and motion estimation for 2D image.
- Implement 3D reconstruction techniques.
- Design real time applications for image processing and computer vision.

TEXTBOOKS:

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

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21AD307	NATURAL LANGUAGE PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To implement NLP concepts
- To implement text classification and summarization
- To understand Sentiment Analysis
- To learn spam detection model
- To design statistical processing for real-time applications

LIST OF EXPERIMENTS

1. Implementation of resume screening with python
2. Development of Sentiment Analysis with python
3. Develop Keyword extraction with python
4. Development of NLP for other languages
5. Implement NLP for whatsapp chat
6. Chatbot Implementation
7. Implement of next word prediction model

Requirement: Standalone desktops with Python

TOTAL :60PERIODS

COURSE OUTCOMES:

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

CO1: Implement NLP concepts using python

CO2: Create NLP applications for other languages

CO3: Illustrate detection models

CO4: Develop applications using sentiment analysis

CO5: Implement whatsapp chat analysis

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER- VII

21AD401	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn about the different types of data and how to visualize them effectively.
- To develop skills in applying visualization techniques to solve problems and understand data.
- To use a structured approach to create effective visualizations.
- To extract valuable insights from large datasets using visualization.
- To build visualization dashboards to support decision-making.

UNIT-I	INTRODUCTION	9

Overview of data visualization - Data Abstraction - Data Types, Dataset Types, Attribute Types Task Abstraction – Analysis tasks abstractly, Designer or User action, Four Levels for Validation, four Levels of Design Angles of Attack Threats and Validation Approaches.

UNIT-II	VISUALIZATION TECHNIQUES	9

Scalar and point techniques, vector visualization techniques, multidimensional techniques, visualizing cluster analysis, matrix visualization in Bayesian data analysis.

UNIT-III	VISUAL ANALYTICS	9

Arrange Networks and Trees, Connection -Link Marks, Matrix Views, Costs and Benefits: Connection vs. Matrix, Containment- Hierarchy Heat Map, Map Color and Other Channels, Color Theory Color maps Other Channels.

UNIT-IV	VISUALIZATION TOOLS & TECHNIQUES	9

Manipulate View- Change View over Time Select Elements Navigate: Changing Viewpoint Navigate: Reducing Attributes -Visualization Attributes, Introduction to various data visualization tools, Visualization using R

UNIT-V	DIVERSE TYPES OF VISUAL ANALYSIS	9

Time- Series Analysis, Ranking Analysis, Deviation Analysis, Distribution Analysis, Correlation Analysis Multivariate Analysis, Integration of visualization tools with Hadoop. Visualization Dashboard Creations Dashboard creation using visualization tools for the use cases: Finance-marketing-insurance-healthcare.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discover various data types and ways to visualize them for better understanding.
CO2: Identify visualizations techniques to specific problems using datasets.
CO3: Understand the different techniques for arranging networks and trees structured approach for visual analytics.
CO4: Show how to analyze extensive datasets using different visualization methods and tools.
CO5: Create dashboards with visualizations to help make decisions on large dataset.

TEXTBOOKS:

1. Tamara Munzer, Visualization Analysis and Design -, first edition,CRC Press 2015
2. Andy Kirk, Data Visualisation A Handbook for Data Driven Design, Second Edition,2019
3. Stephen Few, Now You See It -, Analytics Press, 2009

REFERENCES:

1. Dr.Chun-hauh Chen, W.K.Hardle,A.Unwin, Handbook of Data Visualization, Springer publication,2008
2. Ben Fry, Visualizing Data -, O'Reilly Media, 2008
3. John Verzani, Simpler- Using R for introductory statistics, Taylor&Francis, 2005

21AD402	DATA VISUALIZATION LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand various type of data, apply and evaluate the principles of data visualization
- To acquire skills to apply visualization techniques to a problem and its associated dataset
- To understand the benefits and drawbacks of using connection and matrix views for data visualization.
- To identify the various visualization tools and techniques to represent large dataset.
- To learn how to bring valuable insight from a massive dataset using visualization

LIST OF EXPERIMENTS

1. Implement a Program for acquiring and plotting data
2. Implement a Program for Statistical Analysis such as Multivariate Analysis, PCA, LDA, Correlation, regression and analysis of variance
3. Implement a Program for Financial analysis using Clustering, Histogram and HeatMap
4. Implement a Program for Time-series analysis stock market
5. Implement a Program for Visualization of various massive dataset - Finance - Healthcare - Census – Geospatial
6. Implement a Program for Visualization on Streaming dataset (Stock market dataset, weather forecasting)
7. Implement a Program for Market-Basket Data analysis-visualization
8. Implement a Program for Text visualization using web analytics.

TOTAL: 60PERIODS

COURSE OUTCOMES:

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

CO1: Explain the concepts of data abstraction and task abstraction in data visualization.

CO2: Identify and apply the different types of visualization techniques to data.

CO3: Use visual analytics techniques to explore and analyze data.

CO4: Use visualization tools to perform diverse types of visual analysis.

CO5: Create dashboard using visualization tools for different use cases**.**

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER VIII

21AD404	PROJECT WORK II	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

The main objectives of this course are:

- To gain domain knowledge, and technical skills to solve potential business / research problems.
- To gather requirements and design suitable software solutions and evaluate alternatives.
- To work in small teams and understand the processes and practices in the 'industry.
- To Implement, Test and deploy solutions for target platforms.
- To prepare project reports and presentation.

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 end of the course, learners will be able to

CO1: Gain Domain knowledge and technical skill set required for solving industry / research problems
CO2: Provide solution architecture, module level designs, algorithms
CO3: Implement, test and deploy the solution for the target platform
CO4: Prepare detailed technical report, demonstrate and present the work

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
VERTICAL - I

21PAD01	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- 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 PROGRAMMING LANGUAGE	9

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

UNIT-IV	INFERENCE MODELS OF COGNITION	9

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

UNIT-V	LEARNING MODELS OF COGNITION	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

Illustrate the basic components of social networks.

CO1: Summarize the theory of cognition with suitable example.

CO2: Understand and outline the architecture of cognition.

CO3: Apply mathematical functions through WebPPL.

CO4: Demonstrate applications using cognitive inference model.

CO5: Demonstrate applications using cognitive learning model.

TEXT BOOKS:

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

3. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”,The MIT Press, 1999.

REFERENCES:

1. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016.

21PAD02	RECOMMENDER SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the foundations of the recommender system.
- To gain the significance of content-based recommender systems.
- To learn about collaborative filtering.
- To train and design the attack resistant recommender system.
- To learn collaborative filtering.

UNIT-I	INTRODUCTION	9

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

UNIT-II	CONTENT-BASED RECOMMENDATION SYSTEMS	9

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

UNIT-III	COLLABORATIVE FILTERING	9

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

UNIT-IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	9

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

UNIT-V	EVALUATING RECOMMENDER SYSTEMS	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Understand the basic concepts of recommender systems.
CO2: Implement machine-learning and data-mining algorithms in recommender systems data sets.
CO3: Implement Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
CO4: Design and implement a simple recommender system.
CO5: Evaluate the recommender systems for different applications.

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press, 1st Edition, 2011.
3. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

REFERENCES:

1. Monideepa Roy, Pushpendu Kar, Sujoy Datta, Recommender Systems: A Multi-Disciplinary Approach,1st Edition, CRC Press, 2023.
2. Francesco Ricci, Lior Rokach, Bracha Shapira, Recommender Systems Handbook, 1st Edition, Springer, 2011.

21PAD03	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To study the distributed system principles and architecture models.
- To gain knowledge about various communication models.
- To understand distributed file systems.
- To learn synchronization and replication techniques.
- To study the resource management techniques.

UNIT-I	INTRODUCTION	9

Introduction – Examples of distributed systems–Trends in distributed systems – Focus on resource sharing –Challenges – World Wide Web – System models – Physical models – Architectural models – Fundamental models.

UNIT-II	COMMUNICATION IN DISTRIBUTED SYSTEM	9

Inter Process Communication – the API for the Internet protocols – External data representation – Multicast communication – Network virtualization: Overlay networks. MPI – Request–reply protocols – Remote procedure call. Distributed Objects: Java RMI – Group communication – Publish–subscribe systems – Message queues – Shared memory approaches – From Objects to Components: Enterprise Java Beans.

UNIT-III	PEER TO PEER SYSTEMS AND DISTRIBUTED FILE SYSTEMS	9

Introduction – Napster and its legacy – Peer–to–peer Middleware – Routing overlays – Overlay case studies: Pastry, Tapestry. Distributed File Systems – File service architecture – Sun Network File System –Google File System – Name Services and Domain Name System – Directory services – Case studies: The Global Name System, X.500 Directory Service.

UNIT-IV	SYNCHRONIZATION AND FAULT TOLERANCE	9

Introduction – Clocks, events and process states – Synchronizing physical clocks – Logical time and logical clocks – Global states – Coordination and Agreement – Distributed mutual exclusion – Elections – Transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic commit protocols – Concurrency control in distributed systems – Distributed deadlocks.

UNIT-V	RESOURCE AND PROCESS MANAGEMENT	9

Resource management: Desirable features of a good global scheduling algorithm –Task assignment approach – Load balancing approach – Load sharing approach – Process management: Process migration – Threads.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explore the system models in distributed system.
CO2: Apply various communication models in distributed system.
CO3: Explore distributed file systems.
CO4: Apply synchronization and replication algorithms in distributed system.
CO5: Use resource management algorithms for load balancing.

TEXT BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.

3. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

REFERENCES:

1. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
2. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.
3. MukeshSinghal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw–Hill, 2001.

21PAD04	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics of Quantum Computing.
- To familiarize the concepts of Quantum gates.
- To explore the applications of Quantum Computing.
- To understand the importance of Shor's algorithm & Grover's algorithm.
- To conceptualize the physical realization of Quantum computers.

UNIT-I	FUNDAMENTALS OF QUANTUM COMPUTING	9

From Bits to Qubits – Power of Quantum Computing – How Quantum Physics Differs from classical physics? – Obstacles and Research – Qubits - Quantum Mechanics - Computer Science Perspectives.

UNIT-II	QUANTUM GATES AND CIRCUITS	9

Quantum Gates – Single & Multiple Qubit Gates – Matrix Representation of Quantum Gates and Circuits – Bell States – Quantum Measurement – Quantum Half-Adder and Subtractor.

UNIT-III	APPLICATIONS OF QUANTUM COMPUTING	9

Quantum Teleportation – Quantum Parallelism – Superdense Coding – Quantum Cryptography - Quantum Noise and Error Correction.

UNIT-IV	QUANTUM ALGORITHMS	9

Deutsch-Jozsa Algorithm - Shor's Algorithm – Examples- Quantum Fourier Transform –Implementation- Phase estimation- Shor's algorithm using phase estimation – order finding and factoring - Grover's Algorithm (Quantum Search Algorithms)- steps- Geometric visualization- order of Grover's algorithm – Applications.

UNIT-V	QUANTUM COMPUTER REALIZATION AND SOFTWARE	9

Physical Realization of Quantum Computers – Basic requirements- Harmonic oscillator Quantum computer – Optical photon quantum computer- Optical cavity quantum Electrodynamics – Ion traps- Nuclear magnetic resonancesilicon quantum computer- Quantum Computing Software-Quantum Qudit Simulator-CAD for Quantum Computer Simulator(QCAD)- Quantum Circuit Viewer.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Apply the basic concepts in Quantum computing.
CO2: Design simple circuits using Quantum gates.
CO3: Design vital applications using Quantum computing.
CO4: Explore the applications of Apply Shor's and Grover's algorithm in Quantum computing.
CO5: Explore Quantum computing software.

TEXT BOOKS:

1. Vishal Sahni, "Quantum Computing", McGraw Hill education , First edition, 2007.
2. Dan C. Marinescu, Gabriela M. Marinescu, "Approaching Quantum Computing", Prentice Hall, 2004.

3. Mika Hirvensalo “Quantum Computing”,2nd Edition, Springer, 2004.

REFERENCES:

1. Giuliano Beneti, Giulio Casati, GuilianoStrini, "Principles of Quantum Computation and Information", Vol.1 Basic Concepts, World Scientific Publishing Company, October 2004.
2. David Mcmahon, “ Quantum Computing Explained”, Wiley-IEEE Computer Society Press, 2007.

21PAD05	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing.
- To motivate students to do programming and experiment with the various cloud computing environments.
- To shed light on the Security issues in Cloud Computing.
- To introduce about the Cloud Standards.

