B.Tech. Degree

in

Artificial Intelligence and Data Science

CURRICULUM & SYLLABUS (CBCS)

(For students admitted from the Academic Year 2022-2023)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING
Chunkankadai, Nagercoil – 629 003.

CHOICE BASED CREDIT SYSTEM

Inconsonance to the vision of our College,

An engineering graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of Indian Society.

Academically, he/she would be a graduate with a strong engineering foundation with proficient technical knowledge and skills. He would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself and for the benefit of the society.

He would have been well trained in research methodology and would have established himself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He would be a person with a passion for technical innovations committed to lifelong learning and research.

He would be well prepared and confident to develop ingenuous solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

Artificial Intelligence and Data Science is a demanding programme due to the fastest growing industries in the world today. This curriculum aims to create accomplished, innovative and ethical data scientist who will lead the way in finding problems and solving them when they move into the industry or as entrepreneurs.

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

1. Utilize their proficiencies in the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volumes of data.

2. Advance their technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.

3. Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
4. Design and model AI based solutions to critical problem domains in the real world.
5. Exhibit innovative thoughts and creative ideas for effective contribution towards economy building.

II.   PROGRAMME OUTCOMES (POs)

PO	Graduate Attribute
1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III.   PROGRAMME SPECIFIC OUTCOMES (PSOs)

Graduates should be able to:

- Evolve AI based efficient domain specific processes for effective decision making in severaldomains such as business and engineering problems.

- Create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems

- Develop fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

PEO's – PO's & PSO's MAPPING:

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

PROGRAMME ARTICULATION MATRIX

Year	Semester	Course name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

Year	Sem	Course														
I	I	MA22101	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
		PH22101	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-
		CH22101	3	2	2	1	-	-	2	-	-	-	-	1	-	-	-
		CS22101	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
		HS22102	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
		GE3152	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
		EN22101	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-
		BS22101	3	1	-	-	-	2	2	-	2	1	-	1	-	-	-
		CS22102	3	3	3	3	2	-	-	-	-	-	-	1	3	-	-
		HS22101	3	2	2	1	-	-	1	-	1	-	1	1	-	-	2
I	II	MA22201	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
		ES22202	2	1	-	-	-	-	-	-	2	1	-	1	-	-	-
		AD22201	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
		ME22201	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
		GE3252	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
		EN22201	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
		PH22203	2	2	-	-	-	1	-	-	-	-	-	1	2	2	-
		CH22201	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
		AD22202	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
		ES22203	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
II	III	MA22302	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
		AD22301	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2
		AD22302	2	2	2	2	1	-	-	-	2	2	1	1	2	2	2
		AD22303	3	3	3	3	3	2	-	-	2	1	2	3	3	2	1
		AD22304	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2
		SD22301	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2
		HS22301	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
		AC22301	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-

Year	Sem	Course															
II	**IV**	MA22401	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
		AD22401	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2
		AD22402	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2
		AD22403	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1
		AD22404	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1
		SD22401	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2
		AC22401	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
III	**V**	AD22501	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2
		AD22502	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2
		AD22503	2	2	-	1	1	1	1	2	3	1	2	1	2	1	-
		AD22505	3	3	3	3	3	2	2	1	3	3	3	2	3	2	2
		SD22501	3	2	2	-	2	-	-	-	-	-	-	2	2	-	2
		AC22501	-	-	-	-	-	-	-	2	2	3	3	2	-	2	-
		HS22501	-	-	-	-	-	-	2	3	2	-	-	2	-	2	-
III	**VI**	HS22601	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-
		AD22601	3	2	2	2	1	-	-	-	2	2	2	2	2	2	2
		AD22602	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2
		SD22601	3	2	2	-	2	-	-	-	-	-	-	2	-	1	1
IV	**VII**	MS22701	2	2	2	-	2	-	-	-	1	-	-	2	-	1	-
		AD22701	3	3	3	3	3	2	2	1	3	3	3	2	3	2	2
		SD22701	3	2	2	-	2	-	-	-	-	-	-	2	2	-	-
IV	**VIII**	AD22801	3	3	3	3	3	2	2	1	3	3	3	2	3	2	2

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1.	MA22101	Matrices and Calculus	BSC	3	1	0	4	4
2.	PH22101	Engineering Physics	BSC	3	0	0	3	3
3.	CH22101	Engineering Chemistry	BSC	3	0	0	3	3
4.	CS22101	Problem Solving and Python Programming	ESC	3	0	0	3	3
5.	HS22102	Universal Human Values: Understanding Harmony and Ethical Human Conduct	HSMC	2	0	0	2	2
6.	GE3152	Heritage of Tamil	HSMC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
7.	EN22101	Communicative English	HSMC	2	0	2	4	3
PRACTICAL COURSES								
8.	BS22101	Physics & Chemistry Laboratory	BSC	0	0	4	4	2
9.	CS22102	Python Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
10.	IP22101	Induction Programme	-	-	-	-	-	0
11.	HS22101	Higher Order Thinking	MC	1	0	0	1	1
		TOTAL		**18**	**1**	**10**	**29**	**24**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22201	Statistics and Numerical Methods	BSC	3	1	0	4	4
2	ES22202	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
3	AD22201	Data Structures and Algorithms using C	ESC	3	1	0	4	4
4	ME22201	Engineering Graphics	ESC	2	0	2	4	3
5	GE3252	Tamils and Technology	HSMC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
5	EN22201	Technical English	HSMC	2	0	2	4	3
6	PH22203	Physics for Information Science	BSC	2	0	2	4	3
7	CH22201	Environment and Sustainability	BSC	2	0	2	4	3
PRACTICAL COURSES								
8	AD22202	Data Structures and Algorithms using C Laboratory	ESC	0	0	4	4	2
9	ES22203	Engineering Practices Laboratory	ESC	0	0	4	4	2
		TOTAL		**18**	**2**	**16**	**36**	**28**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22302	Discrete Mathematics	BSC	3	1	0	4	4
THEORY COURSES WITH PRACTICAL COMPONENT								
2	AD22301	Design and Analysis of Algorithms	PCC	3	0	2	5	4

3	AD22302	Database Management Systems	PCC	3	0	2	5	4
4	AD22303	Web Technology	PCC	3	0	2	5	4
5	AD22304	Data Exploration and Visualization	PCC	3	0	2	5	4
EMPLOYABILITY ENHANCEMENT COURSES								
6	SD22301	Coding Skills and Soft Skills Training – Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
7	HS22301	Value Education-1	MC	1	0	0	1	0
8	AC22301	Constitution of India	AC	2	0	0	2	0
TOTAL				**18**	**1**	**12**	**31**	**22**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22401	Probability and Statistical Techniques	BSC	3	1	0	4	4
THEORY COURSES WITH PRACTICAL COMPONENT								
2	AD22401	Operating Systems	PCC	3	0	2	5	4
3	AD22402	AI Methodologies	PCC	3	0	2	5	4
4	AD22403	Fundamentals of Data Science and Analytics	PCC	3	0	2	5	4
5	AD22404	Digital Principles and Computer Organization	PCC	3	0	2	5	4
EMPLOYABILITY ENHANCEMENT COURSES								
6	SD22401	Coding Skills and Soft Skills Training – Phase II	EEC	0	0	4	4	2
MANDATORY COURSES								
7	AC22401	Industrial Safety Engineering	AC	2	0	0	2	0
TOTAL				**17**	**1**	**12**	**30**	**22**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	AD22501	Machine Learning	PCC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
2	AD22502	Introduction to Computer Networks	PCC	3	0	2	5	4
3		Professional Elective I	PEC	2	0	2	4	3
4		Professional Elective II	PEC	2	0	2	4	3
PRACTICAL COURSES								
5	AD22503	Machine Learning Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
6	AD22504	Technical Seminar	EEC	0	0	2	2	1
7	AD22505	In plant / Industrial Training	EEC	-	-	-	-	1
8	SD22501	Coding Skills and Soft Skills Training – Phase III	EEC	0	0	4	4	2
MANDATORY COURSES								
9	AC22501	Entrepreneurship Development	AC	2	0	0	2	0
10	HS22501	Value Education II	MC	1	0	0	1	0
		TOTAL		**13**	**0**	**16**	**29**	**19**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	HS22601	Professional Ethics	HSMC	3	0	0	3	3
2		Open Elective – I	OEC	3	0	0	3	3

THEORY COURSES WITH PRACTICAL COMPONENT

				L	T	P		
3	AD22601	Deep Learning	PCC	3	0	2	5	4
4		Professional Elective III	PEC	2	0	2	4	3
5		Professional Elective IV	PEC	2	0	2	4	3
PRACTICAL COURSES WITH THEORY COMPONENT								
6	AD22602	Embedded Systems and IoT Laboratory	PCC	1	0	4	5	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	SD22601	Coding Skills and Quantitative Aptitude – Phase I	EEC	0	0	4	4	2
		TOTAL		**14**	**0**	**14**	**28**	**21**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MS22701	Principles of Management	HSMC	3	0	0	3	3
2		Open Elective – II	OEC	3	0	0	3	3
3		Open Elective – III	OEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4		Professional Elective V	PEC	2	0	2	4	3
5		Professional Elective VI	PEC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSES								
6	AD22701	Mini Project	EEC	0	0	6	6	3
7	SD22701	Coding Skills, Logical Reasoning and Quantitative Aptitude Training – Phase II	EEC	0	0	4	4	2
		TOTAL		**13**	**0**	**14**	**27**	**20**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSES								
1	AD22801	Project Work / Internship	EEC	0	0	16	16	8
		TOTAL		**0**	**0**	**16**	**16**	**8**

TOTAL CREDITS =164

* On successful completion of the final year, students will be able to apply theoretical and practical knowledge which leads to employability.

SUMMARY

B. TECH. ARTIFICIAL INTELLIGENCE & DATA SCIENCE									
S. No	Subject Area	Credits per Semester							Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	7	4				3	3		17
2	BSC	12	10	4	4					30
3	ESC	5	14							19
4	PCC			16	16	9	7			48
5	PEC					6	6	6		18
6	OEC						3	6		9
7	EEC			2	2	4	2	5	8	23
8	MC			√		√				0
9	AC			√	√	√				0
Total		24	28	22	22	19	21	20	8	164

PROFESSIONAL ELECTIVE COURSES

LIST OF VERTICALS	
1.	**DATA ANALYTICS**

2.	DESIGN AND DEVELOPMENT
3.	CREATIVE MEDIA
4.	COMPUTING TECHNIQUES

VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4
Data Analytics	**Design and Development**	**Creative Media**	**Computing Techniques**
Health Care Analytics	UI and UX Design	Augmented Reality/Virtual Reality	Parallel Computing
Engineering Predictive Analytics	Web Services and API Design	Multimedia and Animation	Cloud Computing Methods
Social Media Web Analytics	Mobile Application Development	Video Creation and Editing	Optimization Techniques
Text Analytics	Devops and Micro services	Visual Effects	Bio-inspired Optimization Techniques
Audio Analytics	Software Development Processes	Multimedia Data Compression and Storage	AI and Robotics
Business Data Analytics	Agile Methodologies	AI in Drone Technology	Artificial Neural Networks and its Applications
	Salesforce Administration		
	Modern Application Development		

VERTICAL 1: DATA ANALYTICS

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AD22511	Health Care Analytics	PEC-1	2	0	2	4	3
2.	AD22512	Engineering Predictive Analytics	PEC-2	2	0	2	4	3
3.	AD22611	Social Media Web Analytics	PEC-3	2	0	2	4	3
4.	AD22612	Text Analytics	PEC-4	2	0	2	4	3
5.	AD22711	Audio Analytics	PEC-5	2	0	2	4	3
6.	AD22712	Business Data Analytics	PEC-6	2	0	2	4	3

VERTICAL 2: DESIGN AND DEVELOPMENT

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AD22521	UI and UX Design	PEC-1	2	0	2	4	3
2.	AD22522	Web Services and API Design	PEC-2	2	0	2	4	3
3.	AD22621	Mobile Application Development	PEC-3	2	0	2	4	3
4.	AD22622	Devops and Micro services	PEC-4	2	0	2	4	3
5.	AD22721	Software Development Processes	PEC-5	2	0	2	4	3
6.	AD22722	Agile Methodologies	PEC-6	2	0	2	4	3
7	CS22753	Salesforce Administration	PEC-7	2	0	2	4	3

| 8 | CS22713 | Modern Application Development | PEC-8 | 2 | 0 | 2 | 4 | 3 |

VERTICAL 3: CREATIVE MEDIA

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AD22531	Augmented Reality/Virtual Reality	PEC-1	2	0	2	4	3
2.	AD22532	Multimedia and Animation	PEC-2	2	0	2	4	3
3.	AD22631	Video Creation and Editing	PEC-3	2	0	2	4	3
4.	AD22632	Visual Effects	PEC-4	2	0	2	4	3
5.	AD22731	Multimedia Data Compression and Storage	PEC-5	2	0	2	4	3
6.	AD22732	AI in Drone Technology	PEC-6	2	0	2	4	3

VERTICAL 4: COMPUTING TECHNIQUES

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AD22541	Parallel Computing	PEC-1	2	0	2	4	3
2.	AD22542	Cloud Computing Methods	PEC-2	2	0	2	4	3
3.	AD22641	Optimization Techniques	PEC-3	2	0	2	4	3
4.	AD22642	Bio-inspired Optimization Techniques	PEC-4	2	0	2	4	3

| 5. | AD22741 | AI and Robotics | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6. | AD22742 | Artificial Neural Networks and its Applications | PEC-6 | 2 | 0 | 2 | 4 | 3 |

OPEN ELECTIVE TO BE OFFERED TO OTHER DEPARTMENT
OPEN ELECTIVE – I

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AD22681	Introduction To AI And ML	OEC	3	0	0	3	3
2	AD22682	Introduction To Big Data Analytics	OEC	3	0	0	3	3

OPEN ELECTIVE – II

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AD22781	Fundamentals of Artificial Intelligence	OEC	3	0	0	3	3
2	AD22782	Data Visualization Techniques	OEC	3	0	0	3	3

OPEN ELECTIVE – III

SI. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AD22783	Augmented Reality / Virtual Reality	OEC	3	0	0	3	3
2	AD22784	Fundamentals of Machine Learning	OEC	3	0	0	3	3

SYLLABUS

SEMESTER I

MA22101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical Applications
- To familiarize the students with differential calculus
- To familiarize the student with functions of several variables. This is needed in many branches of engineering
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications
- To make the students understand various techniques ODE

UNIT I	MATRICES	12

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Problem solving using Cayley-Hamilton method – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature, rank, index.

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	MULTIPLE INTEGRALS	12

Double integrals – Double integrals in Cartesian and polar coordinates –Area enclosed by plane curves - Change of order of integration – Triple integrals – Volume of solids: cube, rectangular parallelopiped.

UNIT V	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear differential equations of second and higher order with constant coefficients when the R.H.S is e^{ax}, x^n , sin ax, cos ax, $e^{ax} x^n$, e^{ax} sinbx, e^{ax} cosbx – Linear differential equations of second and third order with variable coefficients: Cauchy's and Legendre's linear equations – Method of

variation of parameter .

TOTAL: 60 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Define the basic concepts of matrices, limit and continuity of a function, differentiation, ODE and integration
CO2:	Explain the properties of matrices and nature of the quadratic form
CO3:	Interpret the techniques of differentiation, partial differentiation, ODE and integration
CO4:	Apply diagonalization of matrices in quadratic form and apply Cayley Hamilton theorem to find the inverse of matrices
CO5:	Solve problems on differentiation, partial differentiation, integration and ODE using different methods

TEXT BOOKS:	
1.	Narayanan, S. and ManicavachagomPillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, Reprint 2017.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:	
1.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
3.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4.	Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3

PH22101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology
- To help the students to interrelate the topics such as properties of matter, thermal physics, ultrasonics, quantum theory and crystals, learned in the course
- To motivate students to compare and contrast the available equipment in the respective fields
- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course

UNIT I	PROPERTIES OF MATTER	9

Elasticity – Types of Elastic moduli – Factors affecting elasticity - Stress-strain diagram and its uses - beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: determination of young's modulus – I shaped Girders - twisting couple - torsion pendulum: determination of rigidity modulus and moment of inertia – torsion springs - other states of matter

UNIT II	THERMAL PHYSICS	9

Modes of Heat transfer – Thermal conductivity – Newton's law of cooling – Linear heat flow – Thermal conductivity in compound media - Lee's Disc method – Radial heat flow – Rubber tube method – Solar water heater - Thermodynamics – Isothermal and adiabatic process – Otto cycle – Diesel cycle

UNIT III	ULTRASONICS	9

Sound waves – ultrasonics – properties - production: magnetostriction method - piezoelectric method – cavitation - acoustic grating: wavelength and velocity of ultrasonic waves in liquids – applications: welding, machining, cleaning, soldering and mixing (qualitative) - SONAR – ultrasonic flaw detector - ultrasonography.