UNIT-I	FOUNDATION OF COMPUTING TECHNOLOGIES	9

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

UNIT-II	INTRODUCTION TO CLOUD COMPUTING	9

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs .

UNIT-III	CLOUD SERVICES	9

Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).

UNIT-IV	CLOUD APPLICATION DEVELOPMENT	9

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.

UNIT-V	CLOUD DATA AND SECURITY	9

Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
CO2: Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
CO3: Explain the core issues of cloud computing such as security, privacy, and interoperability.
CO4: Identify possible applications for state-of-the-art cloud computing
CO5: Provide the appropriate cloud computing solutions and recommendations according to the applications used.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012.

2. Barrie Sosinsky, “Cloud Computing Bible” John Wiley & Sons, 2010.
3. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009.

REFERENCES:

1. Dan C. Marinescu, “Cloud Computing: Theory and Practice”, Morgan Kaufmann Publications, Third Edition, 2022.
2. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, “Mastering Cloud Computing”, TMGH Publications, First Edition, 2017.

21PAD06	SOFT COMPUTING ESSENTIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- Define soft computing and explain its key characteristics, and major areas of application.
- Describe Membership Functions and their role in quantifying uncertainty in Fuzzy Logic.
- Analyze the components of a General Genetic Algorithm and understand their roles in optimization problems.
- Understand the fundamental concepts of artificial neural networks and implement simple neural networks to solve classification and regression problems.
- Design and implement hybrid soft computing systems to solve complex problems

UNIT-I	INTRODUCTION TO SOFT COMPUTING	9

Concept Of Computing Systems, Difference between Hard Computing and Soft Computing, Characteristics of Soft Computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT-II	FUZZY LOGIC	9

Introduction, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership Functions, Fuzzy Arithmetic, Classical Logic and Fuzzy Logic, Fuzzy Rule-Based Systems, Fuzzy Decision Making.

UNIT-III	GENETIC ALGORITHMS	9

History of Genetic Algorithms (GA), Biological Background of GA, Basic Terminologies in GA, Simple GA, General Genetic Algorithm, GA Operators: Encoding, Crossover, Selection, Mutation, Classification of Generic Algorithm.

UNIT-IV	ARTIFICIAL NEURAL NETWORKS	9

Fundamental Concepts of Artificial Neural Networks, Models of ANNs, Important Terminologies of ANNs, McCulloch-Pitrs Neuron, Hebb Network, Perceptron Network, Back-Propagation Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization.

UNIT-V	HYBRID SYSTEMS	9

Integration of Neural Networks, Fuzzy Logic, and Genetic Algorithms, Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts and principles of soft computing.

CO2: Perform Fuzzy Arithmetic operations and construct Fuzzy Rule-Based Systems for decision-making.

CO3: Analyze the performance of genetic algorithms and identify ways to improve their performance.

CO4: Apply ANNs for pattern recognition and data analysis using techniques like Kohonen Self-Organizing Feature Maps and Learning Vector Quantization.

CO5: Analyze Neuro-Genetic Hybrid Systems and Fuzzy-Genetic Hybrid Systems for solving complex problems.

TEXTBOOKS:

1. S. N. Sivanandam and S. N. Deepa,"Principles of Soft Computing" 4th Edition,Wiley,2018.
2. David E. Goldberg, "Genetic Algorithms", 4th Edition, Addison-Wesley Professional,2018.
3. D.K. Pratihar "Soft Computing: Fundamentals And Applications" 2nd Edition, Alpha Science International,2015.

REFERENCES:

1. Samir Roy,"Soft Computing", 5th Edition, PHI Learning Pvt. Ltd,2018.
2. Fakhreddine O. Karray and Clarence de Silva,"Soft Computing and Intelligent Systems Design"2nd Edition, Pearson Education,2004.

3. Kevin P. Murphy,"Machine Learning: A Probabilistic Perspective: 4th Edition, MIT Press,2021.

21PAD07	GENERATIVE AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamental concepts Generative AI.
- To understand integration of generative AI and NLP.
- To learn security aspects of generated content.
- To acquire knowledge on programming and problem-solving abilities.
- To get familiar with applications of Generative AI.

UNIT I	INTRODUCTION	9

History of Generative Models-History of Generative AI - Developments in Generative AI – Evaluating Generative AI - Applications of Generative AI - Regulatory and Legal aspects of Generative AI - Ethical and responsible Use - Intellectual Property Rights- Privacy and data protection-Bias and discrimination - safety and security.

UNIT II	GENERATIVE AI AND ChatGPT	9

Use cases for Generative AI - Content Creation - Image and Video Analysis - Disaster response - Fraud Detection - Decision Making - Predictive analytics - personalized services - Use cases for ChatGPT - Customer service - Naturel Language Processing - Information Retrieval -Language Translation - Policy Analysis - Speech Recognition - Virtual Assistants.

UNIT III	GENERATED CONTENT AUTHENTICATION	9

Authenticity AI generated content - Limitations and challenges of generative AI - generated content - Spread of Misinformation - Amplification of Bias - Creation of Fake identities - job displacement - Security Risks.

UNIT IV	CODING POTENTIAL OF GENERATIVE AI	9

Potential of ChatGPT in coding and Programming-Problem solving abilities (Quantitative) - Problem solving abilities (Qualitative) - Problem solving abilities of ChatGPT - How beginner start ChatGPT for problem solving - Potential of ChatGPT in Research work.

UNIT V	APPLICATIONS OF GENERATIVE AI WITH CHATGPT	9

Use cases financial Industry - Use cases in Healthcare Industry - Use cases in E-commerce Industry - Generative AI and Chatgpt help india G20 Summit - Future Scope of ChatGPT.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Outline the concepts of Generative AI and list its legal aspects.
CO2: Make use of use cases to integrate Generative AI with application such as ChatGPT.
CO3: Illustrate various security aspects in generated content.
CO4: Illustrate examples for problem solving abilities in ChatGPT.
CO5: Prepare use cases for various applications of Generative AI.

TEXT BOOKS:

1. Utpal Chakraborty, Soumyadeep Roy, Sumit Kumar, Rise of Generative AI and ChatGPT, 1st Edition, BPB Publications,2023.
2. Maula, D. B., Generative AI: The Beginner's Guide. (n.p.): Amazon Digital Services LLC – Kdp, 2023.

3. Patel, D. M., Artificial Intelligence & Generative AI for Beginners: The Complete Guide. United States, 2023.

REFERENCES:

1. Joseph Babcock,Raghav Bali,Generative AI with Python and Tensorflow 2, 1st Edition, Packt Publishing Ltd.,2021.
2. Emerson, J., Ripples of Generative AI: How Generative AI Impacts, Informs, and Transforms Our Lives. (n.p.): Artificial Intelligence.,2023.
3. Valentina Alto, Modern Generative AI with ChatGPT and Open AI, Packt Publishing Ltd.,2023.

21PAD08	FOG COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics of Edge and Fog Computing.
- To conceptualize the communication standards.
- To familiarize with integration of edge with data analytics.
- To understand the importance of security infrastructures and management.
- To explore the applications of edge Computing.

UNIT-I	FOG COMPUTING AND ITS MODELS	9

Introduction to Fog Computing: Fog Computing, Characteristics, Application Scenarios, Issues andchallenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles.

UNIT-II	COMMUNICATION TECHNOLOGIES	9

Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.

UNIT-III	EDGE, FOG & CLOUD	9

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.

UNIT-IV	IoT & SECURITY INFRASTRUCTURE	9

Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog-IoT Architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virualization, security and privacy issues. Integrating IoT, Fog, Cloud Infrastructures: Methodology, Integrated C2F2T Literature by Modeling Technique by Use-Case Scenarios, Integrated C2F2T Literature by Metrics.

UNIT-V	APPLICATIONS	9

Exploiting Fog Computing in Health Monitoring: An Architecture of a Health Monitoring IoT Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction, Data-Driven Intelligent Transportation Systems, Fog Computing for Smart Transportation, Applications Case Study: Intelligent Traffic Lights Management (ITLM) System.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explain the basic concepts in Edge computing.
CO2: Understand the architecture, its components and working of components and its performance.
CO3: Explore Fog on security, multimedia and smart data.
CO4: Explore the integration of fog computing with IoT.
CO5: Model the fog computing scenario.

TEXT BOOKS:

1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y., 2020

2. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by Rajkumar Buyya and Satish Narayana Srirama, John Wiley & Sons, 2019
3. Amir Vahid Dastjerdi and Rajkumar Buyya, —Fog Computing: Helping the Internet of Things Realize its Potential, University of Melbourne, IEEE Computer Soc, 2016

REFERENCES:

1. Amir M. Rahmani, Pasi Liljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edgell, Springer International Publishing, 2018.
2. Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, —Fog Computing and Its Role in the Internet of Things, MCC' 12, 2012.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VERTICAL – II

21PAD17	CYBER THREAT ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To Understand the security problems and defend the cyberspace.
- To gain knowledge for protecting against attacks, threats and intrusion.
- To Understand how to leverage intelligence.
- To explore adversary behaviour and make use of indicators of compromise to detect and stop malware.
- To explore knowledge on intelligence reports.

UNIT-I	CYBER ATTACKS, INTRUSIONS, THREATS	9

Introduction to cyber-attacks, attack model, Adversary Types, Vulnerability Types, Threat Types, Attacks vs. Intrusion, DDoS, Types, Malware, malware Types, Introduction to Dark net, Cybercrimes.

UNIT-II	CYBER THREATS AND INTRUSION KILL CHAIN	9

Introduction to Advanced Persistent Threats, Intrusion Kill Chain, Zero days, Attack surface, Attack vectors, Evasion techniques – Host and Network level evasions, Covert Communication: Infiltration and Exfiltration, Advanced Evasion techniques.

UNIT-III	THREAT INTELLIGENCE	9

Cyber Threat Intelligence (CTI), Overview of Threat Intelligence Lifecycle and Frameworks, CTI types, generic threat actor, Indicators of Compromise (IoCs).

UNIT-IV	THREATINTELLIGENCE MODEL	9

Campaign analysis, Diamond model, Threat intel methodologies, Intrusion reconstruction, OSINT, Challenges with detection intrusions.

UNIT-V	SECURITYOPERATION CENTRE (SOC)	9

Introduction to SIEM, Threat Intelligence Data Collection, Threat Intelligence Collection Management, Threat Intelligence Data Feeds and Sources, Data Processing and analysis, building your own SOC, Visualizing the threat intelligence data. Threat Intelligence Reports: Baseline and Diff, Blacklists and Whitelists, Tracking, Integration.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Develop incident response skills to combat network and system.
CO2: Classify various types of attacks and learn the tools to launch the attacks.
CO3: Explain the security of network and system.
CO4: Review and analyze threat intelligence logs and reports.
CO5: Classify and Respond to the threats.

TEXT BOOKS:

1. Wilson Bautista, Practical Cyber Intelligence: How Action-based Intelligence Can be an Effective Response to Incidents, Packt publisher, 2018.
2. Arun E Thomas, Security Operations Center - SIEM Use Cases and Cyber Threat Intelligence, 2018.

3. Jocelyn O. Padallan, “Cyber Security”, Arcler press, 2019

REFERENCES:

1. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, Elsevier, 2011.
2. John Sammons, The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, Syngress publisher, 2013

21PAD18	IoT SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To Understand the security practices of IoT.
- To gain knowledge about attacks and threats.
- To explore about secure and smart IoT applications.
- To acquire knowledge on executing security algorithms on IoT devices.
- To explore societal impact on IoT security.

UNIT-I	INTRODUCTION: SECURING THE INTERNET OF THINGS	9

Introduction – Security Requirements in IoT architectures – Security in Enabling Technologies – IoT Security Life Cycle – Cryptographic Fundamentals for IoT Security Engineering - Security Concerns in IoT Applications – Basic Security Practices.

UNIT-II	SECURITY ARCHITECTURE IN THE INTERNET OF THINGS	9

Introduction – Security Requirements in IoT – Insufficient Authentication/Authorization – Insecure Access Control – Threads to Access Control, Privacy, and Availability – Attacks Specific to IoT – Malware Propagation and Control in Internet of Things.

UNIT-III	PRIVACY PRESERVATION	9

Privacy Preservation Data Dissemination - Privacy Preservation for IoT used in Smart Building – Exploiting Mobility Social Features for Location Privacy Enhancement in Internet of Vehicles – Lightweight and Robust Schemes for Privacy Protection in Key personal IoT Applications: Mobile WBSN and Participatory Sensing.