UNIT IV	QUANTUM PHYSICS	9

Black body radiation – Planck's radiation law – Deduction of Wien's displacement law and Rayleigh Jean's law - Compton effect, Photoelectric effect (qualitative) – matter waves – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – scanning tunneling microscope.

UNIT V	CRYSTAL PHYSICS	9

Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, Crystal planes, directions and Miller indices – Characteristics of crystal structures: SC, BCC, FCC and HCP structures - crystal imperfections: point, line and surface defects – crystal growth : epitaxial and lithography techniques

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall the basics of properties of matter, thermal physics and ultrasonics, to improve their engineering knowledge.
CO2:	Define the advanced physics concepts of quantum theory and the characteristics of crystalline materials.
CO3:	Illustrate Bending of beams, thermal behavior and ultrasonic devices to assess societal and safety issues.
CO4:	Summarize the dual aspects of matter, crystal structures and imperfections of crystals.
CO5:	Apply the moduli of elasticity of different materials, thermal energy, ultrasonics, scanning tunneling microscope and crystal growth techniques in engineering fields.

TEXT BOOKS:

1.	Gaur, R.K & Gupta.S.L, Engineering Physics, Dhanpat Rai Publishers, 2016.
2.	Shatendra Sharma & Jyotsna Sharma, Engineering Physics, Pearson India Pvt Ltd., 2018

REFERENCES:

1.	Halliday.D, Resnick, R. & Walker. J, "Principles of Physics", Wiley, 2015.
2.	Bhattacharya, D.K. & Poonam.T., Engineering Physics, Oxford University Press, 2015.
3.	Pandey.B.K, & Chaturvedi.S, Engineering Physics, Cengage Learning India. 2012.
4.	Malik H K & Singh A K, "Engineering Physics", McGraw Hill Education (India Pvt. Ltd.) 2nd edition 2018.
5.	Serway.R.A. & Jewett, J.W, "Physics for Scientists and Engineers", Cengage Learning India. 2010.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	3	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-	2

CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO	2	1	-	-	-	-	-	-	-	-	-	1	-	1	1

CH22101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with water treatment methods and electrochemistry Concept
- To gain basic knowledge of corrosion and protection methods
- To understand the basic concepts and synthesis of various engineering materials, nano materials and fuels
- To familiarise the students with the principles, working process and application of energy storage devices

UNIT I	WATER TREATMENT	9

Water: Sources, impurities - Hardness of water: Types - Estimation of hardness (EDTA method) - Disadvantages of hard water in boilers (Scale, Sludge) – Softening methods: Internal treatment (Calgon, Sodium Aluminate) and External treatment (Demineralisation process). Domestic water treatment – Desalination of brackish water: RO and Solar desalination method.

UNIT II	ELECTROCHEMISTRY AND CORROSION	12

Electrochemical cell – Free energy and emf – Nernst equation and applications – Oxidation and reduction potential – Standard electrodes: Standard Hydrogen electrode, Saturated calomel electrode, Glass electrode – pH measurement – Conductometric titration (acid-base, precipitation) and Potentiometric titrations: Redox titration (Fe^{2+} x $Cr_2O_7^{2-}$).
Corrosion – Types: Chemical corrosion and Electrochemical corrosion – Corrosion control methods: Sacrificial anodic and Impressed current Cathodic protection method

UNIT III	FUELS AND COMBUSTION	8

 Fuels - classification of fuels – Comparison of solid, liquid and gaseous fuel - Solid fuel - coal - analysis of coal (proximate only) – Liquid fuel - Petroleum – Refining of petroleum - manufacture of synthetic petrol (Bergius process) – Biodiesel – preparation, properties and uses. Gaseous fuel – CNG, LPG.
Combustion – Calorific value – Types (Gross and Net calorific value) – Dulong's formula – GCV and LCV calculation using Dulong's formula. Flue gas – Analysis of flue gas by Orsat method.

UNIT IV	ENERGY STORAGE DEVICES	8

Batteries – Types (Primary and Secondary) - Lead acid battery, Lithium ion battery - Super capacitors – Storage principle, types and examples – Electric vehicle – working principle - Fuel

cells – microbial fuel cell and polymer membrane fuel cell.
Nanomaterials in energy storage – CNT –Types, properties and applications.

UNIT V	ENGINEERING MATERIALS	8

Abrasives – Types: Natural and Artificial – SiC – preparation, properties and uses. Refractories – Types Acidic, Basic, Neutral – Refractoriness, RUL. Cement – Manufacture – Special cement – white cement and water proof cement. Glass – Manufacture, properties and uses

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall the basic concepts of water softening, nano materials and batteries
CO2:	Summarize the types of corrosion, fuels and energy storage devices
CO3:	Explain the basic principles of electrochemistry and engineering materials
CO4:	Identify suitable methods for water treatment, fuel and corrosion control
CO5:	Apply the knowledge of engineering materials, fuels and energy storage devices for material selection and also in energy sectors

TEXT BOOKS:

1.	P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
2.	S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.

REFERENCES:

1.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2.	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi 2015.
3.	Sivasankar B. "Engineering chemistry", Tata McGraw Hill Publishing company Ltd, New Delhi, 2008.
4.	B.S.Murty, P.Shankar, Baldev Raj, B B Rath and James Murday, "Text book of nano science and technology", Universities press.
5.	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	-	-	-	-	-	-	-	1	-	2	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	-	3	-
CO3	3	2	2	1	-	-	1	-	-	-	-	1	-	2	-

CO4	3	2	2	1	-	-	2	-	-	-	-	1	-	3	2
CO5	3	2	2	1	-	-	2	-	-	-	-	1	-	-	1
CO	3	2	2	1	-	-	2	-	-	-	-	1	-	2	1

CS22101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving
- To learn to solve problems using Python conditionals and loops
- To define Python functions and use function calls to solve problems
- To use Python data structures - lists, tuples, and dictionaries to represent complex data

UNIT I	INTRODUCTION TO COMPUTERS AND PROBLEM SOLVING STRATEGIES	9

Introduction- Components and functions of a computer system- Hardware and Software. Problem solving strategies- Program design tools: Algorithms, Flow charts, Pseudo code

UNIT II	DATA TYPES, EXPRESSIONS, STATEMENTS AND CONTROL FLOW	9

Features of Python -Variables and Identifiers – Data types: Numbers, Strings, Boolean, Tuples, List, Dictionary, Sets - Input operation - Comments, Reserved words, Indentation - Operators and Expressions – Type Conversion - Selection / Conditional Branching Statements - Basic Loop Structures / Iterative Statements - Nested Loops – break statement – continue statement – pass statement

UNIT III	FUNCTIONS AND STRINGS	9

Functions: Function Definition, function call- variable scope and lifetime – return statements. Strings: Definition, operations (concatenation, appending, multiply, slicing) - immutability, comparison, iterations, string methods

UNIT IV	LIST, TUPLES AND DICTIONARIES	9

Lists: Access, updating values- nested, cloning- list operations- list methods- looping in list. Tuples: Tuple operations- nested tuple; Dictionaries- Creating, Accessing, adding, modifying, deleting items

UNIT V	FILES, EXCEPTIONS AND PACKAGES	9

Files: Types of files, Opening and closing Files, Reading and writing files, File positions, Renaming and deleting files. Exceptions: Errors and exceptions, Handling exceptions, Packages

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:	
CO1:	Describe the basics of computer system and problem solving approaches.
CO2:	Describe the usage of Python selection and looping statements.
CO3:	Solve simple problems using Python functions and strings.
CO4:	Make use of Python data structures - lists, tuples, and dictionaries to represent compound data.
CO5:	Illustrate the basic concepts of files, exceptions and packages.

TEXT BOOKS:

1.	Reema Thareja, "Python Programming Using Problem Solving Approach", 13th Edition, Oxford University Press, 2022.
2.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
2.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
CO5	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
CO	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3

HS22102	**UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**	**L**	**T**	**P**	**C**

		2	0	0	2

COURSE OBJECTIVES:

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.

UNIT I	**INTRODUCTION TO VALUE EDUCATION**	6

Value Education - Definition, Concept and Need for Value Education, Basic Guidelines - The Content and Process of Value Education - Basic Guidelines for Value Education - Self exploration as a means of Value Education - Happiness and Prosperity as parts of Value Education.

UNIT II	**HARMONY IN THE HUMAN BEING**	6

Human Being is more than just the Body- Harmony of the Self ('I') with the Body - Understanding Myself as Co-existence of the Self and the Body - Understanding Needs of the Self and the needs of the Body - Understanding the activities in the Self and the activities in the Body.

UNIT III	**HARMONY IN THE FAMILY, SOCIETY AND HARMONY IN THE NATURE**	6

Family as a basic unit of Human Interaction and Values in Relationships - The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love - Comprehensive Human Goal: The Five Dimensions of Human Endeavour - Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.

UNIT IV	**SOCIAL ETHICS**	6

The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities.

UNIT V	**PROFESSIONAL ETHICS**	6

Universal Human Values - Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies - Production System and Management Models.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Illustrate the significance of value inputs in a classroom and start applying them in

	their life and profession.
CO2:	Explain the role of a human being in ensuring harmony in society and nature.
CO3:	Demonstrate the value of harmonious relationship based on trust and respect in their life and profession.
CO4:	Compare values, skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO5:	Classify ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

TEXT BOOKS:

1	R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010.
2	A.N. Tripathy, "Human Values", New Age International Publishers, New Delhi, 2004.

REFERENCES:

1.	Gaur. R.R., Sangal. R, Bagaria. G.P, "A Foundation Course in Value Education", Excel Books, 2009.
2.	Gaur. R.R., Sangal. R, Bagaria. G.P, "Teachers Manual" Excel Books, 2009.
3.	Gaur R R, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2009.
4.	William Lilly, "Introduction to Ethic" Allied Publisher.
5.	Nagarajan, R.S., Professional Ethics and Human values, New Age International Publishers, 2006.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO2	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO3	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO4	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO5	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-
CO	1	-	-	-	-	2	2	3	1	1	-	1	-	3	-

GE3152	**jkpou; kuG**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OBJECTIVES:
• jkpo; nkhopapd; kjpg;Gfs;> ,e;jpahtpy; cs;s mbg;gil nkhopf;FLk;gq;fs; kw;Wk; jkpo; ,yf;fpa tiffis khzth;fs; Ghpe;Jnfhs;s cjTjy;.
• khzth;fs; ghiw Xtpaq;fs;> rpw;gf;fiyfs; kw;Wk; ,irf;fUtpfspd; top jkpo; ghuk;ghpaj;ijg; Ghpe;Jnfhs;s trjp nra;jy;
• jkpoh;fspd; fiy kw;Wk; tPu tpisahl;Lfisg; Ghpe;J nfhs;tjw;F khzth;fSf;F cjTjy;.
• jkpoh;fspd; jpizf; fUj;Jf;fs; kw;Wk; mth;fspd; tho;f;if newpfisg; gw;wp khzth;fSf;F tpopg;Gzh;it Vw;gLj;Jjy;
• ,e;jpa fyhr;rhuj;jpy; jkpoh;fspd; gq;fspg;igAk; mjd; jhf;fj;ijAk; khzth;fs; Ghpe;Jnfhs;s nra;jy;.

UNIT I	nkhop kw;Wk; ,yf;fpak;	3

,e;jpa nkhopf; FLk;gq;fs; − jpuhtpl nkhopfs; − jkpo; xU nrk;nkhop − jkpo; nrt;tpyf;fpaq;fs; − rq;f ,yf;fpaj;jpd; rkar;rhu;gw;w jd;ik − rq;f ,yf;fpaj;jpy; gfpu;jy; mwk; − jpUf;Fwspy; Nkyhz;ikf; fUj;Jf;fs; − jkpo;f; fhg;gpaq;fs;> jkpofj;jpy; rkz ngsj;j rkaq;fspd; jhf;fk; − gf;jp ,yf;fpak;> Mo;thu;fs; kw;Wk; ehad;khu;fs; − rpw;wpyf;fpaq;fs; − jkpopy; etPd ,yf;fpaj;jpd; tsu;r;rp − jkpo; ,yf;fpa tsu;r;rpapy; ghujpahu; kw;Wk; ghujpjhrd; MfpNahupd; gq;fspg;G.

UNIT II	kuG – ghiw Xtpaq;fs; Kjy; etPd Xtpaq;fs; tiu – rpw;gf;	fiy.	3

eLfy; Kjy; etPd rpw;gq;fs; tiu − [k;nghd; rpiyfs; − goq;Fbapdu; kw;Wk; mtu;fs; jahupf;Fk; iftpidg; nghUUl;fs;> nghk;ikfs; − Nju; nra;Ak; fiy − RLkz; rpw;gq;fs; − ehl;Lg;Gwj; njatq;fs; − FkupKidapy; jpUts;Stu; rpiy − ,irf; fUtpfs; − kpUjq;fk;> giw> tPiz> aho;> ehj];tuk; − jkpou;fspd; r%f nghUshjhu tho;tpy; Nfhtpy;fspd; gq;F

UNIT III	ehl;Lg;Gwf; fiyfs; kw;Wk; tPu tpisahl;Lfs;	3

njUf;$j;J> fufhl;lk;> tpy;Yg;ghl;L> fzpahd; $j;J> xapyhl;lk;> Njhy;ghitf; $j;J> rpyk;ghl;lk;> tsup> Gypahl;lk;> jkpou;fspd; tpisahl;Lfs;.

UNIT IV	jkpou;fspd; jpizf; Nfhl;ghLfs;.	3

Jkpofj;jpd; jhtuq;fSk;> tpyq;FfSk; − njhy;fhg;gpak; kw;Wk; rq;f ,yf;fpaj;jpy; mfk; kw;Wk; Gwf;Nfhl;ghLfs; − jkpou;fs; Nghw;wpa mwf;Nfhl;ghL − rq;ffhyj;jpy; jkpofj;jpy; vOj;jwpTk;> fy;tpAk; − rq;ffhy efuq;fSk; Jiw Kfq;fSk; − rq;f fhyj;jpy; Vw;Wkjp kw;Wk; ,wf;Fkjp − fly; fle;j ehLfspy; Nrhou;fspd; ntw;wp.

UNIT V	,e;jpa Njrpa ,af;fk; kw;Wk; ,e;jpa gz;ghl;bw;F jkpou;fspd; gq;fspg;G	3

,e;jpa tpLjiyg;Nghuhpy; jkpou;fspd; gq;F − ,e;jpahtpd; gpwgFjpfspy; jkpo;g; gz;ghl;bd; jhf;fk; − Rakupahij ,af;fk; − ,e;jpa kUj;Jtj;jpy; rpj;j kUj;Jtj;jpd; gq;F − fy;ntl;Lfs;> ifnaOj;Jg;gbfs; − jkpo;g; Gj;jfq;fspd; mr;R tuyhW.

	TOTAL: 15 PERIODS

COURSE OUTCOMES:
,g;ghlj; jpl;lj;jpd; %yk; khzth;fs;:
CO1:	jkpo; nkhopapd; Kf;fpaj;Jtk; kw;Wk; ,yf;fpa tifs tpthpf;f KbAk;.

CO2:	ghiw Xtpaq;fs; Kjy; etPd fiyfs; tiu mth;fspd; mwpit tpthpf;f KbAk;.
CO3:	jw;fhg;Gf; fiyfspd; tYthd mbj;js mwpit tpthpf;f KbAk;.
CO4:	jkpoh;fspd; jpizf; fUj;Jf;fs; kw;Wk; mjd; kjpg;Gfis tpsf;f KbAk;.
CO5:	,e;jpa fyhr;rhuj;jpy; jkpoh;fspd; gq;fspg;ig tpthpf;f ,aYk;.

TEXT & REFERENCE BOOKS:

1.	jkpof tuyhW – kf;fSk; gz;ghLk; – Nf. Nf. gps;is (ntspaPL : jkpo;ehL ghlE}y; kw;Wk; fy;tpay; gzpfs; fofk;.
2.	Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
3.	Dr.S.Singaravelu, "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies.
4.	Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", International Institute of Tamil Studies.
5.	Dr.M.Valarmathi, " The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies.
6.	Dr.K.K.Pillay, "Studies in the History of India with Special Reference to Tamil Nadu".

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-
CO3	-	-	-	-	-	1	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	-	-	3	-
CO	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-

EN22101	COMMUNICATIVE ENGLISH	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To guide the learners on the basics of language including vocabulary and grammar
- To develop the receptive skills of the learners: Reading and Listening
- To develop the productive skills of the learners: Writing and Speaking
- To make the learners realize the importance of accuracy and fluency

•	To help the learners use the language in real situations	
UNIT I	**VOCABULARY AND LANGUAGE STUDY**	**6**

Vocabulary – Synonyms and Antonyms, Word building – Prefixes and Suffixes – Word formation- Definitions - One word substitutes - Reading for vocabulary and language development- Note making and Summarising - Developing Hints.

UNIT II	**READING AND LANGUAGE DEVELOPMENT**	**6**

Parts of speech, Types of sentences – Statement, Interrogative, Imperative, Exclamatory, Wh-questions, **Yes** or **No** questions and tag questions, Formal Letters – Academic, Official, and Business Letters

UNIT III	**GRAMMAR AND LANGUAGE DEVELOPMENT**	**6**

Tense and Voice, Auxiliary verbs (be, do, have), Modal verbs - *Types of Reading* : Intensive Reading and Extensive Reading- *Strategies*: Predicting- Skimming and Scanning -Reading for facts - Understanding the parts of paragraph- Learning the transitional signals used in the passage to classify the text

UNIT IV	**FUNDAMENTALS OF WRITING**	**6**

Punctuation and Capitalization- **Sentence formation**: Word order-Completion of sentences-Conjunctions-Transitional signals- sentence and sentence structures- Informal Letters.

UNIT V	**EXTENDED WRITING**	**6**

Degrees of Comparison – Reported speech **-Paragraph writing**-Topic sentence, supporting sentences and concluding sentence-Informal and Formal expressions

	TOTAL : 30 PERIODS

PRACTICAL EXERCISES	
Listening (Receptive skill**)** Intensive Listening: Effective and Attentive Listening	
Exercises	
1.	Listening for gist from recorded speeches
2.	Listening for specific information from recorded conversations
3.	Listening for strengthening vocabulary skills.
4.	Listening to variety of situations and voices- Listening for language development
5.	Listening for pronunciation: syllables, stress and intonation.
Speaking (Productive Skill)	
Exercises	
1.	Introducing oneself and others
2.	Asking for / giving personal information
3.	Practicing dialogues in pairs
4.	Giving directions-Informal and formal dialogues
5.	Speaking in connected speech
6.	Responding to questions

7.	Short presentations
8.	Speaking in small and big groups
9.	Learning and practicing the essential qualities of a good speaker
	TOTAL: 30 PERIODS
	TOTAL(T+P): 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply and practice the correct usages of language
CO2:	Receive the language effectively and meaningfully through receptive skills
CO3:	Produce the language appropriate to the needs and situations exercising productive skills
CO4:	Transfer or interpret any piece of information with accuracy and fluency
CO5:	Apply the language intellectually and confidently

TEXT BOOKS:

1.	Shobha. K.N, Rayen, Joavani, Lourdes, "Communicative English", Cambridge University Press, 2018.
2.	Sudharshana.N.P and Saveetha. C, "English for Technical Communication", Cambridge University Press: New Delhi, 2016.

REFERENCES:

1.	Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015.
2.	Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA: 2007.
3.	Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education.
4.	Wood F.T, "Remedial English Grammar", Macmillan, 2007.
5.	Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	1	1	-	2	-	1	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	2	-
CO3	-	-	-	-	-	-	-	-	1	1	-	2	-	2	-
CO4	-	-	-	-	-	-	-	-	2	2	-	2	-	3	-
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	3	-
CO	-	-	-	-	-	-	-	-	2	2	-	2	-	2	-

BS22101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

PHYSICS LABORATORY

OBJECTIVES:

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

LIST OF EXPERIMENTS

1.	Non-uniform bending – Determination of Young's modulus.
2.	SHM of Cantilever – Determination of Young's modulus.
3.	Poiseuille's flow – Coefficient of viscosity of liquid
4.	Torsional pendulum - Determination of Rigidity modulus.
5.	Newton's ring – Radius of curvature of convex lens.
6.	Lee's Disc – Determination of coefficient of thermal conductivity of bad conductor.

TOTAL: 30 PERIODS

CHEMISTRY LABORATORY

OBJECTIVES

- To inculcate experimental skills to test basic understanding of water quality parameters such as, acidity, alkalinity and hardness.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.

LIST OF EXPERIMENTS

1.	Determination of total hardness of water by EDTA method.
2.	Conductometric titration of strong acid and strong base.
3.	Determination of strength of given hydrochloric acid using pH meter.
4.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
5.	Determination of alkalinity in water sample.
6.	Estimation of iron content of the given solution using potentiometer.

TOTAL: 30 PERIODS

	TOTAL: 60 PERIODS
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Determine different moduli of elasticity used in day to day engineering applications
CO2:	Calculate the viscosity of liquids and radius of curvature of convex lens
CO3:	Estimate the coefficient of thermal conductivity of bad conductors
CO4:	Determine the water quality parameters of the given water sample.
CO5:	Analyze quantitatively the metals (Fe, Ni,) in the any sample volumetrically as well as by using spectroanalytical methods.

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	-	-	-	-	-	-	2	1	-	1	-	2	-
CO2	3	1	-	-	-	-	-	-	2	1	-	1	-	2	-
CO3	3	1	-	-	-	-	-	-	2	1	-	1	-	3	-
CO4	3	1	-	-	-	2	2	-	1	-	-	-	-	2	-
CO5	3	1	-	-	-	2	2	-	1	-	-	-	-	3	-
CO	3	1	-	-	-	2	2	-	2	1	-	1	-	2	-

CS22102	**PYTHON PROGRAMMING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

1.	Identification and solving of simple real life or scientific or technical problems, and developing algorithms and flow charts for the same
2.	Python programming using simple statements and expressions
3.	Scientific problems using Conditionals and Iterative loops
4.	Implementing real-time/technical applications using Lists, Tuples
5.	Implementing real-time/technical applications using Sets, Dictionaries

6.	Implementing programs using Functions
7.	Implementing programs using Strings
8.	Implementing real-time/technical applications using File handling
9.	Implementing real-time/technical applications using Exception handling
10.	Exploring Pygame tool
11.	Developing a game activity using Pygame like bouncing ball
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Develop algorithmic solutions to simple computational problems
CO2:	Develop and execute simple Python programs
CO3:	Implement programs in Python using conditionals, loops and functions for solving problems
CO4:	Process compound data using Python data structures
CO5:	Utilize Python packages in developing software applications

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	1	3	-	-
CO5	3	3	3	3	2	-	-	-	-	-	-	1	3	-	-
CO	3	3	3	3	2	-	-	-	-	-	-	1	3	-	-

HS22101	HIGHER ORDER THINKING	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- Teaching the students the sources and dynamics of thinking.
- Teaching the students the basics of systematic and scientific thinking.
- Initiating the students into critical thinking and to use critical thinking in practical life
- Initiating students into creative thinking

UNIT I	INTRODUCTION TO COGNITION, KNOWLEDGE AND THINKING	3

Cognition - Different Cognitive functions - Cognition and intelligence - Cognitive development: till adolescence and post adolescence - possibility of true knowledge - The sources of Knowledge. Sensation, perception. Reality of perception - Concept formation, abstraction. Memory and retrieving - Introduction to thinking and types of thinking. Systematic thinking

UNIT II	LOGIC AND REASONING	3

Commonsense and scientific knowledge. Pursuit of truth.- Syllogistic Logic. Greek and Indian. - Exercises

UNIT III	CRITICAL THINKING SKILLS AND DISPOSITIONS	3

Critical Thinking Skills & Dispositions. Critical Thinking Exercises

UNIT IV	ANALYSIS OF ARGUMENTS	3

Propositions and fallacies. - Analyzing arguments. - Exercises.

UNIT V	CREATIVE THINKING AND INNOVATIVE THINKING	3

Evolution of Scientific Thinking and Paradigm Shift. - Dynamics of Thoughts: Hegel. - Convergent thinking and divergent thinking (out of the box thinking). - Problem solving and Planning.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate the sources of knowledge and the process of thinking
CO2:	Demonstrate critical thinking skills and dispositions of critical thinking
CO3:	Confidently engage in creative thinking and problem solving

REFERENCES:	
1	Introduction to Logic, Irving M. Copi, Carl Cohen and Kenneth McMahon, Fourteenth Edition, Pearson Education Limited, 2014.
2	Teaching Thinking Skills: Theory and Practice, Joan Boykoff Baron and Robert J. Sternberg, W.H. freeman and Company, New York.
3	Cognitive Psychology, Robert J. Sternberg, Third Edition, Thomson Wadsworth, UK

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	-	-	-	-	-	-	-	1	-	-	2
CO2	3	2	2	1	-	-	-	-	-	-	-	1	-	-	2
CO3	3	2	2	1	-	-	1	-	1	-	1	1	-	-	2
CO	3	2	2	1	-	-	1	-	1	-	1	1	-	-	2

MA22201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES:					

- To provide the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- 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 solving algebraic and transcendental equations.
- 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.
- To acquaint the knowledge of various numerical methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	12

Statistical hypothesis –Type I and Type II errors – Large sample tests based on Normal distribution for single mean and difference of means –Tests based on t distribution for single mean and equality of means – Test based on F distribution for equality of variances – Chi square test for single variance and goodness of fit – Independence of attributes – Contingency table: Analysis of r ✕ c tables.

UNIT II	DESIGN OF EXPERIMENTS	12

General principles – Analysis of variance (ANOVA) – One way classification – Completely randomized design (CRD) – Two way classification – Randomized block design (RBD) – Three way classification –Latin square design(LSD) – Two factor experiments: 2^2 factorial design

UNIT III	NUMERICAL SOLUTION OF EQUATIONS	12

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel .

UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	12

Newton's forward and backward interpolation – Interpolation with unequal intervals – Lagrange's interpolation– Divided differences – Newton's divided difference – Approximation of derivates using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3, 3/8 rules– Numerical double integration: Trapezoidal and Simpson's rules.

UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL	12

EQUATIONS

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the basic concepts of statistical tests, ANOVA, solution of equations, interpolations and ODE.
CO2:	Discuss the techniques of statistical tests and design of experiments.
CO3:	Explain the solution of equations, ODE, interpolations, differentiation and integration.
CO4:	Apply the concept of testing of hypothesis and design of experiment in real life.
CO5:	Solve equations, ODE, interpolation, differentiation and integration using numerical techniques.

TEXT BOOKS:

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

REFERENCES:

1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics, Tata McGraw Hill Edition, 2004.
5.	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.

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3

ES22202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the basic circuit components
- To educate on the working principles and applications of electrical machine
- To explain the construction and working of semiconductor devices
- To educate on logic gates, flip flops and registers
- To introduce the functional elements and working of measuring instruments

UNIT I	INTRODUCTION TO ELECTRICAL ENGINEERNG	9

Introduction-Conductors, semiconductors and Insulators-Electrostatics – Electric Current-Electromotive Force-Electric Power- Ohm's Law-Basic circuit components-Electromagnetism related laws-Kirchhoff's Laws.

UNIT II	ELECTRICAL MACHINES	9

Construction, working principle and types of DC Generator – Motor- single phase Transformer - single phase and three phase Induction motor –Applications.

UNIT III	ANALOG ELECTRONICS	9

Classification of Semiconductors– Construction , Characteristics and working -PN Junction Diode-Zener Diode - Bipolar Junction Transistor-IGBT- SCR- MOSFET.

UNIT IV	DIGITAL ELECTRONICS	9

Review of number systems, binary codes- Boolean Algebra-Logic gates-Implementation of Boolean expression using K-map –Types of flip flops, Registers.

UNIT V	MEASUREMENTS AND INSTRUMENTATION	9

Functional elements of an instrument –Static and dynamic characteristics of instruments, Errors, Principles of electrical indicating instruments- Types of indicating instruments -Moving Coil and Moving Iron instruments- DSO -Transducers-Resistive Transducers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply the basic laws to determine circuit parameters
CO2:	Explain the construction, working and application of electrical machines.
CO3:	Explain the construction and working of semiconductor devices.
CO4:	Interpret the function of combinational and sequential circuits.
CO5:	Interpret the operating principles of measuring instruments.

	TEXT BOOKS:
1.	M .S.Sukhja ,T.K.Nagsarkar ―Basic Electrical and Electronics Engineering, Oxford Higher Education First Edition, 2018.
2.	S. Salivahanan, R.Rengaraj ―Basic Electrical and Instrumentation Engineering, McGraw Hill Education, First Edition, 2019.

	REFERENCES:
1.	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2.	H.S. Kalsi, ‗Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.
3.	V. K. Mehta, Rohit Mehta ―Basic Electrical Engineering‖, S.Chand & Company Pvt. Ltd, New Delhi, 2012.
4.	S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015.
5.	B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	1	-	-	-	-	-	1	2	2	-
CO2	2	-	-	-	-	1	-	-	-	-	-	1	2	-	-
CO3	2	-	-	-	-	1	-	-	-	-	-	1	2	-	-
CO4	2	-	-	-	-	1	-	-	-	-	-	1	2	-	-
CO5	2	-	-	-	-	1	-	-	-	-	-	1	2	-	-
CO	2	2	-	-	-	1	-	-	-	-	-	1	2	2	-

AD22201	DATA STRUCTURES AND ALGORITHMS USING C	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To introduce the basics of algorithm analysis.
- To learn the concepts of list ADTs.
- To understand the concepts of stack and queue ADTs.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

UNIT I	ALGORITHM ANALYSIS (10+2 SKILL)	12

Mathematical Background- Model- Maximum subsequence problem- solution - Running Time

Calculations- for loop- nested for loops-consecutive statements- if/else- logarithms in the running time- Euclid's algorithm.	

UNIT II	LINEAR DATA STRUCTURES – LIST (10+2 SKILL)	12
Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly-Linked Lists – Circular Linked List – Applications.		

UNIT III	LINEAR DATA STRUCTURES – STACK & QUEUE (10+2 SKILL)	12
Stack ADT – Stack Model- Implementation of Stack – Applications – Queue ADT – Queue model- Queue Implementation – Applications.		

UNIT IV	NON-LINEAR DATA STRUCTURES (10+2 SKILL)	12
Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.		

UNIT V	SORTING AND SEARCHING TECHNIQUES (10+2 SKILL)	12
Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.		

TOTAL: 60 PERIODS

SKILL DEVELOPMENT ACTIVITIES
(Group Seminar/ Mini Project
/ Assignment/ Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc.)

COURSE OUTCOMES:

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

CO1:	Analyze the basics of algorithm.
CO2:	Apply linear/non–linear data structure operations for solving a given problem.
CO3:	Identify sort and search algorithms for a given application.
CO4:	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

TEXT BOOKS:

1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2016.
2.	ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.

REFERENCES:

1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
2.	Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.
3.	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2016.
4.	Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2018.
5.	Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

Course outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-

ME22201	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To draw the engineering curves.
- To draw orthographic projection of points and lines
- To draw orthographic projection of solids and section of solids.
- To draw the development of surfaces
- To draw the isometric projections of simple solids and freehand sketch of simple objects.