UNIT-IV	TRUST, AUTHENTICATION AND DATA SECURITY	9

Trust and Trust Models for IoT – Emerging Architecture Model for IoT Security and Privacy – preventing Unauthorized Access to Sensor Data – Authentication in IoT – Computational Security for the IoT – Secure Path Generation Scheme for real-Time Green IoT – Security Protocols for IoT Access Networks.

UNIT-V	SOCIAL AWARENESS AND CASE STUDIES	9

User Centric Decentralized Governance Framework for Privacy and Trust in IoT – Policy Based Approach for Informed Consent in IoT - Security and Impact of the IoT on Mobile Networks – Security Concerns in Social IoT – Security for IoT Based Healthcare – Smart cities.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Describe the basics of securing Internet of Things.
CO2: Explain architecture and threats in IoT.
CO3: Analyze various privacy schemes related to IoT
CO4: Describe the authentication mechanisms for IoT security and privacy.
CO5: Explain security issues for various applications using case studies.

TEXT BOOKS:

1. Shancang Li, Li Da Xu, “Securing the Internet of Things,” Syngress (Elsevier) publication, 2017.
2. Fei Hu, “Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations,” CRC Press (Taylor & Francis Group), 2016.
3. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A Hands-on approach,” VPT Publishers, 2014.

REFERENCES:

1. Alasdair Gilchris, “Iot Security Issues,” Walter de Gruyter GmbH & Co, 2017.

2. Sridipta Misra, Muthucumaru Maheswaran, Salman Hashmi, “Security Challenges and Approaches in Internet of Things,” Springer, 2016.
3. Brian Russell, Drew Van Duren,“Practical Internet of Things Security,” Packet Publishing Ltd, 2016.

21PAD19	MALWARE ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.
- To acquire knowledge about various functions of malware.
- To deal with malware analysis in android.

UNIT-I	FIUNDATION OF MALWARE ANALYSIS	9

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning – Hashing - Finding Strings -Packing and Obfuscation - PE file format – Static - Linked Libraries and Functions - Static Analysis tools -Virtual Machines and their usage in Malware analysis – Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring -Viewing processes - Registry snapshots.

UNIT-II	STATIC ANALYSIS	9

The Stack – Conditionals – Branching - Rep Instructions – Disassembly - Global and local variables - Arithmetic operations – Loops - Function Call Conventions - C Main Method and Offsets. Portable Executable File Format - The PE File Headers and Sections - IDA Pro - Function analysis – Graphing – The Structure of a Virtual Machine - Analyzing Windows programs - Anti-static analysis techniques – obfuscation – packing – metamorphism - polymorphism.

UNIT-III	DYNAMIC ANALYSIS	9

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls – registries - network activities. Anti-dynamic analysis techniques - VM detection techniques- Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark – Kernel vs. User-Mode Debugging – OllyDbg – Breakpoints – Tracing - Exception Handling – Patching.

UNIT-IV	MALWARE FUNCTIONS	9

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

UNIT-V	ANDROID MALWARE ANALYSIS	9

Android Malware Analysis: Android architecture - App development cycle – APKTool- APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

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

TEXT BOOKS:

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012.
2. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition, Jones & Bartlett Publishers, 2009.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O’Reilly, 2015.

REFERENCES:

1. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.
2. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel”, Addison-Wesley Professional,2005.

21PAD20	STEGANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn the basics of steganography to understand.
- To detect and analyze hidden information through steganalysis.
- To master different steganography frameworks and algorithms.
- To analyze practical Application of Steganography Techniques
- To use of Detection and Distortion Techniques.

UNIT-I	INTRODUCTION TO STEGANOGRAPHY	9

Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis.

UNIT-II	STEGANOGRAPHY FRAMEWORK	9

Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive).

UNIT-III	STEGANOGRAPHY TECHNIQUES	9

Substitution system and biplane tools, Transform domain techniques, Spread spectrum and information hiding, Statistical Steganography, Distortion and code generation techniques, Automated generation of English text.

UNIT-IV	STEGANALYSIS	9

Detecting hidden information, Extracting hidden information, Disabling hidden Information, Watermarking techniques, History, Basic Principles, applications, Requirements of algorithmic design issues, Evaluation and benchmarking of watermarking system.

UNIT-V	DETECTION & DISTORTION TECHNIQUES	9

Applications of Steganography, Steganography for Dissidents, Steganography for Criminals. Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Learn various ways to hide information, including text, images, audio, video, and speech.

CO2: Understand and use different methods for secret communication, such as pure steganography, secret key, and public key steganography.

CO3: Apply practical techniques for hiding information, like substitution systems, biplane tools, and statistical steganography.

CO4: Develop skills in finding, extracting, and disabling hidden information through steganalysis**.**

CO5: Understand techniques like LSB Embedding and Texture-based methods for detection and distortion.

TEXT BOOKS:

1. Stefan Katzenbelsser and Fabien A. P. Petitcolas, “Information hiding techniques for Steganography and Digital Watermarking”, ARTECH House Publishers,2011.

2. Peter Wayner, “Disappearing Cryptography–Information Hiding: Steganography & Watermarking”, Morgan Kaufmann Publishers, New York, 2002.
3. Hang Zhou, Kejiang Chen, Zehua Ma, Feng Wang,” Triangle Mesh Watermarking and Steganography”, Springer, 2023.

REFERENCES:

1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker,“Digital Watermarking and Steganography”, Margan Kaufmann Publishers, New York,2011.
2. Jessica Fridrich, “Steganography in Digital Media: Principles, Algorithms, and Applications”,Cambridge university press, 2010.

21PAD21	BIOMETRIC SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn various biometric technologies.
- To learn the biometric recognition systems.
- To gain knowledge on iris recognition.
- To know about hand geometry and voice biometrics.
- To learn methods for security in biometric systems.

UNIT-I	INTRODUCTION	9

Introduction – Operation of a biometric system – Verification versus identification – Performance of a biometric system – Applications of biometrics – Biometric characteristics.

UNIT-II	FINGERPRINT AND FACE RECOGNITION	9

Introduction – Fingerprint Sensing– Feature extraction – Matching – Performance evaluation– Introduction to Face Recognition – Face Recognition Techniques – Databases – Advanced Correlation Filters – Tensor faces– Active Appearance Models for Face Recognition – Face Super-resolution using Locality Preserving Projections.

UNIT-III	IRIS RECOGNITION	9

History of Iris Recognition – Active Contours – Flexible Generalized Embedded Coordinates – Fourier-based Trigonometry – Correction for Off-Axis Gaze – Detecting Eyelashes by Statistical Inference – Excluding Eyelashes by Statistical Inference Alternative Score Normalization Rules – Adapting for Large-Scale Applications.

UNIT-IV	HAND GEOMETRY GAIT RECOGNITION AND VOICE BIOMETRICS	9

History of Hand Geometry – Applications – Technology – Performance – Standardization – Introduction to Gait Recognition – HumanID Gait Challenge Problem – Recognition Approaches – Introduction to Voice Biometrics – Identity information in the speech signal – Feature Extraction – Tokenization – Text-dependent speaker recognition – Text-independent speaker recognition.

UNIT-V	BIOMETRIC AUTHENTICATION	9

Introduction to Palmprint Authentication System – System Framework – Recognition Engine – On-Line Signature Verification – Resources for On-Line Signature Verification – Biometrics Security Overview – Vulnerabilities in Biometric Systems – Biometric Template Security – Encoded Biometric Schemes.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Identify the various Biometric technologies.
CO2: Design of various biometric recognition systems for the organization.
CO3: Familiarize with concepts of iris recognition.
CO4: Apply hand geometry and voice biometrics in various applications.
CO5: Examine the need for security in biometric systems.

TEXT BOOKS:

1. A.K. Jain, P. Flynn, A.A. Ross, Handbook of Biometrics, Springer, 2008.

2. Samir Nanavati, Michael Thieme, Raj Nanavati, "Biometrics - Identity Verification in a Networked World", WILEY- Dream Tech, 2009.
3. Paul Reid "Biometrics for Network Security", Pearson Education, 2004.

REFERENCES:

1. John D. Woodward, Jr. "Biometrics- The Ultimate Reference"-Wiley Dreamtech.1st edition, 2003.
2. John R. Vacca, “Biometric Technologies and Verification Systems”, Elsevier Inc, 2007.

21PAD22	BLOCKCHAIN AND CRYPTOCURRENCY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the mechanism of Blockchain and Cryptocurrency.
- To understand the functionality of current implementation of blockchain technology.
- To understand the required cryptographic background.
- To explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain.
- An exposure towards cryptocurrency ecosystem.

UNIT-I	INTRODUCTION TO CRYPTOGRAPHY AND CRYPTOCURRENCIES	9

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency- Decentralization-Centralization vs. Decentralization-Distributed consensus, Consensus with- out identity using a blockchain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

UNIT-II	MECHANICS OF BITCOIN	9

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations and improvements.

UNIT-III	BITCOIN MINING AND ANONYMITY	9

The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies - Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash.

UNIT-IV	COMMUNITY, POLITICS, AND REGULATION	9

Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who‟s in Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti Money Laundering Regulation, New York‟s Bit LicenseProposal. Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-PredictionMarkets, and Real World Data Feeds.

UNIT-V	ALTCOINS AND THE CRYPTOCURRENCY ECOSYSTEM	9

Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining-Atomic Crosschain Swaps-6 Bitcoin Backed Altcoins, Side Chains, Ethereum and Smart Contracts.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Understand and apply the fundamentals of Cryptography in Cryptocurrency.
CO2: Summarize about various operations associated with the life cycle of Block chain and Cryptocurrency.
CO3: Describe the methods for verification and validation of Bitcoin transactions.
CO4: Demonstrate the general ecosystem of several Cryptocurrency.
CO5: Summarize the principles, practices and policies associated Bitcoin business.

TEXT BOOKS:

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. “Bitcoin and cryptocurrency technologies: a comprehensive introduction”,Princeton University Press, 2016.
2. Antonopoulos, A. M. “Mastering Bitcoin: unlocking digital cryptocurrencies. Oreilly Media, Inc.”, 2014.
3. Makoto Yono, “Blockchain and Crypto Currency”, Economic, Law and Institutions in Asia Pacific, 1st Edition, 2020.

REFERENCES:

1. Franco, P. “Understanding Bitcoin: Cryptography, engineering and economics”, John Wiley and Sons, 2014.
2. Yadav Satya Prakash, “Blockchain And Cryptocurrency”, I K International, 2022.

21PAD23	INFORMATION SECURITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To acquire knowledge about system security related incidents and insight on potential defences.
- To counter measures against common threat/vulnerabilities.
- To provide the knowledge of installation, configuration and troubleshooting of information security devices.
- To make familiarize on the tools and common processes in information security audits.
- To explore about data management.

UNIT-I	INFORMATION SECURITY DEVICES	9

Identify And Access Management (IdAM), Networks (Wired And Wireless) Devices, Endpoints/Edge Devices, Storage Devices, Servers, Infrastructure Devices (e.g. Routers, Firewall Services) , Computer Assets, Servers And Storage Networks, Content management, IDS/IPS.

UNIT-II	SECURITY DEVICE MANAGEMENT	9

Different types of information security devices and their functions, Technical and configuration specifications, architecture concepts and design patterns and how these contribute to the security of design and devices.

UNIT-III	DEVICE CONFIGURATION	9

Common issues in installing or configuring information security devices, Methods to resolve these issues, Methods of testing installed/configured information security devices.

UNIT-IV	INFORMATION SECURITY AUDIT PREPARATION	9

Establish the nature and scope of information security audits, Roles and responsibilities, Identify the procedures/guidelines/checklists, Identify the requirements of information security, audits and prepare for audits in advance, Liaise with appropriate people to gather data/information required for information security audits. Security Audit Review - Organize data/information required for information security audits using standard templates and tools, Audit tasks, Reviews, Comply with the organization‘s policies, standards, procedures, guidelines and checklists, Disaster Recovery Plan.

UNIT-V	DATA AND INFORMATION MANAGEMENT	9

Fetching the data/information from reliable sources, Checking that the data/information is accurate, complete and up-to-date, Rule-based analysis of the data/information, Insert the data/information into the agreed formats, Reporting unresolved anomalies in the data/information.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Classify security devices and summarize the functions of it.
CO2: Understand the configuration of network devices.
CO3: Identify the procedure for security audit and generate reports.
CO4: Understand policies, standards of audit process.
CO5: Analyze data and prepare reports.

TEXT BOOKS:

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, Wiley, 2017.
2. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
3. Christopher J. Alberts, Audrey J. Dorofee, Managing Information Security Risks, Addison-Wesley Professional, 2004.

REFERENCES:

1. Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, Konstantin V.Gavrilenko, Assessing Information Security: Strategies, Tactics, Logic and Framework, IT Governance Ltd, O'Reilly 2010.
2. Christopher J. Alberts, Audrey J. Dorofee, Managing Information Security Risks, Addison-Wesley Professional, 2004.

21PAD24	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn the fundamentals of Cyber forensics and Data Acquisition.
- To understand the procedure for processing, analysis and validation of digital evidence.
- To learn the principles of network forensics.
- To gain knowledge on email investigation, mobile device forensics and cloud forensics.
- To study the Indian and International cyber laws.

UNIT-I	INTRODUCTION	9

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues. Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT-II	DATA ACQUISITION	9

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT-III	FORENSIC PROCESSING	9

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT-IV	EMAIL, MOBILE AND CLOUD FORENSICS	9

E-mail and Social Media Investigations: Exploring the Role of E-mail in Investigations- Exploring the Roles of the Client and Server in E-mail- Investigating E-mail Crimes and Violation- Understanding E-mail Servers- Using Specialized E-mail Forensics Tools- Applying Digital Forensics to Social Media. Mobile Device Forensics and the Internet of Anything: Understanding Mobile Device Forensics- Understanding Acquisition Procedures for Mobile Devices- Understanding Forensics in the Internet of Anything. Cloud Forensics: An Overview of Cloud Computing Legal Challenges in Cloud Forensics- Technical Challenges in Cloud Forensics- Acquisitions in the Cloud- Conducting a Cloud Investigation- Tools for Cloud Forensics.

UNIT-V	CYBER LAWS AND CASE STUDIES	9

Cybercrime Case Studies: Cybercrime against individuals- Cybercrime against property- Cybercrime against Nation. Introduction to Cyber Laws- Cyber Laws in India and case studies-International Cyber laws and case studies: Cybercrime Legislation in the Netherlands - Cyber laws in Malaysia - Cybercrime laws in the UK - Cybercrime laws of the USA - Australian laws related to privacy.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explain the benefits and procedure for cybercrimes.
CO2: Determine how to perform data acquisition.
CO3: Analyse and validate evidences collected from various sources.
CO4: Identify issues in email investigation, mobile device forensics and cloud forensics.
CO5: Apply cyber law for different case studies.

TEXT BOOKS:

1. Nelson, Phillips, Steuart, "Computer Forensics and Investigations", Cengage Learning, Sixth Edition, 2018.
2. Dejey, Murugan, "Cyber Forensics", Oxford University Press, 2018.
3. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006,

REFERENCES:

1. John R. Vacca, "Computer Forensics", Firewall Media, New Delhi, 2009.
2. Keith J. Jones, Richard Bejtlich, Curtis W. Rose, "Real Digital Forensics", Addison Wesley Pearson Education, 2005.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VERTICAL- III

21PAD25	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: 21PAD25

The main objectives of this course are:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence.
- To understand various types of analytics for Business Forecasting.
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business.

UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS	9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling –Validating and verifying analytical results, Communicating and presenting results to clients and Driving organizational change and assessing impact– Interpretation – Deployment and Iteration.

UNIT-II	BUSINESS INTELLIGENCE	9

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions – Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions.

UNIT-III	BUSINESS FORECASTING	9

Introduction to Business Forecasting and Predictive analytics - Data Mining and Predictive Analysis Modeling -Linear Regression, Cluster, CART and Neural Network model– Data Visualization and Analytics-Charts(Bars-Pie-Line-Scatter-Map-Bubble-Box & Whisker-Tree map - Heat map-Circle and Area) - Worksheet, Dashboard and Story Board creation.

UNIT-IV	HR & SUPPLY CHAIN ANALYTICS	9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain.

UNIT-V	MARKETING & SALES ANALYTICS	9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explain the real world business problems and model with analytical solutions.
CO2: Identify the business processes for extracting Business Intelligence.
CO3: Apply predictive analytics for business fore-casting.
CO4: Apply analytics for supply chain and logistics management.
CO5: Use analytics for marketing and sales.

TEXT BOOKS:

1. James H. Stock and Mark W. Watson ,"Introduction to Econometrics",Third Edition,Addison-Wesley, 2017.
2. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , 1st Edition,Pearson Ed, 2014.
3. Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th edition, Cengage Learning, 2015,

REFERENCES:

1. R. Evans James, "Business Analytics", 2nd Edition, Pearson Education,2017.
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics,1st Edition, Wiley,2011
3. Philip Kotler and Kevin Keller, "Marketing Management", 15th edition, PHI, 2016.

21PAD26	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To explain terminology, technology and applications of predictive analysis.
- To apply data preparation techniques and generate appropriate association rules.
- To discuss various descriptive models, their merits, demerits and application.
- To describe various predictive modelling methods.
- To learn about advanced text visualization techniques.

UNIT-I	INTRODUCTION TO PREDICTIVE ANALYTICS	9

Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions-The Value of Statistical Significance- Pulling It All Together into a Data Audit – Case study: Churn prevention.

UNIT-II	DATA PREPARATION AND ASSOCIATION RULES	9

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules – Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules - Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules- Hospital Readmission.

UNIT-III	MODELLING	9

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation.

UNIT-IV	PREDICTIVE MODELLING	9

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms- Case study: predictive web Analytics.

UNIT-V	TEXT MINING	9

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs.Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explain terminology, technology and applications of predictive analysis.
CO2: Apply data preparation techniques to effectively interpret big data.
CO3: Discuss various descriptive models, their merits, demerits and application.
CO4: Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions.
CO5: Illustrate the features and applications of text mining.

TEXT BOOKS:

1. Dean Abbott, “Applied Predictive Analytics-Principles and Techniques for the Professional in Data Analyst”, Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, 3rd Edition ,Elsevier, 2012
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, 2nd Edition, Springer Verlag, 2009.

REFERENCES:

1. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, First Edition, Que Publishing,2012.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani “ An Introduction to Statistical Learning with Applications in R”, Springer,2013.
3. Alberto Cordoba, “Understanding the Predictive Analytics Lifecycle”, 1st Edition, Wiley, 2014.

21PAD27	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamental concepts of big data and its importance in the modern world.
- To learn about data discovery techniques and open source technologies for big data analytics.
- To understand the basics of Hadoop and the Hadoop ecosystem.
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig and Hive for bigdata analytics.
- To understand the concept of data mining and its role in big data analytics.

UNIT-I	INTRODUCTION TO BIG DATA	9

Big Data and its Importance – Four Vs of Big Data – Drivers for Big Data –Introduction to Big Data Analytics – Big Data Analytics applications.

UNIT-II	BIG DATA TECHNOLOGIES	9

Hadoop's Parallel World – Data discovery – Open-source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data.

UNIT-III	INTRODUCTION HADOOP	9

Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT-IV	HADOOP ARCHITECTURE	9

RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

UNIT-V	DATA ANALYTICS WITH R	9

Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Analyze the drivers for big data and the applications of big data analytics.
CO2: Explore data discovery techniques and open source technologies for big data analytics.
CO3: Grasp the fundamentals of Hadoop and the Hadoop ecosystem, a collection of tools and technologies for big data management.
CO4: Explore HDFS architecture, Hadoop configuration, MapReduce framework, and the role of HBase in Big Data processing.
CO5: Gain hands-on experience with data mining techniques and tools, encompassing data preprocessing, feature selection, and model evaluation.

TEXT BOOKS:

1. Seema Acharya, Subhasini Chellappan,"Big Data Analytics", First Edition, Wiley 2015.
2. Michael Minelli, Michehe Chambers,"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", First Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. "Hadoop: The Definitive Guide", Tom White, Third Edition, O"Reilly Media, 2012.

REFERENCES:

1. Arvind Sathi," Big Data Analytics: Disruptive Technologies for Changing the Game", First Edition,IBM Corporation, 2012.
2. Jay Liebowitz ,"Big Data and Business Analytics", , Auerbach Publications, First Edition, CRC press ,2013.
3. Tom Plunkett, Mark Hornic,"Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", First Edition, McGraw-Hill/Osborne Media, Oracle press,2013.

21PAD28	IoT DOMAIN ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To identify and analyze the various challenges faced in implementing IoT analytics solutions.
- To gain a foundational understanding of networking basics, including network topologies, protocols, and communication models.
- To understand the key components of IoT analytics systems to achieve modularity and maintainability.
- To apprehend data quality, assessing the accuracy, completeness, and consistency of IoT data.
- To relate feature engineering techniques to prepare IoT data for machine learning algorithms.

UNIT-I	IOT ANALYTICS AND CHALLENGES	9

Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges.

UNIT-II	IOT DEVICES AND NETWORKING PROTOCOLS	9

IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.

UNIT-III	IOT ANALYTICS FOR THE CLOUD	9

Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.

UNIT-IV	EXPLORING IOT DATA	9

Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.

UNIT-V	DATA SCIENCE FOR IOT ANALYTICS	9

Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Identify and analyze the various challenges faced in implementing IoT analytics solutions.

CO2: Analyze IoT data to infer protocol and device characteristics, enabling network optimization and device management.

CO3: Explore cloud security considerations for IoT analytics, ensuring data privacy and protection against cyberattacks.

CO4: Employ techniques to understand data quality, assessing the accuracy, completeness, and consistency of IoT data**.**

CO5: Implement validation methods to evaluate the performance and generalization ability of machine learning models in IoT analytics.

TEXT BOOKS:

1. Minteer, Andrew, “Analytics for the Internet of Things (IoT)”,1st Edition, Packt Publishing Ltd. 2017.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, First Edition, CISCO Press, 2017.
3. Kai Hwang, Min Chen,” Big-Data Analytics for Cloud, IoT and Cognitive Computing”, First Edition ,Wiley,2017.

REFERENCES:

1. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, 1st Edition, Wiley,2016.
2. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, 1st Edition ,River Publishers Gerardus Blokdyk,2017.
3. Gerardus Blokdyk,” IoT Analytics A Complete Guide”, 1st Edition, 5starcooks,2019.

21PAD29	ANALYTICS IN CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- 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 – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Understand the design challenges in the cloud.

CO2: Apply the concept of virtualization and its types**.**

CO3: Experiment with virtualization of hardware resources and Docker.

CO4: Develop and deploy services on the cloud and set up a cloud environment.

CO5: Explain security challenges in the cloud environment.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers,1st Edition, 2013.
2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 1st Edition, 2014.
3. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 1st Edition, 2010.

REFERENCES:

1. Rajkumar Buyya, James Broberg, Andrez M Goscinski, “Cloud Computing: Principles and Paradigms”, Wiley International, 1st Edition,2013
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 1st Edition, 2005.
3. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc.,1st Edition ,2009.

21PAD30	MULTIVARIATE DATA ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamental concepts of univariate, bivariate, and multivariate techniques.
- To conceptualize research models with variables and engage in effective data collection practices.
- To explore different approaches to factor analysis and interpret the results obtained.
- To apprehend the application of moderation models and their role in understanding complex relationships.
- To gain proficiency in multiple discriminant analysis and its applications in group classification.

UNIT-I	INTRODUCTION	9

Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques –Guidelines for multivariate analysis and interpretation.

UNIT-II	PREPARING FOR MULTIVARIATE ANALYSIS	9

Conceptualization of research model with variables, collection of data –-Approaches for dealing with missing data – Testing the assumptions of multivariate analysis.

UNIT-III	MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS	9

Multiple Linear Regression Analysis – Inferences from the estimated regression function -Validation of the model. -Approaches to factor analysis – interpretation of results.

UNIT-IV	LATENT VARIABLE TECHNIQUES	9

Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT-V	ADVANCED MULTIVARIATE TECHNIQUES	9

Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Demonstrate a deep understanding of the concepts and methods used in multivariate data analysis, including their strengths and limitations.

CO2: Use advanced techniques to conduct thorough and insightful analysis of multivariate data, and interpret the results accurately and effectively.

CO3: Show a strong understanding of real-world problems, and conduct deep analysis using appropriate methods to draw reasonable conclusions.

CO4: Write a clear and insightful report for a real-world case study, including well-supported and convincing details.