CONCEPTS AND CONVENTIONS

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I	PLANE CURVES	12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II	PROJECTION OF POINTS, LINES AND PLANES	12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to any one principal plane.

UNIT III	PROJECTION OF SOLIDS	12

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

UNIT IV	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	12

Sectioning of solids (Prisms, pyramids cylinders and cones) 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 V	ISOMETRIC PROJECTIONS AND FREEHAND SKETCHING	12

Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids & cylinders, in simple vertical positions. Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.Practicing three dimensional modeling of projection of simple objects by CAD Software (Demonstration purpose only).

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1:	Recall the existing national standards and interpret a given three dimensional drawing
CO2:	Interpret graphics as the basic communication and methodology of the design process
CO3:	Acquire visualization skills through the concept of projection
CO4:	Develop the sectioned solids and discover its true shape
CO5:	Develop imagination of physical objects to be represented on paper for engineering communication.

TEXT BOOKS

1.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
2.	Jeyapoovan T., "Engineering Graphics using AutoCAD", Vikas Publishing House, 7th Edition, 2015.

REFERENCES

1.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited 2008.

2.	Julyes Jai Singh S., "Engineering Graphics", SRM tri sea publishers, Nagercoil, 7th Edition, 2015.
3.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
4.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
5.	Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
CO2	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
CO5	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-
CO	3	1	-	-	-	-	-	-	-	2	-	-	-	2	-

GE3252	jkpoUk; njhopy; El;gKk;	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:
- rq;f fhyj;jpd; nerT kw;Wk; gPq;fhd; njhopy; El;gj;ij khzth;fs; Ghpe;Jnfhs;s trjp nra;jy;.
- rq;f fhyj; jkpoh;fspd; tbtikg;G njhopy;El;gk; gw;wpa tpopg;Gzh;it Vw;gLj;Jjy;.
- gz;ila fhy cw;gj;jp njhopy;El;gj;jpd; midj;J epiyfisAk; NtWgLj;jp mwpa khzth;fSf;F cjThy;.
- tptrhak; kw;Wk; ePh;g;ghd;Kd njhopy;El;gj;jpd; gz;ila mwpitg; Ghpe;Jf; nfhs;s nra;jy;.
- jkpo; nkhopapd; b[pl;ly; kakhf;fy; gw;wpg; Ghpe;Jf; nfhs;s nra;jy;.

myF I	nerT kw;Wk; ghidj; njhopy;El;gk	3

rq;f fhyj;jpy; nerTj; njhopy; – ghidj; njhopy;El;gk; – fUg;G rptg;G ghz;lq;fs; – ghz;lq;fspy; fPwy; FwpaPLfs;

myF II	tbtikg;G kw;Wk; fl;blj; njhopy;El;gk	3

rq;f fhyj;jpy; tbtikg;G kw;Wk; fl;Lkhdq;fs; & rq;f fhyj;jpy; tPl;Lg; nghUl;spy; tbtikg;G – rq;f fhyj;jpy; fl;Lkhd nghUl;fSk; eLfy;Yk; – rpyg;gjpfhuj;jpy; Nkil mikg;G gw;wpa tptuq;fs; –

khky;yGur; rpw;gq;fSk;> Nfhtpy;fSk; – Nrhou; fhyj;J ngUq;Nfhapy;fs; kw;Wk; gpw topghl;Lj; jyq;fs; – ehaf;fu; fhyf; Nfhtpy;fs; – khjpup fl;likg;Gfs; fw;wp mwpjy;> kJiu kPdhl;rp mk;kd; Myak; kw;Wk; jpUiky ehaf;fu; k`hy; – nrl;bebl;L tPLfs; – gpupl;b\;; fhyj;jpy; nrd;idapy; ,e;Njh – rhNuhnrdpf; fl;blf; fiy.

myF III	cw;gj;jpj; njhopy; El;gk;	3

fg;gy; fl;Lk; fiy – cNyhftpay; – ,Uk;Gj; njhopw;rhiy – ,Uk;ig cUf;Fjy;> v/F – tuyhw;Wr; rhd;Wfshf nrk;G kw;Wk; jq;f ehzaq;fs; – ehzaq;fs; mr;rbj;jy; – kzp cUthf;Fk; njhopw;rhiyfs; – fy;kzpfs;- fz;zhb kzpfs; – RLkz; kzpfs; – rq;F kzpfs; - vYk;Gj;Jz;Lfs; – njhy;ypay; rhd;Wfs; – rpyg;gjpfhuj;jpy; kzpfspd; tiffs;.

myF IV	Ntshz;ik kw;Wk; ePu;;ghrdj; njhopy;El;gk	3

miz> Vup> Fsq;fs;> kjF – Nrhou;fhyf; FKopj; J}k;gpd; Kf;fpaj;Jtk; – fhy;eil guhkupg;G – fhy;eilfSf;fhd tbikf;fgl;l fpzWfs; – Ntshz;ik kw;Wk; Ntshz;ikr; rhe;ej; njhopy;ghLfs; – fly;rhu; mwpT – kPd;tsk; – Kj;J kw;Wk; Kj;Jf;Fspj;jy; – ngUq;fly; FwpT;j gz;ila mwpT – mwpTrhu; r%fk;.

myF V	mwptpay; jkpo; kw;Wk; fzpdpj;jkpo;	3

mwptpay; jkpopd; tsu;r;rp – fzpdpj;jkpo; tsu;r;rp – jkpo; E}y;fis kpd;gpg;G nra;jy; – jkpo; nkd;nghUl;fs; cUthf;fk; – jkpo; ,izaf; fy;tpf;fofk; – jkpo; kpd; E}yfk; – ,izajpy; jkpo; mfuhjpfs; – nrhw;Fitj; jpl;lk;.

| | | **TOTAL: 15 PERIODS** |

COURSE OUTCOMES:

,g;ghlj; jpl;lj;jpd; %yk; khzth;fs;:

CO1:	rq;f fhyj;jpd; nerT kw;Wk; gPq;fhd; njhopy; El;gj;jpd; Kf;fpaj;Jtij tpthpf;f KbAk;.
CO2:	rq;f fhyj; jkpoh;fspd; tbikg;G njhopy;El;gk; gw;wpa mwpit tpsf;f KbAk;.
CO3:	gz;ila jkpoh;fspd; cw;gj;jp njhopy;El;gk; gw;wpa tYthd mbj;js mwpit ntspg;gLj;j KbAk;.
CO4:	jkpoh;fspd; tptrhak; kw;Wk; ePh;g;ghrhd njhopy;El;gj;jpd; gz;ila mwpit tpthpf;f KbAk;.
CO5:	jkpo; nkhopapd; b[pl;ly; kakhf;fy; gw;wpa fUj;ij tpsf;f KbAk;.

TEXT & REFERENCE BOOKS:

1.	fzpzpj;jkpo; – Kidtu; ,y. Re;juk;. (tpfld; gpuReuk;)
2.	fPob – itif ejpf;fiuapy; rq;ffhy efu ehfuPfk; (njhy;ypay; Jiw ntspaPL) / Keeladi - 'Sangam City Civilization on the banks of river Vaigai', Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
3.	nghUie – Mw;wq;fiu ehfuPfk;. (njhy;ypay; Jiw ntspaPL) / "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
4.	Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
5.	Dr.S.Singaravelu, "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies.

6.	R.Balakrishnan, "Journey of Civilization Indus to Vaigai", RMRL.

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	2	-
CO2	-	-	-	-	-	1	1	-	-	-	-	-	-	2	-
CO3	-	-	-	-	-	1	1	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	1	1	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	1	1	-	-	-	-	-	-	3	-
CO	-	-	-	-	-	1	1	-	-	-	-	-	-	3	-

EN22201	TECHNICAL ENGLISH	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To widen strategies and skills to augment ability to read and comprehend engineering and technology texts
- To develop writing skill to make technical presentations
- To draft convincing job applications and effective reports
- To strengthen listening skills to comprehend technical lectures and talks in their areas of specialization
- To cultivate speaking skills both technical and general.

UNIT I	LANGUAGE STUDY	12

Technical Vocabulary- synonyms, antonyms, prefix and suffix, word formation, Homonyms and Homophones - puzzles,- Reading: skimming a reading passage – scanning for specific information- Instruction- Interpreting – Writing: Recommendation- Checklist.

UNIT II	READING AND STUDY SKILLS	6

Active and Passive voice- Extended Definitions- Imperatives- Numerical Adjectives- Purpose Statement – Reading: Critical reading- Newspaper articles- journal reports- editorials and opinion blogs - Report Writing: Fire Accident, Industrial visit, Project report, feasibility report, survey report, business report.

UNIT III	WRITING SKILLS- INTRODUCTION TO PROFESSIONAL	6

	WRITING	
	Error Spotting/Common Errors- Concord-Compound words- Abbreviations and Acronyms- Discourse Markers - Finding key information – shifting facts from opinion- interpreting visual material- making inference from the reading passage - Interpretation of charts- - Minutes of the meeting- Paraphrasing- Proposal writing.	
UNIT IV	**TECHNICAL WRITING AND GRAMMAR**	**6**
	If Conditional Clauses- Prepositional Phrases- Fixed and semi fixed expressions- -e-mail communication- reading the attachment files having a poem /joke / proverb/sending their responses through e-mail.- Job application letter and Resume/CV/ Bio-data.	
UNIT V	**EXTENDED WRITING AND LANGUAGE STUDY**	**6**
	Articles- Cause and Effect expressions- Collocations- Sequencing words- Reading longer technical texts and taking down notes- Structure of Essay- Types of Essay: Narrative essay- Descriptive Essay- Analytical Essay- Cause and Effect Essay – Compare and contrast essays.	

TOTAL – 30 PERIODS

PRACTICAL EXERCISES

Listening Skills – Listening for professional Development
Listening to UPSC Toppers Mock Interviews- Listening to debates/discussions/different viewpoints /scientific lectures/event narrations/documentaries/telephonic conversations

Speaking Skills –emphasizing communicative establishment
Seeking Information -asking and giving directions- narrating personal experiences/ events- answering interview questions- picture description- presenting a product and giving instruction to use a product – mini presentations-role plays- speaking in formal and informal situations-speaking about one's locations - speaking about great personalities –describing a simple process- telephone skills and etiquette

TOTAL: 30 PERIODS

TOTAL (T+P) = 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Infer advanced technical texts from varied technical genres to expand engineering knowledge and explore more ideas.
CO2:	Analyze technical contents written on par with international standards and rewrite contents using the right vocabulary without grammatical errors to make their articles published in reputed journals.
CO3:	Present reports and job letters utilizing the required format prescribed on par with international standards using the exact vocabulary to make their works worthy to be read .
CO4:	Employ the language tones and styles appropriately in interviews and Group Discussions effortlessly following the strategies expected by the corporate world

CO5:	Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness.

TEXT BOOKS:

1.	Mike Markrl, "Technical Communication", Palgrave Macmillan, London, 2012.
2.	Sumant, S and Joyce Pereira, "Technical English II", Chennai: Vijay Nicole Imprints Private Limited, 2014.

REFERENCES:

1.	Raman, Meenakshi & Sangeetha Sharma, "Communication Skills", New Delhi: OUP, 2018.
2.	Rizvi M, Ashraf, "Effective Technical Communication", New Delhi: Tata McGraw-Hill Publishing Company Limited, 2007.
3.	Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.
4.	Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA: 2007.
5.	Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	1	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	2	-
CO3	-	-	-	-	-	-	-	-	2	3	-	2	-	2	-
CO4	-	-	-	-	-	-	-	-	2	3	-	2	-	3	-
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	3	-
CO	-	-	-	-	-	-	-	-	2	3	-	2	-	2	-

PH22203	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the concepts of light, electron transport properties and the essential

	principles of semiconductors	
	• To become proficient in magnetic properties of materials and the functioning of optical devices	
	• To know the basics of quantum structures and Single electron transistor	
	• To induce the students to design new devices that serve humanity by applying the knowledge gained during the course	

UNIT I	PHOTONICS	6
Interference – Air wedge – LASER – population inversion - Einstein coefficient's –NdYAG Laser - CO_2 laser – semiconductor laser – Optical fibre – Total internal reflection – propagation of light – Numerical Aperture and Acceptance angle – Fiber optic communication system – Endoscopy.		

UNIT II	ELECTRICAL PROPERTIES OF MATERIALS	6
Classical free electron theory - Expression for electrical conductivity and Thermal conductivity, Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Band theory of solids - Electron effective mass – concept of hole.		

UNIT III	SEMICONDUCTING MATERIALS	6
Semiconductors –direct and indirect band gap semiconductors – Intrinsic semiconductors Carrier concentration, band gap in intrinsic semiconductors – extrinsic semiconductors - N-type & P-type semiconductors – Variation of carrier concentration and Fermi level with temperature - Hall effect - measurement of Hall coefficient – applications		

UNIT IV	MAGNETIC PROPERTIES OF MATERIALS	6
Magnetic dipole moment – atomic magnetic moment, permeability, susceptibility- Magnetic material classification: diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism – Domain Theory- B-H curve – Hard and soft magnetic materials – Magnetic storage devices: Magnetic hard disc with GMR sensor		

UNIT V	OPTOELECTRONIC AND NANODEVICES	6
Carrier generation and recombination processes - Photo diode – solar cell - Organic LED – Optical data storage - Quantum confinement – Quantum structures - single electron phenomena and single electron transistor - Quantum dot laser		

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Relate the concepts of light, electron transport properties of conductors and basic principles of semiconductors.
CO2:	Define the magnetic properties of materials and the principles of optoelectronic and nano devices.
CO3:	Illustrate laser and fiber optics, classical and quantum concepts of conducting materials, physics of semiconducting materials.

CO4:	Summarize the functioning of various magnetic, optoelectronic and nano devices.
CO5:	Demonstrate the concepts of optics, fibre optics, moduli of elasticity and thermal energy, behavior of conductors, semiconductors and functioning of magnetic, optical and nano devices in various engineering applications.

TEXT BOOKS:

1.	Gaur, R.K & Gupta.S.L, Engineering Physics, Dhanpat Rai Publishers, 2016.
2.	Kasap,S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2017.

REFERENCES:

1.	Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012.
2.	Kittel, C. Introduction to Solid State Physics. Wiley, 2017.
3.	Garcia, N. & Damask, A. Physics for Computer Science Students, Springer-Verlag, 2012.
4.	Hanson, G.W. ―Fundamentals of Nanoelectronics, Pearson Education, 2009.
5.	Rogers, B., Adams, J. & Pennathur, S. Nanotechnology: Understanding Small Systems, CRC Press, 2014.

LIST OF EXPERIMENTS

1.	Uniform bending – Determination of Young's modulus
2.	Air-wedge – Thickness of thin wire
3.	Spectrometer – Grating
4.	LASER – Wavelength and particle size determination
5.	Optical fibre – Acceptance angle and Numerical aperture
6.	Band gap determination
	TOTAL: 30 PERIODS
	TOTAL (T+P) = 60 PERIODS

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	3	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	2	1
CO5	3	3	-	-	-	-	-	-	-	2	-	1	-	3	2
CO	2	1	-	-	-	-	-	-	-	2	-	1	-	2	1

CH22201	ENVIRONMENT AND SUSTAINABILITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the concept of ecosystem and biodiversity
- To conversant with various types of pollution and its effects
- To obtain knowledge on natural resources and its exploitation
- To understand the social issues related to environment and methods to protect
- To gain knowledge on sustainability and environment

UNIT I	ECOSYSTEM AND BIODIVERSITY	6

Environment – Ecosytem – Structure and function of an ecosystem – Energy flow in an ecosystem – Food chain and food web –.Biodiversity – Types – Values, threats and conservation of biodiversity – Endangered and endemic species – Hot spot of biodiversity – Biodiversity at state level, national level and global level.