CO5: Make better business decisions by effectively using advanced techniques in data analytics**.**

TEXT BOOKS:

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, “Multivariate Data
2. Analysis”, Pearson Education, 7th Edition,New Delhi, 2009.
3. Barbara G. Tabachnick, Linda S.Fidell, “Using Multivariate Statistics”, 6th Edition, Pearson, 2012.
4. Richard A Johnson and Dean W.Wichern,” Applied Multivariate Statistical Analysis”, 6th Edition, Prentice Hall, New Delhi, 2012.

REFERENCES:

1. David R Anderson, Dennis J Seveency, and Thomas A Williams, Statistics for Business and Economics, Thompson, 13th Edition,Singapore, 2019,
2. Michael Jambu, “Exploratory and multivariate data analysis”, 1st Edition, Academic Press Inc., 1990,
3. T.W. Anderson ,“An Introduction to Multivariate Statistical Analysis”,3rd Edition, Wiley,2009,

21PAD31	GEOSPATIAL DATA ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamentals of Geo Spatial technology.
- To design geographic information science database.
- To familiar with the modeling techniques.
- To Learn spatial, raster and terrain analysis.
- To get exposed to spatial modeling and estimation.

UNIT-I	INTRODUCTION TO GIS	9

Introduction – GIS Components – GIS in Organizations – Data Models : Introduction – Common Spatial Data Models – Raster Data Models – Other Data Models – Data File and Structures - Geodesy – Datums.

UNIT-II	DESIGNING GIS DATABASE WITH DIGITAL DATA	9

Projections and Coordinate Systems – Building GIS Database – Digitizing Coordinate capture – Coordinate Transformation – Output : Maps – Data – Meta Data - Digital Data: Introduction – Global Digital Data – Attribute Data and Tables.

UNIT-III	GEOSPATIAL NAVIGATION SYSTEM AND DATA MODEL	9

Global Satellite Navigation System : Introduction – Differential Correction – Optical and Laser Coordinate Surveying – GNSS Applications – Aerial and Satellite Images : Basic Principles – Aerial Images – Satellite Images – Air born LiDAR.

UNIT-IV	SPATIAL AND RASTER ANALYSIS	9

Introduction – Selection and Classification – Dissolve – Proximity Functions and Buffering – Overlay – Map Algebra – Local Functions – Neighborhood, Zonal and Global Functions – Terrain Analysis.

UNIT-V	SPATIAL MODELING AND ESTIMATION	9

Sampling – Spatial Interpolation Methods –Spatial Prediction –Core Area Mapping–Cartographic Modeling– Saptio–Temporal Models–Data Standards and Data Quality – GNSS – Datum Modernization–Improved Remote Sensing–Cloud Based GIS–Open GIS.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Use the fundamental concepts of Geographic Information Science and Technology.

CO2: Design Geo Spatial Database.

CO3: Describe the geospatial system and represents various data model.

CO4: Analyze Geospatial data using spatial and raster analysis techniques.

CO5: Create and design principles, including thematic map display, map projections, and cartographic Design.

TEXT BOOKS:

1. Paul Bolstad, “GIS Fundamentals: A First Text on Geographic Information Systems”, XanEdu Publishing Inc , 6th edition, 2019.
2. Robert Haining, “Spatial Data Analysis Theory and Practice”, Cambridge University, 1st Edition, 2010.
3. O’Sullivan, D and Unwin, D.J.,” Geographic Information Analysis”, Wiley,2nd edition,2010.

REFERENCES:

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2nd Edition, 2016
2. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

21PAD32	TIME SERIES ANALYSIS AND FORECASTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the graphical and numerical description of time series data.
- To apply regression models to general time series data.
- To use exponential smoothing methods to forecast future values.
- To apply ARIMA models to model stationary time series data.
- To be familiar with multivariate time series models and forecasting.

UNIT-I	STATISTICS BACKGROUND FOR FORECASTING	9

Introduction- Graphical Displays- Numerical Description of Time Series Data (stationarity, autocovariance, autocorrelation)- Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting-Evaluation and Monitoring Forecasting Model Performance.

UNIT-II	REGRESSION ANALYSIS AND FORECASTING	9

Introduction-Least Squares Estimation in Linear Regression- Statistical Inference In Linear Regression- Prediction of New Observations- Variable Selection Methods in Regression- Generalized and Weighted Least Squares- Regression Models for General Time Series Data.

UNIT-III	EXPONENTIAL SMOOTHING METHODS	9

Introduction- First-Order Smoothing- Modeling Time Series Data- Second-Order Exponential Smoothing-Higher-Order Exponential Smoothing- Forecasting.

UNIT-IV	AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS	9

Introduction- Linear Models for Stationary Time Series- Finite Order Moving Average Processes- Finite Order Autoregressive Processes- Mixed Autoregressive – Moving Average (ARMA)-Nonstationary Processes- Time Series Model Building.

UNIT-V	SURVEY OF OTHER FORECASTING METHODS	9

Multivariate Time Series Models and Forecasting- State Space Models- Combining Forecasts to Improve Prediction Performance- Neural Networks and Forecasting.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Evaluate and monitor forecasting model performance using appropriate metrics.

CO2: Understand and apply least squares estimation to fit linear regression models.

CO3: Interpret and evaluate the performance of exponential smoothing models.

CO4: Fit ARIMA models using maximum likelihood estimation**.**

CO5: Combine forecasts from different methods to improve predictive accuracy.

TEXT BOOKS:

1. Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulachi , “Introduction to Time Series Analysis and Forecasting”,2nd Edition,Wiley,2015.
2. George E. P. Box , Gwilym M. Jenkins , Gregory C. Reinsel , Greta M. Ljung, “Time Series Analysis: Forecasting and Control”, 5th Edition,Wiley,2015.

REFERENCES:

1. Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci , James R. Broyles , Christopher J. Rigdon , Rachel T. Johnson, “Student Solutions Manual to Accompany Introduction to Time Series Analysis and Forecasting” **,** 1st Edition, Wiley,2009.
2. Rob Hyndman, George Athanasopoulos, “Forecasting: principles and practice”, 1st Edition, Kindle Edition,2018.
3. Galit Shmueli, Kenneth C. Lichtendahl Jr, “Practical Time Series Forecasting with R: A Hands-On Guide”, 2nd Edition, Kindle Edition,2016.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
VERTICAL - IV

21PAD33	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and maintain the software bot.

UNIT-I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT-II	AUTOMATION PROCESS ACTIVITIES	9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events.

UNIT-III	APP INTEGRATION, RECORDING AND SCRAPING	9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT-IV	EXCEPTION HANDLING AND CODE MANAGEMENT	9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT-V	DEPLOYMENT AND MAINTENANCE	9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Enunciate the key distinctions between RPA and existing automation techniques and platforms.
CO2: Use UiPath to design control flows and work flows for the target process
CO3: Implement recording, web scraping and process mining by automation
CO4: Use UiPath Studio to detect, and handle exceptions in automation processes
CO5: Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, Apress publications, 2020.
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020.

REFERENCES:

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.

21PAD34	REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the fundamental concepts of reinforcement learning.
- To learn the principles of Monte Carlo prediction.
- To define R-Learning framework and its application in reinforcement learning problems.
- To explore linear methods for function approximation in reinforcement learning.
- To utilize heuristic search algorithms in reinforcement learning.

UNIT-I	INTRODUCTION	9

Introduction - Elements of RL, History of RL- Evaluative feedback -Goals and rewards – Returns – Markovian Decision Problem (MDP) – Value functions - Optimality Criterion in MDPs. Policy Evaluation- Policy Improvement- Value Iteration, asynchronous DP- Efficiency of DP.

UNIT-II	MONTE CARLO METHODS	9

Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Monte Carlo Control- Policy Evaluation - Policy Improvement - On-policy and off - policy Monte Carlo controls -Incremental implementation.

UNIT-III	LEARNING	9

Temporal-Difference prediction - Optimality of TD – Sarsa – Q Learning – Off-Policy TD Control - R Learning -ActorCritic Model- Unifying Monte Carlo and TD –Traces - Games.

UNIT-IV	FUNCTION	9

Approximation - Value prediction and control – Gradient Descent methods - Linear methods – Control with Function Approximation - Artificial Neural Network based approximation.

UNIT-V	PLANNING AND LEARNING	9

Model based learning and planning - Integrating Planning, Acting, and Learning - prioritized sweeping - Trajectory Sampling - Monte Carlo Tree Search - Heuristic search - Case Studies.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Implement and apply policy iteration and value iteration reinforcement learning algorithms.
CO2: Implement and apply Monte Carlo reinforcement learning algorithms.
CO3: Implement and apply temporal-difference reinforcement learning algorithms.
CO4: Construct and apply on/off - policy reinforcement learning algorithms with function approximation.
CO5: Implementation and testing of complete decision making systems.

TEXT BOOKS:

1. Sutton R. S. and Barto A. G., "Reinforcement Learning: An Introduction",2nd Edition MIT Press,2018.
2. Reinforcement Learning', Richard.S.Sutton and Andrew G.Barto, 2nd edition, MIT Press, 2018.
3. CsabaSzepesvári, "Algorithms for Reinforcement Learning", 2nd Edition, Morgan & Claypool, 2013.

REFERENCES:

1. Belousov, B., Abdulsamad, H., Klink, P., Parisi, S., Peters, J. (Eds.), “Reinforcement Learning Algorithms: Analysis and Applications”,1st Edition, Springer 2021.
2. Kevin Murphy , “Machine Learning - A Probabilistic Perspective” ,1st Edition, MIT press, 2012.
3. Christopher Bishop, “Pattern Recognition and Machine Learning”, 1st Edition, Springer, 2006.

21PAD35	FOUNDATIONS OF GAME DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment.

UNIT-I	3D GRAPHICS FOR GAME DESIGN	9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation –Controller Based Animation.

UNIT-II	GAME DESIGN PRINCIPLES	9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT-III	GAME ENGINE DESIGN	9

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

UNIT-IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS	9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT-V	GAME DEVELOPMENT USING PYGAME	9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explain the concepts of 2D and 3d Graphics.
CO2: Design game design documents**.**
CO3: Implementation of gaming engines.
CO4: Survey gaming environments and frameworks.
CO5: Implement a simple game in Pygame**.**

TEXT BOOKS:

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, 1st Edition, Addison Wesley,2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, 1st Edition, Apress, 2007.

3. Paul Craven, “Python Arcade games”, 1st Edition, Apress Publishers,2016.

REFERENCES:

1. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, 2nd Edition, CRC Press,2006.
2. Jung Hyun Han, “3D Graphics for Game Programming”, 1st Edition, Chapman and Hall/CRC, 2011.
3. Jason Gregory ,”Game Engine Architecture” 3rd Edition, A K Peters, 2019.

21PAD36	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To understand the different models of HCI.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT-I	FOUNDATIONS OF HCI	9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT-II	DESIGN & SOFTWARE PROCESS	9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules.

UNIT-III	MODELS AND THEORIES	9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT-IV	MOBILE HCI	9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT-V	WEB INTERFACE DESIGN	9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Design effective dialog for HCI.
CO2: Demonstrate the software process and design rules.
CO3: Design effective HCI for individuals and persons with disabilities.
CO4: Identify the importance of user feedback.
CO5: Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004
2. Brian Fling, “Mobile Design and Development”, 1st Edition, O‘Reilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, 1st Edition, O‘Reilly, 2009

REFERENCES:

1. Julie A. Jacko and Andrew Sears, The human-computer interaction handbook: fundamentals, evolving Technologies, and emerging applications, Lawrence Erlbaum Associates, 1st Edition, Inc.,Publishers, 2003.
2. Lloyd P. Rieber, Computers, Graphics, & Learning, 1st Edition, Brown & Benchmark publishers, 2005.
3. Yvonne Rogers, Helen Sharp, Jenny Preece, Interaction Design: beyond human-computer interaction, 2nd Edition, John-Wiley and Sons Inc., 2009.

21PAD37	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics of GPU architectures.
- To write programs for massively parallel processors.
- To understand the issues in mapping algorithms for GPUs.
- To introduce different GPU programming models.
- To study different algorithms for GPUs.

UNIT-I	GPU ARCHITECTURE	9

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture -CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling.

UNIT-II	CUDA PROGRAMMING	9

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT-III	PROGRAMMING ISSUES	9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT-IV	OPENCL BASICS	9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT-V	ALGORITHMS ON GPU	9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication – Programming Heterogeneous Cluster.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Describe GPU Architecture.
CO2: Write programs using CUDA, identify issues and debug them.
CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication.
CO4: Write simple programs using OpenCL.
CO5: Identify efficient parallel programming patterns to solve problems.

TEXT BOOKS:

1. Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), 1st Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous computing with OpenCL”, 3rd Edition, Morgan Kauffman, 2015.
3. Nicholas Wilt, CUDA Handbook: A Comprehensive Guide to GPU Programming, 1st Edition, Addison -Wesley, 2013.

REFERENCES:

1. Jason Sanders, Edward Kandrot, CUDA by Example: An Introduction to General Purpose GPU Programming, 1st Edition, Addison - Wesley, 2010.
2. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, 3rd Edition, Morgan Kaufmann, 2016.

21PAD38	WEB AND SOCIAL MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basic issues and types of web and social media mining.
- To familiarize the learners with the concept of web and social media analytics and understand its significance.
- To familiarize the learners with the tools of web and social media analytics.
- To Enable the learners to develop skills required for analyzing the effectiveness of web and social media for business purposes.
- To know the applications in real time systems.

UNIT-I	INTRODUCTION TO SOCIAL MEDIA ANALYSIS	9

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations, Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods.

UNIT-II	COMMUNITY BUILDING AND MANAGEMENT	9

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts.

UNIT-III	SOCIAL MEDIA POLICIES AND MEASUREMENTS	9

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT-IV	WEB ANALYTICS	9

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT-V	SOCIAL MEDIA ANALYTICS	9

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Understand about web, social media mining.
CO2: Understand the significance of web and social media analytics.
CO3: Learn tools of web and social media analytics.
CO4: Develop skills required for analyzing the effectiveness of web and social media for business purposes.
CO5: Know the applications in real time systems.

TEXT BOOKS:

1. Matthew Ganis, Avinash Kohirkar, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.

2. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
3. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014.

REFERENCES:

1. Bittu Kumar, Social Networking, V & S Publishers, 2013.
2. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.

21PAD39	AI IN FINANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To explore the concepts of machine intelligence.
- To understand the types of Finance, and Concepts of AI in Finance.
- To discuss the neural networks and reinforcement learning.
- To learn algorithmic trading and test it in python environment.
- To understand the role of AI in finance and its applications.

UNIT-I	MACHINE INTELLIGENCE	9

Artificial Intelligence: Algorithms, Neural Networks— Importance of Data. Super Intelligence : Forms of Intelligence – Paths to Super intelligence – Intelligence Explosion.

UNIT-II	FINANCE AND MACHINE LEARNING	9

Normative Finance: Uncertainty and Risk – Expected Utility Theory – Mean – Variance Portfolio Theory – Capital Asset Pricing Model – Arbitrage Pricing Theory. Data-Driven Finance: Scientific Method – Financial Econometrics and Regression – Data Availability, Normative Theories Revisited – Debunking Central Assumptions. Machine Learning. AI– First Finance.

UNIT-III	STATISTICAL INEFFICIENCIES	9

Dense Neural Networks: Baseline prediction – Normalization – Dropout – Regularization – Bagging – Optimizers .Recurrent Neural Networks: Second Example – Financial Price Series – Financial Return Series – Financial Features. Reinforcement Learning : Fundamental Notations – OpenAI Gym - Monte Carlo Agent – Neural Network Agent – DQL Agent – Simple Finance Gym - Better Finance Gym – FQL Agent.

UNIT-IV	ALGORITHMIC TRADING	9

Vectorized Back testing: Back testing an SMA-Based Strategy – Back testing a Daily DNN-Based Strategy – Back testing an Intraday DNN-Based Strategy. Risk Management: Trading Bot, Vectorized Back testing Event-Based Back testing – Assessing Risk – Back testing Risk Measures. Execution and Deployment: Oando Account – Data Retrieval – Order Execution – Trading Bot.

UNIT-V	OUTLOOK	9

AI-Based Competition: AI and Finance – Lack of Standardization – Education and Training Fight for Resources – Market Impact – Competitive Scenarios – Risks – Regulation and Oversight. Financial Singularity.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Explore the main concepts of AI and machine learning.
CO2: Use financial types, metrics and machine learning techniques in AI.
CO3: Apply neural networks in Finance.
CO4: Explore algorithmic trading that AI and machine learning techniques can add to various portfolio and risk management strategies.
CO5: Apply the concepts of AI in financial applications.

TEXT BOOKS:

1. Yves Hilpisch, “Artificial Intelligence in Finance – A Python-Based Guide”, O’Reilly Media, Inc. 1st Edition, 2020.
2. Nydia Remolina, Aurelio Gurrea-Martinez, "Artificial Intelligence in Finance: Challenges, Opportunities and Regulatory Developments", Edward Elgar Publishing ,1st Edition, Ltd,2023.
3. Jeffrey Ng, “Hands-On Artificial Intelligence for Banking: A practical guide to building intelligent financial applications using machine learning techniques”, Packt, 2020.

REFERENCES:

1. Oliver Wyman, "Artificial Intelligence Applications in Financial Services”, Marsh & McLennan, 1st Edition, 2019.
2. Ivana Bartoletti, Anne Leslie, Shân M. Millie ,"The AI Book: The Artificial Intelligence Handbook for Investors, Entrepreneurs and FinTech Visionaries", 1st Edition, Wiley,2020.

21PAD40	ARTIFICIAL NEURAL NETWORKS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To explore the architecture and learning principles of Neural Networks.
- To develop various hybrid algorithms involved in Neural Networks.
- To provide adequate knowledge of application of Neural Networks in real time systems.
- To understand the architecture of Adaptive Resonance theory.
- To define the Neocognitron and its process.

UNIT-I	NEURAL NETWORKS ARCHITECTURES	9

Neurophysiology – General Processing Element – Perceptron representation – Learning – Linear separability–Problems with the perceptron training algorithms – Multilayer perceptron Learning rules – Supervised learning –ADALINE Architecture – LMS learning rule – Applications.

UNIT-II	BACK PROPAGATION NETWORK AND SIMULATED ANNEALING	9

Back Propagation Network – operation, generalized delta rule, Training algorithm – updating of output and hidden layer weights – Practical difficulties and considerations – Application of BPN – Annealing – Boltzmann machine – Learning – Application.

UNIT-III	COUNTER PROPAGATION NETWORK AND SELF ORGANIZING MAP	9

Counter Propagation network concept – Architecture –Training – Practical consideration – Applications- Self organizing map – learning algorithm, feature map classifier, Applications.

UNIT-IV	ASSOCIATIVE MEMORY AND ADAPTIVE RESONANCE THEORY	9

Associative Memory concept – Bi–directional Associative Memory – Hopfield memory – traveling salesman problem – Architecture of Adaptive Resonance Theory – Pattern matching in ART network.

UNIT-V	NEOCOGNITRON	9

Architecture of Neocognitron– Data processing and performance of architecture of spatio temporal networks for speech recognition.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Apply the concept of neural networks in practical applications.

CO2: Design, implement and analyze the performance of Back Propagation Neural Network.

CO3: Apply Counter Propagation Network and Self Organizing Map for solving various problems.

CO4: Solve real world problems using Associative and Adaptive Neural Network Techniques.

CO5: Implement Neocognitron architecture for practical applications.

TEXT BOOKS:

1. J.A. Freeman and B.M.Skapura, "Neural Networks, Algorithms Applications and Programming Techniques", Addison–Wesely, 2003.
2. Laurene V. Fausett “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Prentice Hall, 2013.

REFERENCES:

1. Jang J.S.R., Sun C.T and Mizutani E, “Neuro Fuzzy and Soft computing”, Pearson education, Reprint 2010.
2. S.Rajasekaran and G.A.VijayalakshmiPai “Neural networks, Fuzzy logics, and Genetic algorithms”, Prentice Hall of India, 2013.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
VERTICAL- V

21PAD41	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT-I	FUNDAMENTALS	9

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

UNIT-II	STORYTELLING	9

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

UNIT-III	USING AUDIO AND VIDEO	9

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

UNIT-IV	WORKING WITH FINAL CUT PRO	9

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

UNIT-V	WORKING WITH AVID XPRESS DV 4	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Compare the strengths and limitations of Nonlinear editing.
CO2: Identify the infrastructure and significance of storytelling.
CO3: Apply suitable methods for recording to CDs and VCDs.
CO4: Address the core issues of advanced editing and training techniques.
CO5: Design and develop projects using AVID XPRESS DV 4.

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Robert M. Goodman and Partick McGarth, “Editing Digital Video: The Complete Creative and Technical Guide”, Digital Video and Audio, McGraw – Hill 2003.
3. Andrei Besedin, “Digital Video And Photo Editing Software With Adobe Photoshop Software Creating Cloud Classroom Book! : Classroom in a Book”, Kindle Edition, 2021.

REFERENCES:

1. Final Cut Pro 6 User Manual, 2004.
2. Keith Underdahl, “Digital Video for Dummies”, Third Edition, Dummy Series, 2001.

21PAD42	ESSENTIALS OF UI AND UX DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT-I	FOUNDATIONS OF DESIGN	9

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

UNIT-II	FOUNDATIONS OF UI DESIGN	9

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

UNIT-III	FOUNDATIONS OF UX DESIGN	9

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

UNIT-IV	WIREFRAMING, PROTOTYPING AND TESTING	9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT-V	RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Build UI for user Applications.
CO2: Evaluate UX design of any product or application.
CO3: Demonstrate UX Skills in product development.
CO4: Implement Sketching principles.
CO5: Create Wireframe and Prototype.

TEXT BOOKS:

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022.
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021.
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3rd Edition , O’Reilly 2020.

REFERENCES:

1. Steve Schoger, Adam Wathan “Refactoring UI”, 2018.
2. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile”, 3rd Edition, 2015.
3. https://www.nngroup.com/articles/

21PAD43	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the process of online market.
- To acquire the knowledge on search engine optimization.
- To Explore the role and importance of digital marketing in today's rapidly changing business environment.
- To learn about social media marketing.
- To focuses on how digital transformation can be utilized by organizations and how its effectiveness can be measured.

UNIT-I	INTRODUCTION TO ONLINE MARKET	9

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

UNIT-II	SEARCH ENGINE OPTIMISATION	9

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

UNIT-III	E- MAIL MARKETING	9

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

UNIT-IV	SOCIAL MEDIA MARKETING	9

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

UNIT-V	DIGITAL TRANSFORMATION	9

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

TOTAL: 45PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured.

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOKS:

1. Puneet Singh Bhatia,"Fundamentals of Digital Marketing",1st edition, Pearson Education,2017.
2. Vandana Ahuja,"Digital Marketing" Oxford University Press,2015.
3. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning,2017.

REFERENCES:

1. Philip Kotler, “Marketing 4.0: Moving from Traditional to Digital” Wiley, 1st edition,2017.
2. Ryan, D., "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited,2014.
3. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education,2019.

21PAD44	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT-I	ANIMATION BASICS	9

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

UNIT-II	CGI, COLOR, LIGHT	9

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

UNIT-III	SPECIAL EFFECTS	9

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

UNIT-IV	VISUAL EFFECTS TECHNIQUES	9

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

UNIT-V	COMPOSITING	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: To implement animation in 2D / 3D following the principles and techniques.
CO2: To use CGI, color and light elements in VFX applications.
CO3: To create special effects using any of the state of the art tools.
CO4: To apply popular visual effects techniques using advanced tools.
CO5: To use compositing tools for creating VFX for a variety of applications.

TEXT BOOKS:

1. Chris Roda, “Real Time Visual Effects for the Technical Artist”, CRC Press, 1st Edition, 2022.
2. Steve Wright, “Digital Compositing for film and video, Routledge”, 4th Edition, 2017.
3. John Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.

REFERENCES:

1. Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, “The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023.

4. Jasmine Katatikarn, Michael Tanzillo, “Lighting for Animation: The art of visual storytelling , Routledge, 1st Edition, 2016.
5. Eran Dinur, “The Complete guide to Photorealism, for Visual Effects, Visualization and Games”, Routledge, 1st Edition, 2021.

21PAD45	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To understand the basics of web and mobile app development.
- To learn development of native applications with basic GUI Components.
- To develop cross-platform applications with event handling.
- To implement applications with location and data storage capabilities.
- To demonstrate web applications with database access.

UNIT-I	FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT	9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.

UNIT-II	NATIVE APP DEVELOPMENT USING JAVA	9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective- C for iOS, Basics of React Native, Native Components, JSX, State, Props.

UNIT-III	HYBRID APP DEVELOPMENT	9

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova.

UNIT-IV	CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE	9

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.