UNIT II	NATURAL RESOURCES	6

Introduction – Forest resources – Uses and Overexploitation - Deforestation – causes and consequences – Water resources – effect of over utilisation of water – Food resources – Impacts of modern agriculture (pesticides, fertilizers, water logging, salinity) – Sustainable Energy resources – Wind, Solar, hydroelectric power, geothermal – Land resources – Desertification, soil erosion – Role of an individual in the conservation of natural resources.
Case study – Deforestation, water conflicts, fertilizer and pesticide problem.

UNIT III	ENVIRONMENTAL POLLUTION AND MANAGEMENT	7

Definition, causes, effects and control measures of air pollution, water pollution, noise pollution, thermal pollution and marine pollution – Waste water treatment - Waste management – solid waste, bio waste, e-waste - Disaster management – Flood, cyclone, earthquake

UNIT IV	SOCIAL ISSUES AND HUMAN HEALTH	6

Population explosion and its effects on environment — variation of population among nations - Environmental issues and Human health – Food adulteration – Risk of food adulteration – Detection and prevention of food adulteration - COVID-19 – Human rights – Value education

UNIT V	SUSTAINABLE DEVELOPMENT AND ENVIRONMENT	5

Sustainable development – needs and challenges — Goals – Aspects of sustainable development – Assessment of sustainability - Environmental ethics – Green chemistry – Eco mark, Eco products – EIA – Regional and local environmental issues and possible solutions - Role of engineering in environment and human health

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall the basic concepts of environment and sustainable development.
CO2:	Summarize the types of pollution, various natural resources and food adulterants.
CO3:	Explain the methods for waste management and detection of adulterants.

CO4:	Apply the gained knowledge to overcome various issues related to health and environment.
CO5:	Identify suitable methods for local environmental issues and sustainability.

TEXT BOOKS:

1.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, New Delhi, 2017.
2.	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2015.

REFERENCES:

1.	Erach Bharucha, "Text book of Environmental studies" Universities Press (I) PVT LTD, Hyderabad, 2015.
2.	Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2015.
3.	Tyler Miller G and Scott E. Spoolman,"Environmental Science", Cengage Learning India PVT LTD, 2014.
4.	Ruth F. Weiner and Robin A. Matthews. Butterworth, "Environmental Engineering", Heineman Publications, 4th Edition.
5.	Dash M.C, "Concepts of Environmental Management for Sustainable Development", Wiley Publications, 2019.

EXPERIMENTS

1.	Determination of DO content of waste water sample (Winkler's method).
2.	Determination of chloride content of water sample by Argentometric method
3.	Estimation of copper content in water by Iodometry.
4.	Determination of Ca / Mg in waste water sample
5.	Detection of adulterant in ghee/edible oil/coconut oil.
6.	Detection of adulterant in sugar/honey/chilli powder.
	TOTAL:30 PERIODS
	TOTAL (T+P) = 60 PERIODS

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO2	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO3	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO4	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-
CO5	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-

CO	3	-	-	-	-	-	3	-	1	1	-	1	-	2	-

AD22202	DATA STRUCTURES AND ALGORITHMS USING C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To develop applications in C.
- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To get familiarized to sorting and searching algorithms.

LIST OF EXPERIMENTS

1. C programming using statements, expressions, decision making and iterative statements.
2. C programming using Functions and Arrays.
3. C programs using Pointers and Structures.
4. Array implementation of List ADT.
5. Array implementation of Stack and Queue ADTs.
6. Linked list implementation of List, Stack and Queue ADTs.
7. Applications of List, Stack and Queue ADTs.
8. Binary Trees and operations of Binary Trees.
9. Binary Search Trees.
10. Searching techniques.
11. Sorting algorithms: Insertion Sort, Quick Sort, Merge Sort.
12. Hashing – any two collision techniques.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Develop Sorting and searching algorithms for a given application.
CO2:	Apply functions to implement linear and non-linear data structure operations.
CO3:	Identify linear / non-linear data structure operations for a givenproblem.
CO4:	Apply appropriate hash functions that result in a collision free scenario for data storage and Retrieval.
CO5:	Choose different constructs of C and develop applications.

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-

ES22203	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in commonhousehold wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & MECHANICAL)		
PART I	CIVIL ENGINEERING PRACTICES	15
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 inhousehold appliances.	

WOOD WORK:	❖ Sawing, ❖ Planning and ❖ Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.	
PART II	**MECHANICAL ENGINEERING PRACTICES**	**15**
WELDING WORK:	❖ Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. ❖ Practicing gas welding.	
BASIC MACHINING WORK:	❖ Perform turning operation in the given work piece. ❖ Perform drilling operation in the given work piece. ❖ Performing tapping operation in the given work piece.	
ASSEMBLY WORK	❖ Assembling a centrifugal pump. ❖ Assembling a household mixer.	
SHEET METAL WORK:	❖ Making of a square tray	
GROUP – B (ELECTRICAL AND ELECTRONICS)		
PART-I	**ELECTRICAL ENGINEERING PRACTICES**	**15**
	❖ One lamp controlled by one switch. ❖ Series and parallel wiring. ❖ Staircase wiring. ❖ Fluorescent Lamp wiring. ❖ Residential wiring. ❖ Iron Box wiring and assembly.	
PART-II	**ELECTRONIC ENGINEERING PRACTICES**	**15**
	❖ Introduction to electronic components and equipment's ❖ Calculation of resistance using colour coding ❖ Verify the logic gates AND, OR, EX-OR and NOT. ❖ Measurement of AC signal parameters using CRO ❖ Soldering simple electronic circuits on a small PCB and checking continuity.	
		TOTAL: 60 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Prepare various pipe and furniture fittings used in common household.
CO2:	Perform the given metal joining and metal removal operation in the given work piece as per the dimensions.

CO3:	Apply the fundamental concepts involved in Electrical Engineering
CO4:	Explain the basic electrical wiring procedures.
CO5:	Assemble basic electronic components.

Course outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
CO2	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
CO3	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
CO4	2	-	-	-	-	-	-	-	3	1	-	1	-	1	-
CO5	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
CO	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-

SEMESTER III

MA22302	**DISCRETE MATHEMATICS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVES:

- To introduce Propositional Logic and their rules for validity of statements.
- To introduce Predicates Calculus for validating arguments and programs.
- To give the counting principles for solving combinatorial problems.
- To introduce abstract notion of Algebraic structures for studying coding theory and its related areas.
- To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems.

UNIT I	**PROPOSITIONAL CALCULUS**	12

Propositions and notations- Propositional logic – Propositions and truth tables – Propositional equivalences – Conditional propositions – Converse, Contrapositive and Inverse-Tautologies and Contradictions –Normal Forms - Theory of Inference for the statement calculus (Validity using Truth Tables).

UNIT II	**PREDICATE CALCULUS**	12

Predicates –Statement function - Variables and Quantifiers – Nested quantifiers – Predicate formulae –Valid formulas and equivalences –Theory of Inference for the Predicate Calculus - Introduction to proofs – Proof methods and strategy.

| UNIT III | COMBINATORICS | 12 |

Mathematical induction – The pigeonhole principle - Permutations and Combinations – Recurrence relations – Solving linear recurrence relations - Inclusion and exclusion principle (without proof) and its applications.

| UNIT IV | ALGEBRAIC STRUCTURES | 12 |

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Cosets – Lagrange's theorem – Definition: Rings and Fields – Problems on integer modulo n.

| UNIT V | LATTICES AND BOOLEAN ALGEBRA | 12 |

Relations - Equivalence Relation and Partition - Partial order Relations – Partially Ordered Sets – Representation for Partially Ordered Sets - Hasse diagram - Lattices as Partially Ordered Sets (Definition and Examples)– Boolean algebra (Definition and Examples).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Construct truth tables and their values for validity of statements.
CO2:	Apply the rules for validating arguments and programs.
CO3:	Establish the counting principles and recurrence relations.
CO4:	Apply the concepts and properties of groups and rings in the area of coding theory.
CO5:	Develop the significance of relations and Boolean algebra.

TEXT BOOKS:

| 1. | Kenneth H.Rosen, "Discrete Mathematics and its Applications", Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011. |
| 2. | Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. |

REFERENCES:

1.	David Makinson, "Sets, Logics and Maths for Computing", Springer Indian Reprint, 2011.
2.	Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
3.	Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Third Edition, 2010.
4.	Sengadir.T. "Discrete Mathematics and Combinatorics", Pearson Education, New Delhi, 2009.
5.	Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications, 2006.

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3

CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3

AD22301	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
- To illustrate brute force and divide and conquer design techniques.
- To explain dynamic programming and greedy techniques for solving various problems.
- To apply iterative improvement technique to solve optimization problems.
- To examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types –Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework - Asymptotic Notations and their properties – Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS – applications.

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	10

Brute Force: –String Matching - Exhaustive Search: - Traveling Salesman Problem – Divide and Conquer Methodology: Multiplication of Large Integers - Closest-Pair Problems. Decrease and Conquer: Topological Sorting – Transform and Conquer: Heap Sort.

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9

Dynamic programming: – Warshall's and Floyd's algorithms – Multi stage graph – Knapsack Problem and Memory functions. Greedy Technique: – Dijkstra's algorithm - Kruskal's algorithm - Huffman Trees and codes.

UNIT IV	ITERATIVE IMPROVEMENT	8

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V	LIMITATIONS OF ALGORITHM POWER	9

Lower - Bound Arguments - P, NP, NP- Complete and NP Hard Problems. Backtracking: – N Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound: – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Traveling Salesman Problem.

		TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1	Implementation of String Matching using Brute Force approach.
2	Implementation of Multiplication of Large Integers using Divide and Conquer approach.
3	Implementation of Topological Sorting using Decrease and Conquer technique.
4	Implementation of Heap Sort using Transform and Conquer technique.
5	Implementation of Warshall's and Floyd 's algorithms Dynamic programming method.
6	Implementation of Dijkstra's algorithm using Greedy Technique.

7	Implementation of N-Queen problem using Backtracking method.
8	Implementation of Traveling Salesman Problem using Branch and Bound method.

TOTAL: 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Compare the efficiency of recursive and non-recursive algorithms mathematically
CO2:	Compare the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques
CO3:	Illustrate the problems using dynamic programming and greedy algorithmic techniques.
CO4:	Solve the problems using iterative improvement techniques for optimization.
CO5:	Solve the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

TEXT BOOKS:

1.	Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2.	Sandeep Sen and Amit Kumar, "Design and Analysis of Algorithms: A Contemporary Perspective", IIT Delhi, 2018.

REFERENCES:

1.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
2.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
3.	S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
4.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
5.	O'Reilly, "Design and Analysis of Algorithms", Pearson India, 2007, ISBN: 9788177585957.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2
3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22302	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To introduce database development life cycle and conceptual modeling
- To learn SQL for data definition, manipulation and querying a database
- To learn relational database design using conceptual mapping and normalization.
- To learn transaction concepts and serializability of schedules
- To learn data model and querying in object-relational and No-SQL databases

UNIT I	CONCEPTUAL DATA MODELING	8

Data Models- Three Schema Architecture and Data Dependence - Database environment – Database system development lifecycle – Entity-Relationship model – Enhanced-ER model – UML class diagrams

UNIT II	RELATIONAL MODEL AND SQL	10

Relational model concepts - Integrity constraints - SQL Data manipulation – SQL Data definition – Views - SQL programming

UNIT III	RELATIONAL DATABASE DESIGN AND NORMALIZATION	10

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (Up to BCNF).

UNIT IV	TRANSACTION MANAGEMENT	8

Transaction concepts – Properties – Schedules – Serializability – Concurrency Control – Two-phaselocking techniques.

UNIT V	OBJECT RELATIONAL AND NO-SQL DATABASES	9

Mapping EER to ODB schema – UDTs - Object identifier – Reference types – Row types — Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Create a database table, add constraints (primary key, unique, check, not null), insert rows, update and delete rows using SQL DDL and DML commands.
2.	Create a set of tables, add foreign key constraints and incorporate referential integrity.
3.	Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4.	Query the database tables and explore sub queries and simple join operations.
5.	Write user defined functions and stored procedures in SQL.
6.	Create document, column and graph-based data using NOSQL database tools.
7.	Database design using EER-to-ODB mapping / UML class diagrams.
8.	Querying the Object-relational database using Object Query language.
9.	Case Study using any of the real-life database applications - Inventory Management for a

	E-Mart Grocery Shop	
		TOTAL: 30 PERIODS
		TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the database development life cycle and apply conceptual modeling.
CO2:	Apply SQL queries to create, manipulate and query the database.
CO3:	Apply the conceptual-to-relational mapping and normalization to design relational database.
CO4:	Explain the transaction processing and concurrency control concepts.
CO5:	Apply No SQL development tools on different types of No-SQL databases.

TEXT BOOKS:

1	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson, 2017.
2	Thomas M. Connolly, Carolyn E. Begg, "Database Systems – A Practical Approach to Design, Implementation and Management", Sixth Edition, Global Edition, Pearson Education, 2015.

REFERENCES:

1.	Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "Database Modeling and Design - Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2.	Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation,and Management, Ninth Edition, Cengage learning, 2012.
3.	Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
4.	Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems: The Complete Book", 2nd edition, Pearson.
5.	Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	3	3	-	-	-	-	3	1	2	1	2	3	3
2	2	3	1	3	1	-	-	-	1	2	2	1	3	3	3
3	2	2	2	1	1	-	-	-	2	3	1	2	1	1	2
4	2	2	3	1	-	-	-	-	1	2	1	2	2	2	2
5	3	1	3	2	1	-	-	-	1	3	1	1	2	1	1
AVG	2	2	2	2	1	-	-	-	2	2	1	1	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22303	WEB TECHNOLOGY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand about client-server communication and to be familiar with HTML5.
- To design interactive web pages and to use Cascading Style Sheets
- To define web page validation using Java Script objects and use different event handling mechanisms.
- To do modern interactive web applications using JSP and XML.
- To learn the basics of AJAX and web services.

UNIT I	WEB SITE BASICS AND HTML	9

Web Essentials: The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message- Markup Languages: XHTML. An Introduction to HTML -Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT II	CSS AND CLIENT-SIDE SCRIPTING	9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML-CSS3.0. Client-Side Programming: The JavaScript Language- Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements- Operators-Literals-Functions-Objects-Arrays.

UNIT III	SERVER-SIDE SCRIPTING	9

Introduction to the Document Object Model DOM - The Document Tree-DOM Event Handling-Server-Side Programming: Java Servlets- Architecture - Overview-Servlet-Generating Dynamic Content-Sessions-Cookies - Data Storage Servlets and Concurrency- Databases and Java Servlets.

UNIT IV	JSP AND XML	9

JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files- Databases and JSP. XML-Documents and Vocabularies-Versions and Declaration-Namespaces-Event-oriented Parsing: SAX-Transforming XML Documents-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT V	AJAX AND WEB SERVICES	9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services-SOAP Related Technologies

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Create a web page with the following using HTML.
	• To embed an image map in a web page.
	• To fix the hot spots.
	• Show all the related information when the hot spots are clicked

2.	Create a web page with all types of Cascading style sheets.
3.	Create Client-Side Scripts for Validating Web Form Controls using DHTML.
4.	Installation of Apache Tomcat web server.
5.	Write programs in Java using Servlets: • To invoke servlets from HTML forms. Session Tracking.
6.	Write programs in Java to create three-tier applications using JSP and Databases • For conducting on-line examination. • For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7.	Programs using XML.
8.	Programs using DOM and SAX parsers.
9.	Programs using AJAX.

	TOTAL: 30 PERIODS
	TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Build simple web pages using markup languages like HTML and XHTML.
CO2:	Construct dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3:	Develop server-side web pages that have to process request from client side web pages
CO4:	Develop XML and web pages using JSP.
CO5:	Outline web services and how these web services interact.

TEXT BOOKS:

1.	Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2.	Steven Holzner , "The Complete Reference PHP", Tata McGraw-Hill, 2021.

REFERENCES:

1.	Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition,Pearson Education, 2007.
2.	Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3.	Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
4.	Bates, "Developing Web Applications", Wiley, 2006.
5.	Uttam K Roy, Web Technologies, Oxford University Press, 2021.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	2	3	2	-	-	2	2	2	3	3	2	1
2	3	3	3	3	3	2	-	-	2	-	2	3	3	2	1

3	3	3	3	2	3	2	-	-	2	2	2	3	3	2	1
4	3	3	3	3	3	1	-	-	1	1	2	3	3	2	1
5	3	3	3	3	3	1	-	-	-	-	2	3	3	2	1
Avg.	3	3	3	3	3	2	-	-	2	1	2	3	3	2	1

1 - low, 2 - medium, 3 - high, '-'no correlation

AD22304	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To outline an overview of exploratory data analysis.
- To implement visual aids for exploratory data.
- To perform data transformation techniques for data exploration and analysis.
- To apply data sets for data exploration and analysis.
- To use data exploration and visualization techniques for time series data.

UNIT I	EXPLORATORY DATA ANALYSIS	9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Numpy-Pandas-SciPy- Matplotlib.

UNIT II	VISUAL AIDS FOR EDA	9

Technical Requirements- Line chart- Bar Charts- Scatter plot- Pie chart- Table Chart- Polar chart- Data transformation techniques- Data cleaning- loading the CSV file- Converting Nan values- Applying descriptive Statistics- Data refactoring- Dropping columns- Data Analysis- Number of e mails- time of day- Average emails per day and hour- Most frequently used words.

UNIT III	DATA TRANSFORMATION TECHNICAL REQUIREMENTS	9

Merging database style data frames- Concatenating along with an axis- using df. merge with an inner join- pd. merge- merging an index- reshaping and pivoting-Transformation techniques- performing data deduplication- replacing values- Handling missing data- Discretization and binning- outlier detection- permutation and random sampling.

UNIT IV	GROUPING DATSETS	9

Groupby mechanics- selecting a subset column- Max and min, Mean- Data Aggregation- Groupwise operations-Renaming groups aggregation columns Pivot tables and cross tabulations.

UNIT V	TIME SERIES ANALYSIS	9

Fundamentals of TSA – Univariate time series- Characteristics of time series data – TSA with open Power System Data- Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

	PRACTICAL EXERCISES:
1	Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2	Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a Pandas data frame, visualize them and get differentinsights from the data.
3	Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
4	Explore various variable and row filters in R for cleaning data. Apply various plot features in Ron sample data sets and visualize.
5	Perform Time Series Analysis and apply the various visualization techniques.
6	Perform Data Analysis and representation on a Map using various Map data sets with MouseRollover effect, user interaction, etc.
7	Build cartographic visualization for multiple datasets involving various countries of the world;states and districts in India etc.
8	Perform EDA on Wine Quality Data Set.
9	Use a case study on a data set and apply the various EDA and visualization techniques andpresent an analysis report.
	TOTAL: 30 PERIODS
	TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Outline the fundamentals of exploratory data analysis.
CO2:	Show visual aids for data exploration and analysis.
CO3:	Develop transformation techniques for data visualization.
CO4:	Apply grouping datasets in data exploration and analysis.
CO5:	Make use of Data exploration and visualization techniques for time series data.

TEXT BOOKS:

1.	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2.	Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016.
3.	Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.

REFERENCES:

1.	Eric Pimpler, "Data Visualization and Exploration with R", GeoSpatial Training service, 2017.
2.	Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3.	Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.
4.	Tamara Munzner, "Visualization Analysis and Design", Bookshop, Amazon, Jan 23, 2023.
5.	Randy Krum, Effective Communication with Data Visualization and Design,

Bookshop, Amazon, Jan 23, 2023.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	3	-	-	-	-	2	3	3	3	2	2	2
2	2	2	2	1	1	-	-	-	3	2	3	1	3	1	3
3	2	1	2	1	1	-	-	-	3	2	1	2	2	2	1
4	2	2	2	1	-	-	-	-	1	2	1	3	1	3	2
5	3	1	1	2	1	-	-	-	3	2	1	2	2	2	3
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

SD22301	CODING SKILLS AND SOFT SKILLS – PHASE I	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To make the students to solve basic programming logics.
- To help the students develop logics using decision control statements.
- To make them develop logics using looping statements and arrays.
- To train the students for effective communication and identify the common errors in formal writings
- To guide and motivate the students for setting their goals with positive thinking

UNIT I	FUNDAMENTALS IN PROGRAMMING	8

Output of Programs: I/O Functions, Data types, Constants, Operators – Mathematical Problems – Debugging – Puzzles - Company Specific Programming Examples.

UNIT II	DECISION CONTROL STATEMENTS	8

Logic Building Using Conditional Control Statements – Output of Programs – Mathematical Problems - Puzzles – Company Specific Programming Examples

UNIT III	LOOPING STATEMENTS AND ARRAYS	14

Logic Building Using Looping Statements – Number Programs – Programs on Patterns – Array Programs – Programs on Sorting and Searching - Matrix Programs – Puzzles - Output of Programs - Company Specific Programming Examples

UNIT IV	COMMUNICATION IN GENERAL	15

Introduction to communication-Types of communication - Effective Communication-Barriers to communication. **Language Study:** Vocabulary-Formation of sentences-Sentence and sentence structures-Common errors - Writing paragraphs & essays. **Professional writing**: Job application & Resume writing

UNIT V	PERSONALITY DEVELOPMENT	15

Study of personality & ways to improve. **Soft Skills**: Self-evaluation / self-awareness - Goal setting and positive thinking - Self-esteem and confidence - Public speaking – Extempore - Body language and Observation skills

TOTAL: 45 PERIODS

Suggestive Assessment Methods:

1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.

2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.

3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.

4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20.

5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40.

6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.

7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Solve problems on basic I/O constructs.
CO2:	Develop problem solving skills using decision control statements.
CO3:	Develop logics using looping statements and arrays
CO4:	Avoid / fix the common errors they commit in academic and professional writings and prepare standard resumes and update the same for future career
CO5:	Recognize the value of self-evaluation and grow with self confidence

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.

REFERENCES:

1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", First Edition, Pearson Education, 2013.
2.	Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
3.	E Balagurusamy, "Programming in ANSI C", Eighth edition, Mc GrawHill Publications, 2019.
4.	S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills" VK

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO2	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO3	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	1	1
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	1	1
CO	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2

HS22301	VALUE EDUCATION – I	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:
- To give the students a deeper understanding about the purpose of life.
- To animate the students to have a noble vision and a right value system for their life.
- To help the students to set short term and long-term goals in their life.

UNIT I	MY LIFE AND MY PLACE IN THE UNIVERSE	4

Value of my life – My Uniqueness, strengths and weakness – My self-esteem and confidence – My identity in the universe.

UNIT II	MY LIFE AND THE OTHER	4

Realizing the need to relate with other persons and nature – My refined manners and conduct in relationships – Basic communication and relationship skills – Mature relationship attitudes.

UNIT III	MY LIFE IS MY RESPONSIBILITY	3

Personal autonomy – developing a value system and moral reasoning skills – setting goals for life.

UNIT IV	UNDERSTANDING MY EDUCATION AND DEVELOPING MATURITY	4

Importance of my Engineering education – Managing emotions - personal problem-solving skills.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the importance of value-based living.
CO2:	Set realistic goals and start working towards them.
CO3:	Apply the interpersonal skills in their personal and professional life.

5.	Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

CO4:	Emerge as responsible citizens with a clear conviction to be a role model in the society.
REFERENCES:	
1.	David Brooks. The Social Animal: The Hidden Sources of Love, Character, and Achievement. Random House, 2011.
2.	Mani Jacob. Resource Book for Value Education. Institute of Value Education, 2002.
3.	Eddie de Jong. Goal Setting for Success. CreateSpace Independent Publishing, 2014.
4.	Dr.Abdul kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013.

Course outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO2	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO3	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO4	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO5	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-

AC22301	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I	INTRODUCTION	6

History of Making of the Indian Constitution - Drafting Committee - Philosophy of the Indian Constitution - Preamble - Salient Features.

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	6

Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Fundamental Duties.

UNIT III	ORGANISATIONS OF GOVERNANCE	7

Parliament - Composition - Qualifications and Disqualifications - Powers and Functions - Executive President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges - Qualifications, Powers and Functions.

UNIT IV	EMERGENCY PROVISIONS	4

Emergency Provisions - National Emergency, President Rule, Financial Emergency.

UNIT V	LOCAL ADMINISTRATION	7

District's Administration head - Role and Importance -Municipalities - Introduction- Mayor and role of Elected Representative - CEO of Municipal Corporation -Pachayati raj - Introduction - PRI-Zila Pachayat-Elected officials and their roles.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Understand history and philosophy of Indian Constitution.
CO2:	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3:	Understand powers and functions of Indian government.
CO4:	Understand emergency rule.
CO5:	Understand structure and functions of local administration.

TEXT BOOKS:

1.	Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2.	Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.

REFERENCES:

1.	Jain M P, Indian Constitution Law, 7th Edn, Lexis Nexis, 2014.
2.	The Constitution of India (Bare Act), Government Publication, 1950.
3.	M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication, 2005.
4.	Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19th Edition, Prentice-Hall EEE, 2008.
5.	Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007.

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	-	-	1	1	-	1	-	-	-	1	-	1	-
CO2	-	1	1	-	-	1	-	1	-	1	-	-	-	2	-
CO3	-	1	1	-	-	1	-	1	-	1	-	-	-	2	-
CO4	-	-	-	1	-	-	1	-	1	1	1	1	-	1	-
CO5	-	-	1	-	-	-	1	-	-	1	-	1	-	3	-
CO	-	1	1	1	1	1	1	1	1	1	1	1	-	2	-

MA22401	PROBABILITY AND STATISTICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- 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 and correlation.
- To acquaint the knowledge of non-parametric tests which plays an important role in   real life problems.
- To introduce the concept of control charts for statistical quality control.

UNIT I	PROBABILITY AND RANDOM VARIABLES	12

Probability - Axioms of probability – Discrete random variable– Probability mass function– Continuous random variable – Probability density function – Probability distribution – Cumulative distribution function – Mean, Variance- Special distributions: Binomial and Poisson distributions (Derivations not included).

UNIT II	NORMAL DISTRIBUTION AND COVARIANCE	12

Normal distribution: Definition and problems, Central limit theorem (excluding proof) - Two-dimensional discrete distribution – Joint probability mass function - Discrete marginal distribution – Discrete   conditional distribution - Covariance.

UNIT III	CORRELATION, REGRESSION AND ESTIMATION THEORY	12

Correlation (discrete case) – Karl Pearson's coefficient of correlation and Spearman's rank correlation – Linear regression - Regression coefficients – Definitions: Unbiased estimators, Efficiency, Consistency, Sufficiency - Curve fitting by the method of least squares (linear and quadratic forms).

UNIT IV	NON- PARAMETRIC TESTS	12

Introduction - Rank sum tests: Mann – Whitney U test- Wilcoxon two sample test - Kruskal - Wallis H test - Tests based on Runs: One sample run test - Test of randomness - The Kolmogorov -Smirnov test for goodness of fit

UNIT V	STATISTICAL QUALITY CONTROL	12

The Control Chart – Nature of the Control limits - Control charts for variables or measurements - $\bar{X}$ and R charts for variables – Control charts for attributes - The p -chart for Fraction Defective – Control Charts for Number of Defectives - (c and np charts) – Tolerance limits

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply probability and discrete distributions in engineering field.
CO2:	Find the probability using central limit theorem, covariance for discrete random variable.
CO3:	Compute correlation, regression and fitting of curve for discrete data.

CO4:	Apply non-parametric tests in real life problems.
CO5:	Apply control charts in data analysis.

TEXT BOOKS:

1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2.	Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.

REFERENCES:

1.	John E. Freund, "Mathematical Statistics", Prentice Hall, 8th Edition, 2013.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 9th Edition, 2017.
3.	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
2	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
3	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
4	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
5	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-
AVG	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22401	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand Processes and Threads.
- To analyze Scheduling algorithms and process synchronization.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.

UNIT I	INTRODUCTION	9

Operating Systems- Computer System organization; Computer System Architecture- Computer System Structure- Operating Systems operations- Process management- Memory Management- Storage Management- Protection and Security- Computing Environments- Open Source Operating Systems.

UNIT II	OPERATING SYSTEM STRUCTURES	9

Operating System Services- User and Operating System Interface- System Calls- Types of System Calls- System Programs- Operating System Design and Implementation- Operating System Structure- Debugging- OS Generation- System Boot.

UNIT III	PROCESS MANAGEMENT	9

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling algorithms (Thread scheduling, Multiple Processor Scheduling, Real time CPU Scheduling): Process Synchronization - The critical-section problem - Deadlock – System Model- Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT IV	MEMORY MANAGEMENT	9

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

UNIT V	STORAGE MANAGEMENT	9

Disk Structure - Disk Scheduling and Management - File concept - Access methods - Directory Structure - File Sharing; File System Implementation - File System Structure - Directory implementation - Allocation Methods.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Process Management using System Calls: Fork, Exec, Getpid, Exit, Wait, Close.
2.	Illustrate the inter process communication strategy.
3.	Implement mutual exclusion by Semaphores.
4.	Write a C program to avoid Deadlock using Banker's Algorithm.
5.	Write a C program to Implement Deadlock Detection Algorithm.
6.	Write C program to implement Threading.
7.	Implement the paging Technique using C program.
8.	Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit

9.	Write C programs to Implement the various File Organization Techniques.	
		TOTAL: 30 PERIODS
		TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the functionality of operating system
CO2:	Explain file system structure and booting concepts.
CO3:	Compare scheduling algorithms.
CO4:	Compare memory management schemes.
CO5:	Explain storage management and allocation methods.

TEXT BOOKS:

1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
2.	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.

REFERENCES:

1.	Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2.	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3.	Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
4.	Deitel, Deitel, and Choffnes, "Operating Systems", Amazon Web Services (AWS), 2003.
5.	Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts Essentials", Second Edition, John Wiley & Sons, Inc. ISBN 978-1-118-80492-6, 2023

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22402	**AI METHODOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
COURSE OBJECTIVES:					

	•	To learn the basic AI approaches.	
	•	To develop problem solving agents.	
	•	To perform logical and probabilistic reasoning.	

UNIT I	INTELLIGENT AGENTS	9
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents – search algorithms – uninformed search strategies- Depth first and Breath first- Measure of performance and analysis of uninformed search algorithms.

UNIT II	PROBLEM SOLVING	9
Informed Search Strategies - performance and analysis of Informed search algorithms-Local search and optimization problems – Problem solving agents – search in partially observable environments – online search agents and unknown environments.

UNIT III	GAME PLAYING AND CSP	9
Game theory – min-max algorithm – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNIT IV	LOGICAL REASONING	9
Knowledge-based agents – propositional logic – First-order logic – syntax and semantics – knowledge representation – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNIT V	PROBABILISTIC REASONING	9
Acting under uncertainty – Probabilistic reasoning – Bayesian Networks- Dempster – Shafer theory-Decision trees- Hidden Markov Model.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Implementation of Breadth First Search using Python.
2.	Implementation of Depth First Search using Python.
3.	Implementation of Water Jug Problem
4.	Implementation of Tower of Hanoi Problem.
5.	Implementation of Hill Climbing Algorithm.
6.	Implementation of Alpha-Beta pruning in Game Playing.
7.	Implementation of Forward Chaining.
8.	Implementation of Backward Chaining.
9.	Implementation of Bayesian networks.

TOTAL: 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain intelligent agent frameworks.
CO2:	Apply problem solving techniques.
CO3:	Apply game playing and CSP techniques.
CO4:	Build logical reasoning.
CO5:	Build probabilistic reasoning under uncertainty

TEXT BOOKS:

1.	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.

REFERENCES:

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

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22403	FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the various processes of data science.
- To apply descriptive data analytics.
- To describe the relationship between data and infer insights from it.
- To understand inferential data analytics.
- To apply hypothesis testing for making meaningful inferences.

UNIT I	INTRODUCTION TO DATA SCIENCE	8

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	DESCRIPTIVE ANALYTICS	10

Frequency distributions – outliers –interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores

UNIT III	DESCRIBING RELATIONSHIPS	9

Correlation –scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – standard error

of estimate – interpretation of r2 –multiple regression equations –regression towards the mean

UNIT IV	INFERENTIAL STATISTICS	8

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT V	PREDICTIVE ANALYTICS	10

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation.