UNIT-V	NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Develop Native applications with GUI Components.
CO2: Enhance hybrid applications with basic event handling.
CO3: Implement cross-platform applications with location and data storage capabilities.
CO4: Exhibit cross platform applications with basic GUI and event handling.
CO5: Develop web applications with cloud database access.

TEXT BOOKS:

1. Dawn Griffiths, Head First Android Development, , O'Reilly, 3rd edition, November 2021.
2. Raymond K. Camden, "Apache Cordova in Action" , Manning. 2015.
3. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott , "Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native", FullStack publishing, 2019.

REFERENCES:

1. John Horton, "Android Programming for Beginners", Packt Publishing, 2nd Edition, 2018.
2. Shaun Lewis, Mike Dunn, "Native Mobile Development", 2019.
3. Pawan Lingras, Matt Triff, Rucha Lingras, "Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach" 2015.

21PAD46	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

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

UNIT-I	INTRODUCTION TO DEVOPS	9

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.

UNIT-II	COMPILE AND BUILD USING MAVEN , GRADLE & ANT	9

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

UNIT-III	CONTINUOUS INTEGRATION USING JENKINS	9

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

UNIT-IV	CONFIGURATION MANAGEMENT USING ANSIBLE	9

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

UNIT-V	BUILDING DEVOPS PIPELINES USING AZURE	9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Builda sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, and ELK.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment.

CO4: Ability to do configuration management using Ansible.

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps.

TEXT BOOKS:

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

3. Mitesh Soni , Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure , Paperback ,2020 .

REFERENCES:

1. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, 1st Edition, 2015.
2. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, 2nd Edition, 2016.
3. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, 2nd Edition, 2019.
4. https://www.jenkins.io/user-handbook.pdf
5. https://maven.apache.org/guides/getting-started/

21PAD47	OPEN SOURCE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- Understand the difference between open-source software and commercial software.
- Understand the policies, licensing procedures and ethics of FOSS.
- Understand open-source philosophy, methodology and ecosystem.
- Awareness with Open-Source Technologies.
- Knowledge to start, manage open-source projects.

UNIT-I	INTRODUCTION	9

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT-II	OPEN-SOURCE PRINCIPLES AND METHODOLOGY	9

Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization - Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT-III	OPEN SOURCE PROJECT	9

Starting and maintaining own Open-Source Project, Open-Source Hardware, Open-Source Design, Open-source Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice.

UNIT-IV	UNDERSTANDING OPEN-SOURCE ECOSYSTEM	9

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

UNIT-V	OPEN SOURCE ETHICS & CASE STUDIES	9

Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source Technology – Shared Software – Shared Source.Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies. Study: Understanding the developmental models, licensing, mode of funding, commercial/non-commercial use.

TOTAL:45 PERIODS

COURSE OUTCOMES

At end of the course, learners will be able to

CO1: Differentiate between Open Source and Proprietary software and Licensing.
CO2: Understand the policies, licensing procedures and ethics of FOSS.
CO3: Build and modify one or more Free and Open Source Software packages.
CO4: Recognize the applications, benefits and features of Open-Source Technologies.
CO5: Contribute software to and interact with Free and Open Source Software development projects.
CO6: Gain knowledge to start, manage open-source projects.

TEXT BOOKS:

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

REFERENCES:

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

21PAD48	ENTERPRISE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To Understand the basics and configuration of MongoDB.
- To acquire knowledge on web frameworks, develop server side web applications like Node.js and To develop innovative web applications using various technologies.
- To build application on Express Web.
- To provide good understanding of latest web technologies on client side components like ReactJS and Angular2.

UNIT-I	MongoDB	9

Basics, Configuring Server and Client, MongoDB Compass, Creating Database, MongoDB Commands, MongoDB CRUD Operations. Introduction to REST and API, REST Constraints, Representations, Resource Identifier, REST Actions, Status Codes.

UNIT-II	NodeJs	9

Introduction, NodeJS Features and Drawbacks, setup Environment for NodeJs, NodeJS Program architecture, NodeJS Web Server, NodeJS Global Objects, NodeJS OS Objects, NodeJS Error Handling, Node JS Event Loop, NodeJS File System, Async and Sync, Connecting with Database, Handling CRUD Operations.

UNIT-III	Building an Express web application	9

Introduction to Express, Installation of Express, Create first Express application, the application request and response objects, configuring an Express application, rendering views, Authentication, Authorization.

UNIT-IV	Introduction to ReactJS	9

React Components, React State and Props Component intercommunication: Component Composition, pass data from parent to child, pass data from child to parent, Fetching data API using axioms, Types of forms, Form Validations, Posting Data, React Router, and Building & Deploying React App.

UNIT-V	Introduction to Angular2	9

Angular2 Architecture (Component-Based Architecture), Consuming API, State Management, Validation, Routing. Passing data from parent to child and Passing data between siblings. Angular2 Specific: Directives, Modules, Components, Observables, Binding, Pipes, Dependency Injection.

TOTAL:45 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

- Understand the database connectivity and application servers.
- Explore the type of forms with validations using ReactJS.
- Utilize Express framework to develop responsive web applications.
- Demonstrate the architecture and file system of NodeJs.
- Identify the significance of component intercommunication with Angular2.

TEXT BOOKS:

1. Amos Q. Haviv, MEAN Web Development, 2nd Edition, Packt Publications, 2016.
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress. 2019

3. Fernando Doglio, “REST API Development with Node.js”, 2nd Edition, APress, 2018

REFERENCES:

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O‟REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019.
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

OPEN ELECTIVES

21OAD01	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Understand intelligent agents and discuss the different types of agents.
- Solve problems using uninformed and informed search techniques.
- Explain the different types of machine learning models and their applications.
- Train and evaluate neural networks for classification tasks.
- Implement unsupervised learning algorithms for clustering and dimensionality reduction.

UNIT-I	INTELLIGENT AGENT	6

Introduction - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - Intelligent Agents - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems.

UNIT-II	PROBLEM SOLVING WITH SEARCH TECHNIQUES	6

Uninformed Search - Breadth First Search- Depth First Search - Depth Limited Search- Informed Search - Greedy Best First- Constraint Satisfaction Problems (CSP)- Examples - Map Coloring-- Backtracking Search for CSP.

UNIT-III	LEARNING	6

Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation.

UNIT-IV	SUPERVISED LEARNING	6

Neural Network: Introduction, Perceptron Networks - Back propagation networks - Decision Tree: Entropy – classification algorithm - Rule based Classification- Naïve Bayesian classification - Support Vector Machines (SVM).

UNIT-V	UNSUPERVISED LEARNING	6

Unsupervised Learning- Kohonen Self-Organizing Feature Maps - Learning Vector Quantization – Clustering- Types of Clustering – Hierarchical clustering algorithms – k-means algorithm.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Implementing breadth first search.
2. Implementing depth first search.
3. Implementing Greedy Best Search.
4. Implementing a regression model.
5. Implementing a decision tree classifier.
6. Implementing Naïve Bayesian classification.
7. Implementing neural network using self-organizing maps.
8. Implementing k-Means algorithm to cluster a set of data.
9. Implementing hierarchical clustering algorithm.
10. Implementing Learning Vector Quantization.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of intelligent agents, including their definition, nature, structure, and problem-solving capabilities.

CO2: Apply uninformed and informed search techniques to solve various types of problems.

CO3: Analyze the different approaches to machine learning, including classification, regression.

CO4: Implement supervised learning algorithms, such as neural networks, decision trees, and support vector machines

CO5: Evaluate unsupervised learning algorithms, such as self-organizing maps and clustering algorithms, for their effectiveness in data analysis.

TEXTBOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 2017

REFERENCES:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018
2. Saikat Dull, S. Chandramouli, Das, "Machine Learning", 1st Edition, Pearson, 2018.
3. Deepak Khemani, "Artificial Intelligence", 2nd Edition, Tata McGraw Hill Education,2013

21OAD02	IoT CONCEPTS AND APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

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

- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IoT
- To analyze requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things (IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT-I	INTRODUCTION TO INTERNET OF THINGS	5

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

UNIT-II	COMPONENTS IN INTERNET OF THINGS	5

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee, Wifi, GPS, GSM Modules)

UNIT-III	PROTOCOLS AND TECHNOLOGIES BEHIND IOT	6

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

UNIT-IV	OPEN PLATFORMS AND PROGRAMMING	7

IOT deployment for Raspberry Pi /Arduino platform -Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT-V	IoT APPLICATIONS	7

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform
10. Design an IoT based system.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO 1: Explain the concept of IoT and compare the stack of different technologies.

CO 2: Understand the communication modules, various protocols and able to integrate with

Arduino/Raspbery.

CO 3: Design portable IoT using Arduino/Raspberry Pi /open platform

CO 4: Apply data analytics and use cloud offerings related to IoT.

CO 5: Analyze applications of IoT in real time scenario.

TEXTBOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015
3. Perry Lea, “Internet of things for architects”, Packt, 2018

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012
2. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015
5. https://www.arduino.cc/
   https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

21OAD03	DATA SCIENCE FUNDAMENTALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

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

- To Explore the need of Data Science.
- To Understand the life cycle of Data Analytics.
- To gain the insights from the data through statistical analysis.
- To visualize the data by applying visualization techniques.
- To solve real world data analysis using R programming.

UNIT-I	INTRODUCTION TO DATA SCIENCE	5

What is Data - Need for Data Science - Data Science Process – Taxonomy of Data Analytics – History on Methodologies on Data Analytics – KDD Process – State of Practice in Analytics – Key Roles for The New Big Data Ecosystem.

UNIT-II	DATA ANALYTICS LIFE CYCLE	5

Data Analytics Life Cycle Overview – Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize – Case Study on Global Innovation Network and Analysis (GINA).

UNIT-III	INSIGHTS FROM DATA	6

Descriptive statistics – Descriptive Univariate Analysis – Univariate Frequencies – Data Visualization – Statistics - Descriptive Bivariate Analysis - Descriptive Multivariate Analysis.

UNIT-IV	DATA VISUALIZATION	7

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

UNIT-V	DATA ANALYTICS USING EXCEL AND R	7

R – Programming - Key concepts – Basic features of R -Data Exploration and analysis with R – Excel - Statistical methods for evaluation - Presentation and analysis of Quantitative Data - Presentation and analysis of Qualitative Data- Inferential Statistical analysis of data.

Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting. Data Visualization matplotlib: Basics of matplotlib, plotting with pandas, Data Visualization using Excel.

30 PERIODS

PRACTICAL EXERCISES:	30 PERIODS

1. Practical based on NumPy ndarray using R.
2. Working with Pandas Data Frame using R
3. Handling Missing values and Duplicate Values using R.
4. Data Integration in R.
5. Data Entry and Calculate Summary Statistics in Excel.
6. Generate Comparitive Statistics in Excel.
7. Use Diabetes data set from UCI and perform the following operations
   a. Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation and Skewness.
8. Data Cleansing using Excel.
9. Simple Linear Regression Model in Microsoft Excel.
10. Data Visualization using R and Excel.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO 1: Explain the concept of data science and role of data analytics.
CO 2: Understand the overview of life cycle of data analytics.
CO 3: Apply data analytics on data and use different analytics method related to data.
CO 4: Create informative visualization and summarize data sets.
CO 5: Analyze applications using data analysis.

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Sciencell, Manning Publications, 2016.
2. Moreira, J., Carvalho, A., Carvalho, A. C. P. d. L. F., Horvath, T. (2018). AGeneral Introduction to Data Analytics. United Kingdom: Wiley.
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. (2015). Germany: Wiley.

REFERENCES:

1. Thomas Mailund, “Beginning Data Science in R – Data Analysis, Visualization and Modelling for the Data Scientist”, Apress Publication, 2017.
2. O’Neil, C., & Schutt, R., Doing Data Science: Straight Talk from the Frontline O’Reilly Media,2013.
3. McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O’Reilly Media,2017.

21OAD04	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Explain the fundamental concepts of virtual reality (VR).
- Understand and apply geometric modeling techniques in VR development
- Explore the capabilities of World ToolKit and Java 3D for VR development.
- Understand the software development process for AR applications.
- Develop a comprehensive understanding of various AR applications and their real-world impact.