	TOTAL: 45 PERIODS

PRACTICALS:

1.	Download, install and explore the features of NumPy, SciPy, Jupyter, Stats Models and Pandas packages.
2.	Working with NumPy arrays
3.	Working with Pandas data frames
4.	Working with basic plots using Matplotlib.
5.	Consider the diabetes data set from UCI and Pima Indians Diabetes data set for performing the Univariate analysis (Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis).
6.	Apply and explore various plotting functions on UCI data sets. a. Normal curves b. Density and contour plots c. Correlation and scatter plots d. Histograms e. Three-dimensional plotting
7.	Perform regression analysis using diabetes data set from UCI.
8.	Building and validating bivariate analysis: (Linear or logistic regression modeling)

	TOTAL: 30 PERIODS
	TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the data science process.
CO2:	Interpret the statistical inferences from data.
CO3:	Apply regression techniques to predict meaningful conclusions from data analysis.
CO4:	Apply and interpret statistical methods to make decisions based on data analysis.
CO5:	Apply suitable hypothesis and appropriate testing procedure for real time problems.

TEXT BOOKS:

1.	Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (First two chapters for Unit I).
2.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

	(Units II, III, IV & V)
REFERENCES:	
1.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
2.	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.
3.	Chirag Shah, "A Hands-on Introduction to Data Science", Cambridge University Press, 2020.
4.	Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", Apress, 2021.
5.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22404	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To define the fundamentals of computer system, execution of an instruction, memory system and IO communication.
- To demonstrate the basic organization of computer, different instruction formats and addressing modes.
- To apply simplification techniques to implement Boolean expression.
- To design synchronous sequential digital circuits and combinational circuits.

UNIT I	DIGITAL FUNDAMENTALS AND COMBINATIONAL LOGIC	9

Digital system – Logic Gates – Number Base Conventions - Karnaugh Map - Combinational Circuits - Analysis and Design Procedures – Binary Adder – Subtractor – Decoder – Encoder – Multiplexers.

UNIT II	SYNCHRONOUS SEQUENTIAL LOGIC	9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, State Reduction, state assignment, Registers and Counters (Theory based).

UNIT III	COMPUTER FUNDAMENTALS	9

Basic structure of computers – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes – Assembly Language - Encoding of Machine Instruction.

UNIT IV	PROCESSOR	9

Instruction Execution – Hardware components – Instruction Fetch and Execution Steps – Control Signals - Hardwired Control, Micro programmed Control – Pipelining

UNIT V	MEMORY AND I/O	9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Design and implementation of Logic gates.
2.	Design of Adder.
3.	Design of Subtractor
4.	Design of Multiplexer.
5.	Design of Encoder.
6.	Design of Decoder.
7.	Design and implementation of counter.
8.	Design and implementation of shift register.

TOTAL: 30 PERIODS

				TOTAL: 75 PERIODS

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

CO1:	Define the fundamentals of computer system and combinational circuits.
CO2:	Construct synchronous sequential digital circuits.
CO3:	Demonstrate the basic organization of computer, different instruction formats and addressing modes.
CO4:	Summarize hardware and pipeline processor.
CO5:	Explain the characteristics of various memory system and IO communication.

TEXT BOOKS:	
1.	M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013.
2.	Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

REFERENCES:	
1.	Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, Cengage Learning, 2013.
2.	John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3.	David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.
4.	William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
5.	Govindarajalu, ―Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt. Ltd, 2014.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	3	2	1	1	1	1	2	3	2	3	3
2	3	3	3	3	2	1	1	1	1	1	2	3	1	2	2
3	3	3	3	3	2	2	1	1	1	1	2	3	2	3	1
4	3	3	3	3	1	1	1	1	1	1	1	2	1	3	1
5	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1
AVG	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1

1 - low, 2 - medium, 3 - high, '- '- no correlation

SD22401	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE II	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To help students on developing modular applications using functions.
- To train them on building logics using strings and pointers.
- To make them develop applications using user defined data types.
- To train the students on speaking skills for group discussions
- To set them correctly on the track of presentation skills and management skills

UNIT I	FUNCTIONS	12

Logic Building Using Functions – Programs on Recursion – Puzzles - Output of Programs - Company Specific Programming Examples

UNIT II	STRINGS AND POINTERS	12

Logic Building Using Strings – Programs on Strings - Logic Building Using Pointers – Puzzles - Output of Programs - Company Specific Examples

UNIT III	USER DEFINED DATATYPES	6

Working with User Defined Datatypes – Puzzles - Output of Programs - Company Specific Examples

UNIT IV	COMMUNICATION SKILLS / LANGUAGE SKILLS	15

Receptive Skills and productive skills - Skills together - Integration of skills - Input and output **Receptive Skills**: Listening and Reading - Lead-in - Pre-existent knowledge - General understanding of the audio or the written text - Discussion in pairs or small groups – feedback - Text-related task in detail - Focus on aspects of language in the text. **Productive Skills**: Speaking and Writing - lead-in - engaging students with the topic - setting the task - role-play - Monitoring the task - Giving the feedback-positive- task-related follow up - repetition / re-setting of task. **Activities:** Pronunciation: syllable, stress, intonation - Writing memos, e-mails and formal letters - Oral presentations / seminars - Written and Oral Descriptions Group discussions

UNIT V	SOFT SKILLS: SEARCH AND FIND FOR CAREER DEVELOPMENTS	15

Self-motivation: Interpersonal relationship - Attitudes and interpersonal integrity – Time management – prioritizing - Leadership quality – **In the team:** Team building and Team work - Memory technique **Problem solving**: – emotional intelligence – positive attitude towards life – taking up initiatives – developing mind set –openness to feed back – adaptability – active listening – work ethics. **Presentation of skills**: creative thinking – critical thinking – logical thinking - decision making. **Management ability:** empathy – selflessness – humility – cultural respectfulness – versatility – generosity – trustworthiness – planning and executing – target achievement – listening to others' views – friendliness -   active participation – empowering healthy atmosphere – exchange of ideas – mediation – negotiation – qualities – updating the knowledge – pre-work for performance – respect for rules and regulations

TOTAL: 60 PERIODS

Suggestive Assessment Methods:
1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.
3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.
4) Model Exam for coding skills will be conducted for 100 marks which are then reduced to 20
5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40.
6) For assignments, students should attend all the practice tests conducted online on Hacker Rank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
7) The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Develop and implement modular applications using functions
CO2:	Develop logics using strings and pointers.
CO3:	Develop applications in C using user defined datatypes.
CO4:	Practice both receptive skills (listening and reading) and productive skills (writing and speaking) and speak English with standard pronunciation using correct stress and intonation.
CO5:	Practice team building and team work procedures and develop memory techniques and manage abilities like empathy, selflessness, cultural respectfulness and trustworthiness preparing themselves for target achievement.

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.

REFERENCES:

1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", First Edition, Pearson Education, 2013.
2.	Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
3.	E Balagurusamy, "Programming in ANSI C", Eighth edition, Mc GrawHill Publications, 2019.
4.	S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills" VK Publications', 2016
5.	Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

Course	**PO**	**PSO**

outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO2	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO3	3	2	2	-	1	1	1	-	-	-	1	2	2	2	2
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	1	1
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	1	1
CO	3	2	2	-	1	1	1	1	2	3	1	2	2	2	2

AC22401	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

- Explaining the fundamental concept and principles of industrial safety
- Applying the principles of maintenance engineering.
- Analyzing the wear and its reduction.
- Evaluating faults in various tools, equipment and machines.
- Applying periodic maintenance procedures in preventive maintenance.

UNIT I	INDUSTRIAL SAFETY	9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II	MAINTENANCE ENGINEERING	9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III	WEAR AND CORROSION AND THEIR PREVENTION	9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV	FAULT TRACING	9

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in

machine tools and their general causes.

UNIT V	PERIODIC AND PREVENTIVE MAINTENANCE	9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the fundamental concept and principles of industrial safety
CO2:	Apply the principles of maintenance engineering.
CO3:	Apply periodic maintenance procedures in preventive maintenance.
CO4:	Analyze the wear and its reduction.
CO5:	Evaluate faults in various tools, equipment and machines

TEXT BOOKS:

1.	L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.
2.	Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003.

REFERENCES:

1.	Edward Ghali, V. S. Sastri, M. Elboujdaini, Corrosion Prevention and Protection: Practical Solutions, John Wiley & Sons, 2007.
2.	Garg, HP, Maintenance Engineering, S. Chand Publishing.
3.	J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.
4.	R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011.
5.	W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub., 2014

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
CO2	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
CO3	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
CO4	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
CO5	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-
CO	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-

SEMESTER V

AD22501	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified.

UNIT I	INTRODUCTION TO MACHINE LEARNING	8

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II	PROBLEM SOLVING	11

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

UNIT III	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9

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

UNIT IV	NEURAL NETWORKS	9

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

UNIT V	DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS	8

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basic concepts of machine learning.
CO2:	Compare machine learning models.

CO3:	Construct unsupervised learning algorithms.
CO4:	Construct supervised learning models.
CO5:	Explain the classification algorithms.

TEXT BOOKS:	
1.	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2.	Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES:	
1.	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2016.
2.	Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 2017.
3.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5.	Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

CO – PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO 2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO 3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO 4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO 5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22502	INTRODUCTION TO COMPUTER NETWORKS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand the concept of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

UNIT I	INTRODUCTION AND APPLICATION LAYER	10

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

UNIT II	TRANSPORT LAYER	9

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

UNIT III	NETWORK LAYER	7

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

UNIT IV	ROUTING	7

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

UNIT V	DATA LINK AND PHYSICAL LAYERS	12

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

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

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

COURSE OUTCOMES:

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

CO1:	Explain the basic layers and its functions in computer networks.
CO2:	Classify the basics of how data flows from one node to another.
CO3:	Analyze routing algorithms.
CO4:	Summarize protocols for various functions in the network.
CO5:	Analyze the working of various application layer protocols.

TEXT BOOKS:

1.	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Eighth Edition, Pearson Education, 2021.
2.	Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", Sixth Edition TMH, 2022.

REFERENCES:

1.	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2.	William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.
3.	Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice Hall, 2014.
4.	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill, 2012.
5.	Uday A. Bakshi, "Network Analysis ",Technical Publications, Edition 2021.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
CO	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22503	**MACHINE LEARNING LABORATORY**	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
- To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
- To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
- To build the graph-based learning models for standard data sets.
- To compare the performance of different ML algorithms and select the suitable one based on the application.

PRACTICAL EXERCISES:

1.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3.	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5.	Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
6.	Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
9.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

TOTAL: 60 PERIODS

List of Equipments: (30 Students per Batch)

The programs can be implemented in either Python or R.

COURSE OUTCOMES:

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

CO1:	Compare the performance of different ML algorithms based on the application.

CO2:	Develop supervised machine learning algorithms on standard datasets and evaluate the performance.
CO3:	Apply suitable algorithms for selecting the appropriate features for analysis.
CO4:	Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.
CO5:	Build the graph-based learning models for standard data sets.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO2	3	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO3	3	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	-	-
AVG	3	2	2	-	1	1	1	1	2	3	1	2	1	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22504	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To encourage the students to study advanced engineering developments.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

	TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Adapt to review, prepare and present technological developments
CO2:	Defend to face the placement interviews

SD22501	CODING SKILLS AND SOFT SKILLS TRAINING – PHASE III	L	T	P	C
		0	0	4	2

COURSEOBJECTIVES:

- To make the students develop logics using basic Programming Logics, Decisional Statements, Arrays and Strings.
- To help the students know how to use classes and objects.
- To enable the students to implement programs using OOPs Concepts.
- To train the students on interview skills with mock interviews and updated / enhanced resumes
- To prepare students for taking initiatives and decision making with critical thinking

UNIT I	BASIC PROGRAMMING CONSTRUCTS & SOFT SKILLS: TIME MANAGEMENT	12

Structured vs Object oriented programming language – Output of programs on basic I/O functions – Logic building using Decisional Statements – Programs on Patterns and Numbers - Debugging – Puzzles - Company specific programming examples.

Soft Skills: Time management: Prioritizing – Delegation - Decision-making - Goal setting – Multitasking - Problem solving - Strategic thinking - Scheduling – Planning - to-do lists and

checklists - Evaluating urgent tasks - Auditing and improving workflows - Filtering notifications - Setting thoughtful deadlines – Evaluating the work done schedules – Grouping similar tasks – Learn to say 'no'.

UNIT II	PROGRAMMING USING FUNCTIONS AND ARRAYS & SOFT SKILLS: STRESS MANAGEMENT AND EMOTIONAL QUOTIENT	12

Logic building using modular approach – Programming using Friend Function – Programs on Matrices and strings – Puzzles – Output of programs - Company specific programming examples. **Soft Skills: Stress management:** Using guided meditation - Maintain physical exercise and good nutrition - Manage social media time - Connect with others – read and relax. **Emotional Quotient**: Overcoming challenges – defusing conflict - Self-awareness - Self-regulation - Professional etiquette – Avoiding doubt – Introducing others – Courteousness – Non-interruption – Avoiding gossip.

UNIT III	IMPLEMENTING OOPS CONCEPTS & SOFT SKILLS: VALUES OF LIFE AND BEHAVIOURAL ATTITUDES	12

Discussion on basics of OOPs Concepts – Solving problems based on Data Members and Member Functions – Programs based on Construction and Destruction of Objects - Puzzles - Output of Programs – Understanding Access Specifiers – Company specific programming examples. **Soft Skills: Values of life**: Loyalty to others and responsibilities – Living with Spirituality – Maintaining humility – Possessing compassion – Proving being honest – developing kindness – Learning to have integrity – Embracing responsibility. **Behavioural attitudes:** Behaving with sportive attitude – Respecting the freedom of the others – Being bold – Enhancing fun and joy.

UNIT IV	LOGIC BUILDING USING INHERITANCE AND ABSTRACTION & SOFT SKILLS: EMPLOYERS EXPECTATIONS AND RESUME ENHANCEMENT	12

Understanding Super class and Derived Class – Logic building based on inheritance – Programming using Pure Virtual Function and Abstract Classes- The Final Keyword – Puzzles - Output of Programs – Company specific programming examples. **Soft Skills: Employers expectations:** Contributing to the team – Being with stability – Developing the ability to grow - Improving the productivity. **Resume enhancement:** Select the best template for your skills, experience, and goals Adding skills to be an expert - Robusting and compelling objective – Displaying online presence - Quantifying accomplishments various roles.

UNIT V	PROGRAMMING USING ENCAPSULATION AND POLYMORPHISM & SOFT SKILLS: INTERVIEW SKILLS	12

Understanding how Encapsulation works – Understanding the term Polymorphism – Programming using Function Overloading and Overriding – Puzzles – Output of programs – Company specific programming examples. **Soft Skills: Interview Skills**: Clarifying interview questions - Communicate nonverbally - Knowing the resume thoroughly - Leveraging knowledge of the company and interviewer - Mock interviews – Getting rehearsed before moving for interviews.

	TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS:
   1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.

2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20.
3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20.
4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20.
5) A test for Soft Skills will be conducted for 100 marks which will be then calculated to 40.
6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.

The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

At the end of the course, the students will be able to:	
CO1:	Develop programs using Functions, Strings and Arrays.
CO2:	Write programs using Classes and Objects.
CO3:	Develop applications using OOPs Concepts.
CO4:	Apply all the interview skills learned with updated resumes and language skills balancing technical skills and interpersonal skills
CO5:	Attend different job interviews with emotional balance and achieve the target with right planning and unique solutions

TEXT BOOKS:	
1.	Balagurusamy E, "Object Oriented Programing with C++", Tata McGraw Hill Education Pvt.Ltd, Eighth Edition, 2020.
2.	Anthony Williams, "C++ Concurrency in Action", Manning Publications, Second Edition 2019.