UNIT-I	INTRODUCTION	6

The Three I's of Virtual Reality-The Five Classic Components of a VR System-Input Devices-Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT-II	VR DEVELOPMENT PROCESS	6

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT-III	VR PROGRAMMING	6

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT-IV	AUGMENTED REALITY	6

Introduction to Augmented Reality-Augmented Reality Hardware-Augmented Reality Software-Augmented Reality Content

UNIT-V	APPLICATIONS	6

Mobile Augmented Reality-Augmented Reality Applications-The Future of Augmented Reality

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Study of different game engines.
2. Implementation on Video/ Feature Viewing.
3. Implementation on Virtual tour.
4. Implementation on material animation.
5. Implementation to show portal planets.
6. Explore projects in Unity 2D and 3D.
7. Developing architecture of a house using Virtual Reality.
8. Perform CRO based experiment using Virtual Reality.
9. Undertaking qualitative analysis in Chemistry using Virtual Reality.
10. Carry out assembly/disassembly of an engine using Virtual Reality.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Explore the different types of input and output devices used in VR.
CO2: Implement physical modeling techniques to enhance the realism of VR simulations.
CO3: Develop practical VR applications using chosen VR programming tools.
CO4: Create and utilize AR content for various applications.
CO5: Analyze the future prospects and trends of AR technology.

TEXTBOOKS:

1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Alan B. Craig"Understanding Augmented Reality Concepts and Applications",First Edition ,

Morgan Kaufmann,2013
3. Jason Jerald,"The VR Book: Human-Centred Design for Virtual Reality", First Edition, Association for Computing Machinery and Morgan & Claypool, New York, NY, USA. 2015.

REFERENCES:

1. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
2. Steve Aukstakalnis ,"Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", First Edi, Addison-Wesley Professional, 2016.
3. Robert Scoble & Shel Israel "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything" , First edition, Patrick Brewster Press; 2016.

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ONE CREDIT COURSES

21OCAD01	PRACTICAL MACHINE LEARNING WITH TENSORFLOW	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- To work with Tensor Flow.
- To execute prediction and monitoring models.
- To work with large dataset.

CONTENT

1. Getting started with Tensorflow
2. Overview of Machine Learning (Process and Techniques, Demonstration of ML concepts with Deep Playground)
3. Data Input and Preprocessing with Tensorflow
4. Machine Learning Model Building
5. Prediction with Tensorflow
6. Monitoring and evaluating models using Tensorboard
7. Advance Tensorflow (Building custom models - CNNs, Scaling up for large datasets)
8. Distributed training with hardware accelerators

TOTAL:15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Understand the concepts of Tensor Flow and able to implement sample models
CO2: Demonstrate preprocessing of data and to design in sensor board
CO3: Develop custom models by building simple dataset

TEXT BOOKS:

1. Learn Tensorflow 2.0, Pramod Singh, 1st edition, Apress
2. Natural Language Processing with TensorFlow, Thushan Ganegedara, 1st edition, Packt Publishing

REFERENCES:

1. Advanced Deep Learning with TensorFlow 2 and Keras, Rowel Atienza, 2nd edition, Packt Publishing Limited
2. TinyML, Pete Warden, 1st edition, O′Reilly

21OCAD02	PRACTICAL TABLEAU	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- Connect to the data and customize a data source.
- Create a data extract, edit metadata, create groups and hierarchies in field data.
- Use sets to compare data subsets.
- Build a range of essential chart types for analysis.
- Use the Tableau workspace to create visualizations.

CONTENT

1. Introduction To Tableau
2. Data Connections in Tableau Interface
3. Organizing And Simplifying Data
4. Building Chart Types
5. Advanced Chart Types
6. Calculations
7. Logic Statements
8. Mapping
9. Statistics
10. Data Visualization Using Tableau

TOTAL:15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: To apply and comprehend commonly used data analytics techniques with Tableau Desktop.
CO2: Understand the advantages of multiple data analytics techniques through learning practices.
CO3: Understand and produce effective data visualizations.
CO4: Understand good data practices and apply them to different types of real-world data.
CO5: Develop analytics that yield insights for different stakeholders through Tableau sheets, stories, and dashboards.

TEXTBOOK:

1. Ryan Sleeper*, Practical Tableau,* O'Reilly Media, Inc.*,*
2. Joshua N. Milligan, Learning Tableau 2019: Tools for Business Intelligence, data prep, and visual analytics, 3rd Edition, Packt Publishing Ltd, 2019

REFERENCES:

1. Chandresh Sinha, Tableau 10 for Beginners: Version 10.x, Ohio Computer Academy, 2017

21OCAD03	MASTERING POWER BI	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- Identify the primary components of the Power BI interface: reports, data, and model views.
- Import Excel data and build basic visuals.
- Publish a desktop report to the Power BI Service.
- Identify common challenges in Power BI data models, implement smart solutions, and avoid common mistakes.
- Enables to learn about Data Analysis Expressions (DAX) and Data Visualization with Power BI Desktop.

CONTENT

1. Concepts of Business Intelligence
2. Power BI installation
3. Traditional BI vs. Power BI
4. Power BI vs. Tableau vs. QlikView
5. Uses of Power B
6. The Flow of Work in Power BI
7. Working with Power BI
8. Basic Components of Power BI
9. Comparison of Power BI Version
10. Introduction to Building Blocks of Power BI
11. Data model and importance of Data Modelling
12. Creating Calculated Columns and Measures
13. Performing Data Analysis using Data Analysis Expression (DAX)

TOTAL:15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Understand relationships and how to create and manage them.
CO2: Understanding different Data Types.
CO3: Create interactive Data Visualizations and format them.
CO4: Build the Data models for the applications.
CO5: Create calculated columns and measures using DAX Functions.

TEXTBOOK:

1. Raviv, Gil. Collect, Combine, and Transform Data Using Power Query in Excel and Power BI. Redmond: Microsoft Press, 2019.
2. Knight, Devin, Pearson, Michael, Schacht, Bradley, Ostrowsky, Erin. Microsoft Power BI Quick Start Guide. 2nd. Birmingham, UK: PocketPublishing, 2020

REFERENCES:

1. The Definitive Guide to DAX: Business intelligence for Microsoft Power BI, Alberto Ferrari Marco Russo – 15 September 2020
2. Learn Power BI: Step by Step Guide to Building Your Own Reports (2022), by Derek Wilson | 7 March 2022
3. Mastering Power BI,Chandraish Sinha, 30 September 2022
4. Microsoft Power Bi Dashboards Step By Step, 1e, by Errin O'Connor , 6 March 2020

21OCAD01	INTRODUCTION TO INNOVATIVE PROJECTS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

The main objectives of this course are:

- To make students confident enough to handle the day-to-day issues.
- To develop the —Thinking Skillll of the students, especially Creative Thinking Skills
- To train the students to be innovative in all their activities
- To prepare a project report on a socially relevant theme as a solution to the existing issues

CONTENT

1. Innovation
   - Difference between Creativity and Innovation
   - Examples of innovation
   - Being innovative.
   - Project: A literature searches on prototyping of your solution finalized. Prepare a prototype model or process and upload.
2. Innovation Process
   - Steps for Innovation
   - Right climate for innovation
   - Project: Refining the project, based on the review report and uploading the text
3. Innovation Project Proposal Presentation
   - Project proposal contents
   - Economic input
   - ROI – Template
   - Project: Presentation of the innovative project proposal and upload.

TOTAL:15 PERIODS

COURSE OUTCOMES:

At end of the course, learners will be able to

CO1: Understand the various types of thinking skills.
CO2: Enhance the innovative and creative ideas.
CO3: Find out a suitable solution for socially relevant issues- J component

TEXT BOOKS:

1. How to have Creative Ideas, Edward debone, Vermilon publication, UK, 2007
2. The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008

REFERENCES:

1. Creating Confidence, Meribeth Bonct, Kogan Page India Ltd, New Delhi, 2000
2. Lateral Thinking Skills, Paul Sloane, Keogan Page India Ltd, New Delhi, 2008
3. Indian Innovators, Akhat Agrawal, Jaico Books, Mumbai, 2015
4. JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012

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MANDATORY COURSES

21MCC01	CONSTITUTION OF INDIA	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

The main objectives of this course are:

- To explain the basic features and fundamental principles of Constitution of India.
- To explain the salient features and characteristics of the Constitution of India.
- To explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers.
- To explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India.
- To explain the Local Self Government–Constitutional Scheme in India.

SYLLABUS

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy–Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India–The constitution powers and status of the President of India.
9. Amendment of the Constitutional Powers and Procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency.
12. Local Self Government–Constitutional Scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain FreedomunderArticle19
15. Scope of the Right to Life and Personal Liberty under Article21

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India.

CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status.

CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India.

CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical Perspectives of the constitutional amendments in India, and Emergency Provisions.

CO5: Explain the Local Self Government –Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.

TEXT BOOKS:

1. DurgaDasBasu, "Introduction to the Constitution of India",Lexis Nexis Butterworths Wadhwa,20th edition, Reprint 2011.
   Weblink :https://www.india.gov.in/my-government/constitution-india.

21MCC02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

The main objectives of this course are:

- To explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.
- To explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.
- To explain about the use of Traditional Knowledge to meet the basic needs of human being.
- To explain the rich biodiversity material sand knowledge preserved for practicing traditional lifestyle.

  To explain the use of Traditional Knowledge in Manufacturing and Industry.

UNIT-I	TRADITIONAL AND MODERN KNOWLEDGE	3

Two Worlds of Knowledge - Phase of Explorers, Sir Arthur Cotton and Irrigation, Small pox Vaccination, Late Nineteenth Century, Voelcker, Howard and Agriculture, Havell and Indian Art; Indians at the Encounter - Gaekwad of Baroda and Technical Education, Science Education and Modern Industries, Hakim Ajmal Khan and Ayurveda, R. N. Chopra and Indigenous Drugs,Gauhar Jaan and Indian Classical Music; Linking Science and the Rural - Tagore's Sriniketan Experiment, Marthandam, the YMCA Model, Gandhi's Thoughts on Development, Nehru'sViewofGrowth;Post-IndependenceEra-ModernizationandTraditionalKnowledge,Social Roots of Traditional Knowledge Activism, Global Recognition for Traditional Knowledge.

UNIT-II	PROTECTION AND SHARING	3

For Recognition and Protection-United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), International Labour Organization (ILO), UNWorking Group on Indigenous Populations, Evolution of Other Organizations; Norms of Sharing - United Nations Environment Programme (UNEP), World Intellectual Property Organization (WIPO), World Trade Organization (WTO); IPR and Traditional Knowledge-Theoretical Background, Positive Protections of TK, Defensive Strategies, IPR Facilitation for TK.

UNIT-III	TRADITIONAL KNOWLEDGE FOR BASIC NEEDS	3

Indian Mid wifery Tradition—The Dai System, Surface Flow Irrigation Tanks, Housing-A Human Right, Changing Priorities—Niyamgiri. **Biodiversity and Genetic Resources:** Jeevani The Wonder Herb of Kanis, A Holistic Approach -FRLHT, Basmati – In the New Millennium, AYUSH-Based Cosmetics.

UNIT-IV	TRADITIONAL KNOWLEDGE IN MANUFACTURING	3

Drug Discovery, A Sweetener of Bengal, The Sacred Ring of Payyanur, Channapatna Toys

UNIT-V	TRADITIONAL CULTURAL EXPRESSIONS	3

Banarasi Saree, Music, Built and Tangible Heritage, Modern Yoga, Sanskrit and Artificial Intelligence, Climate Change and Traditional Knowledge.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.

CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.

CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being.

CO4: Explain the rich biodiversity material sand knowledge preserved for practicing traditional lifestyle.

CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.

TEXT BOOKS:

1. Nirmal Sengupta"Traditional Knowledge in Modern India Preservation, Promotion, Ethical Access and Benefit Sharing Mechanisms"Springer,2019.
2. AmitJha,"Traditional Knowledge System in India",Atlantic Publishers and Distributors PvtLtd, 2009.
3. Basanta Kumar Mohanta,Vipin Kumar Singh "Traditional Knowledge System and Technology in India", Pratibha Prakashan, 2012.
4. Kapil Kapoor, Michel Danino"Knowledge Traditions and Practices of India", Central Board of Secondary Education,2012.

REFERENCES:

1. NPTEL video lecture on "Ayurvedic Inheritance of India", Video link:https://nptel.ac.in/courses/121/106/121106003/#.
2. Youtube video on "Introduction to Indian Knowledge Systems", Video link:https://www.youtube.com/watch?v=LZP1StpYEPM.
3. Youtube video on "12 Great achievements of Indian Civilization", Video link:https://www.youtube.com/watch?v=xmogKGCmclE.