REFERENCES:	
1.	Bjarne Stroustrup, "A Tour of C++", Pearson Education, Second Edition, 2018.
2.	Scott Meyers, "Effective Modern C++", O'Reilly Publication, December 2014.
3.	Stanely Lippman, Josee Lajoie, Barbara Moo, "C++ Primer", Pearson Education, Fifth Edition, 2012.
4.	Bjarne Stroustrup, The C++ Programming Language, Pearson Education, Fourth Edition 2013.
5.	S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills", VK Publications, 2016.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

CO1	2	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO2	2	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO3	2	2	2	-	1	1	1	-	-	-	1	2	1	2	1
CO4	-	-	-	-	-	-	-	1	2	2	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	2	2	-	2	-	-	-
AVG	2	2	2	-	1	1	1	1	2	2	1	2	1	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AC22501	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		2	0	0	0

COURSEOBJECTIVES:

- Explaining the types, characteristics of entrepreneurship and its role in economic development.
- Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
- Selecting the appropriate form of business ownership in setting up an enterprise.
- Applying the fundamental concepts of finance and accounting to enterprise.
- Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I	ENTREPRENEURSHIP	6

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Entrepreneurial Competencies – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth.

UNIT II	BUSINESS PLAN	6

Sources of business ideas and tests of feasibility: Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation; Project Appraisal, preparation of project report.

UNIT III	SMALL SCALE INDUSTRIES	6

Legal formalities in setting up of SSIs, Business Laws, Governmental Setup in promoting small industries, Status of Small Scale Industrial Undertakings, Steps in starting a small industry, Ownership Structures.

UNIT IV	FINANCING AND ACCOUNTING	6

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management:

UNIT V	SUPPORT TO ENTREPRENEURS	6

Government Policy for Small Scale Enterprises – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry, Social Responsibility of Business.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the types, characteristics of entrepreneurship and its role in economic development.
CO2:	Apply the theories of achievement motivation and the principles of entrepreneurship development program.
CO3:	Select the appropriate form of business ownership in setting up an enterprise.
CO4:	Apply the fundamental concepts of finance and accounting to enterprise.
CO5:	Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

	TEXT BOOKS:
1.	S.S.Khanka, "Entrepreneurial Development", S.Chand & Co. Ltd. Ram Nagar NewDelhi, 2007.
2.	Kurahko & Hodgetts, "Entrepreneurship – Theory, process and practices", Thomson learning, Sixth edition, 2010.
	REFERENCES:
1.	Charantimath, P. M., "Entrepreneurship Development and Small Business Enterprises", Pearson, 2006.
2.	Hisrich R D and Peters M P, "Entrepreneurship", Fifth Edition, Tata McGraw-Hill, 2002.
3.	Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" Dream tech, Second Edition, 2006.
4.	Rabindra N. Kanungo, "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
5.	Singh, A. K., "Entrepreneurship Development and Management", University Science Press, 2009.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	-	-	1	-	1	2	1	2	-	1	-	-	-
CO2	-	-	1	-	1	1	1	2	2	2	-	1	-	2	-
CO3	-	-	1	-	-	2	1	1	1	1	-	1	-	2	-
CO4	1	-	1	-	-	2	1	-	1	1	1	-	-	-	-
CO5	-	1	-	1	-	1	1	-	1	1	-	1	-	2	-
AVG	1	1	1	1	1	2	1	2	1	1	1	1	-	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

HS22501	VALUE EDUCATION II	L	T	P	C
		1	0	0	0

COURSEOBJECTIVES:

- To impart knowledge on essential qualities to become a good leader
- To prepare them to have the ability to relate with others and contribute to industrial and human development
- To teach the significance of being responsible citizens of the society

UNIT I	UNDERSTANDING THE SOCIETY AND BECOMING A LEADER	3

Problems of our society and their causes – styles of leadership – qualities and skills of leadership.

UNIT II	PRACTICING LEADERSHIP FOR SOCIAL CHANGE	4

Possible areas of changes in the society with education – Utilizing Engineering education to create social changes – strategies and people movement for the change.

UNIT III	BALANCING PROFESSIONAL, PERSONAL, FAMILY FOR FULLNESS OF LIFE	4

Healthy adult as an individual and family – stages of life – strategies to balance life

UNIT IV	INNOVATIVE SOCIAL COMMITMENT, SPIRITUALITY AND SOCIAL NETWORKING	4

Social commitment as a healthy spirituality – systematic contribution to society and industry – Networking professionals for growth and change.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate the essential steps to become good leaders.
CO2:	Identify the various societal problems and also the solution.
CO3:	Realize their role and contribution to nation building.
CO4:	Apply the essential steps to become value-based professionals.

TEXT BOOKS:

1.	Warren G.Bennis. On Becoming a Leader. Basic Books, 2009.
2.	Suresh Agarwal. Social Problems in India. Rajat Publications, 2015.

REFERENCES:

1.	Biswaranjan Mohanty. Constitution, Government and Politics in India. New Century Publication, 2009.
2.	Myles Munroe. Releasing Your Potential. Destiny Image, 2007
3.	Kelsang Gyatso, How to Solve Our Human Problems: The Four Noble Truths, Tharpa Publications 2005.
4.	Ifeanyi Enoch Onuoha, Overcoming the challenges of life, Authorhouse, 2011.
5.	John c Maxwell, Five Levels of Leadership, the Proven Steps to Maximize Your Potential, Center Street, 2011.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	2	-	1	1	2	-	2	-	-	-
CO2	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO3	-	-	-	-	-	2	-	1	1	2	-	2	-	-	-
CO4	-	-	-	-	-	2	-	1	1	2	-	2	-	-	-
AVG	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

HS22601	**Professional Ethics**	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify and analyze ethical issues in engineering
- To recognize the code of ethics with appropriate perspective as per industrial standards
- To understand the ethical situations in risky situation
- To provide services in their areas of expertise
- To be aware of the role of engineers in solving global issues

UNIT I	ENGINEERING ETHICS, MORAL REASONING AND ETHICAL THEORIES	10

Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Social Ethics vs Scientific Ethics vs Experiential Ethics – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Professions and Professionalism – Professional Ideals and Virtues – Theories about Right Action – Uses of Ethical Theories.

UNIT II	ENGINEERING AS SOCIAL EXPERIMENTATION	8

Role of Professional Ethics in Engineering Based Product Development – Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – Case Study.

UNIT III	ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK	8

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analyses and Reducing Risk – Case Studies.

UNIT IV	RESPONSIBILITIES AND RIGHTS	9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Whistle Blowing – Employee Rights – Discrimination – Intellectual Property Rights (IPR).

UNIT V	GLOBAL ISSUES AND ROLE OF ENGINEERS	10

Multinational Corporations – Environmental Ethics – Computer Ethics – Ethics of AI – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Corporate Social Responsibility – Ethics in Engineering Practice and Research – Ethical Audit.

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Visualize the scope of engineering ethics and ethical decision making.
CO2:	Develop a perspective on engineering as an experiment.
CO3:	Detail the importance of assessing safety and risk and reducing the risk.
CO4:	Realize the responsibilities and rights of engineers, employees, employers and public.
CO5:	Recognize the role of ethics related to MNC, Environment, Computer, AI, and while acting as manager, consultant, and experts.

TEXT BOOKS:

1.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill Education, 2017.
2.	Govindarajan M, Natarajan S and Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India Pvt. Ltd., 2015.

REFERENCES:

1.	Robert McGinn R., "The Ethical Engineer: Contemporary Concepts & Cases", Princeton University Press, February 2018.
2.	Mark Coeckelbergh, "AI Ethics", The MIT Press, April 2020.
3.	Qin Zhu, Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 5th Edition, 2022.
4.	Deborah C. Poff and Alex C. Michalos, "Encyclopedia of Business and Professional Ethics", Springer Nature, Switzerland AG, May 2023.
5.	Frederic G. Reamer, "Social Work Values and Ethics", Columbia University Press, New York, Sixth Edition, May 2024.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-

CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-
CO	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-

3-High, 2- Medium, 1-Low

AD22601	DEEP LEARNING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:
- To understand the basics of deep neural networks.
- To understand CNN of architectures of deep neural networks.
- To understand the concepts of Artificial Neural Networks.
- To learn the basics of Data science in Deep learning.
- To learn about applications of deep learning in AI and Data Science.

UNIT I	DEEP NETWORKS BASICS	9

Linear Algebra: Scalars - Vectors -- Matrices and tensors; Probability Distributions - Gradient based Optimization – Machine Learning Basics: Capacity -Overfitting and underfitting - Hyperparameters and validation sets -- Estimators -- Bias and variance - Stochastic gradient descent - Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -Optimization.

UNIT II	CONVOLUTIONAL NEURAL NETWORKS	9

Convolution Operation - Sparse Interactions -- Parameter Sharing - Equivariance - Pooling -- Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions -- Regularization -- Optimizers - Gradient Computation.

UNIT III	DEEP LEARNING ALGORITHMS FOR AI	9

Artificial Neural Networks - Linear Associative Networks - Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks- Autoencoders.

UNIT IV	DATA SCIENCE AND DEEP LEARNING	9

Data science fundamentals and responsibilities of a data scientist - life cycle of data science - Data science tools - Data modeling, and featurization - How to work with data variables and data science tools - How to visualize the data - How to work with machine learning algorithms and Artificial Neural Networks.

UNIT V	APPLICATIONS OF DEEP LEARNING	9

Detection in chest X-ray images -object detection and classification -RGB and depth image

fusion - NLP tasks - dimensionality estimation - time series forecasting -building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

	TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1.	Implement a simple neural network using TensorFlow or PyTorch to classify handwritten digits from the MNIST dataset.
2.	Train a convolutional neural network to classify images of cats and dogs using a dataset like the Kaggle Cats vs. Dogs dataset.
3.	Fine-tune a pre-trained CNN model (such as VGG, ResNet, or MobileNet) on a small dataset for a specific classification task.
4.	Generate synthetic images or data that resemble real data using GANs.
5.	Implement an object detection model using frameworks like TensorFlow or PyTorch, and evaluate its performance on datasets such as COCO or PASCAL VOC.
6.	Create a recurrent neural network (RNN) or a transformer model to classify text documents into different categories, such as sentiment analysis or topic classification.
	TOTAL: 30 PERIODS
	TOTAL:75 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the basics in deep neural networks.
CO2:	Explain the basics of Artificial Intelligence using deep learning.
CO3:	Apply Convolution Neural Network for image processing.
CO4:	Apply deep learning algorithms for data science.
CO5:	Apply deep learning algorithms for variety applications.

TEXTBOOKS:

1.	Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer International Publishing, Second Edition, 2023.
2.	Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), "Deep Learning Applications", Springer Publications, 2022.

REFERENCES:

1.	Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.
2.	Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
3.	Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
4.	Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2016.

| 5. | Adam Gibson and Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017. |

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	3	1	-	-	-	2	3	3	1	2	1	1
2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
3	3	1	2	1	-	-	-	-	2	1	1	3	1	2	1
4	2	2	2	2	1	-	-	-	2	1	2	2	1	3	3
5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	3	2	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22602	EMBEDDED SYSTEMS AND IOT LABORATORY	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES:

- To understand the architecture of microcontrollers and peripheral devices.
- To learn programming the embedded processor in assembly.
- To understand the fundamentals of Internet of Things and IOT protocols.
- To build a small low cost embedded system using Raspberry Pi.

To apply the concept of Internet of Things in the real world scenario.

UNIT I	INTRODUCTION TO EMBEDDED SYSTEM	3

Components of Embedded System – Classification - Characteristic of embedded system-Microprocessors & Micro controllers.

UNIT II	EMBEDDED HARDWARE ARCHITECTURE	3

ARM 2 TDMI core based 32 Bit microcontrollers and family of processors, Register, Memory and Data transfer

UNIT III	IOT ARCHITECTURE	3

M2M high-level ETSI architecture- IETF architecture for IoT- OGC architecture-IoT reference model

UNIT IV	BUILDING IOT WITH RASPBERRY PI & ARDUINO	3

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints

UNIT V	CASE STUDIES AND REAL - WORLD APPLICATIONS	3

Real world design constraints - Applications - Amazon Web Services for IoT.

TOTAL: 15 PERIODS

PRACTICAL EXERCISES:	
1.	Write a program to blink an LED connected to a GPIO pin of the microcontroller at a specific frequency.
2.	Interface a push-button switch to a GPIO pin and write a program to detect its state (pressed or released) and perform an action accordingly.
3.	Interface an analog sensor (e.g., temperature sensor) to an ADC pin of the microcontroller.
4.	Write a program to read analog values from the sensor and display them on an LCD or serial monitor.
5.	Test data transfer between registers and memory.
6.	Interfacing sensors with Raspberry PI.
7.	Study and Install IDE of Arduino and different types of Arduino.
8.	Connect a temperature sensor (e.g., DHT11 or DS18B20) to a microcontroller (e.g., Arduino or Raspberry Pi).
9.	Communicate between Arduino and Raspberry PI using any wireless medium.
10.	Write a program to monitor temperature using Arduino.
11.	Implement Zigbee Protocol using Arduino / Raspberry Pi.
12.	Design an IOT based system.
	TOTAL: 60 PERIODS
	TOTAL:75 PERIODS

COURSE OUTCOMES:	
At the end of this course, the students will be able to:	
CO1:	Explain the embedded systems.
CO2:	Identify the embedded systems Architecture.
CO3:	Analyze various protocols for IoT.
CO4:	Design a portable IoT using Rasperry Pi.
CO5:	Analyze applications of IoT in real time scenario.

TEXT BOOKS:	
1.	Rajkamal, "Embedded System: Architecture, Programming and Design", Tata McGraw-Hill, Third Edition, 2017.
2.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2016.

REFERENCES:	
1.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2016.
2.	Alexander G Dean, "Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach", Arm Education Media,Third Edition, 2021.
3.	Jan Ho¨ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things -

	Introduction to a New Age of Intelligence", Elsevier, 2014.
4.	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key Applications and Protocols", Wiley, 2017.
5.	Dr. Sonu Kumar, Dr. M. Venkatanarayana, "Embedded Systems and Internet of Things", IIP Iterative International Publishers, 2023.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

SD22601	Coding Skills and Quantitative Aptitude– Phase I	L	T	P	C
		0	0	4	2

Objectives

1. To create a simple, React Application using React Components.

2. To implement Routing and API Integration in React Applications.

3. To gain hands-on experience with real-world React Applications.

4. To improve aptitude, problem solving skills and reasoning ability of the students

5. To demonstrate the use of mathematical reasoning by justifying through numerical skills.

Unit I	Front End Engineering with React & QA & LR	12

Basic HTML and JavaScript – JSX- Introduction to React- Setting up the environment – Creating first React Component.

Quants: Numbers – Number Systems, Types of Numbers, Series (Arithmetic Progression, Geometric Progression), HCF & LCM, Decimal Fractions, Simplification (Including Expression & Evaluation).

Logical Reasoning - Analogy - Blood Relations/Family Tree.

Unit 2	**Working with React Components & QA & LR**	**12**

React Components: Component properties – Component State – Handling Events- Life Cycle Methods and Hooks- Conditional Rendering- List and Keys - Forms and User Input.

Quants: Average-Problem on Ages.

Logical Reasoning: Coding-Decoding.

Unit 3	**Styling in React & Routing & QA & LR**	**12**

Styling React Components – Routing: Introduction to React Router- Nested Routes – Redirects and Navigation.

Quants: Ratio & Proportions - Partnership-Mixtures and Alligations.

Logical Reasoning: Cryptarithmetic Problems, Syllogisms.

Unit 4	**State Management & QA & LR**	**12**

Context API Basics – Context Provider and Consumer – useContext hook

Quants: Time & Work-Chain Rule-Pipes and Cisterns

Logical Reasoning - Calendar – Clocks - Images (Mirror & Water).

Unit 5	**Working With APIs & QA & LR**	**12**

Fetching Data – Displaying Fetched Data – Updating Data – Project Work.

Quants: Time,Speed & Distance - Problems on Trains,Boats & Streams.

Logical Reasoning: Cubes and Dices - Data Sufficiency.

Suggestive Assessment Methods:

1) Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning.

2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.

3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.

4) For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all assignments will be reduced to 40 marks.

5) Thus 60 marks from internal and 40 marks from assignments will make it a total of 100.

	TOTAL : 60 PERIODS

Course Outcomes:	
Upon completion of the course, the students will be able to:	
CO 1	Construct a basic React application.
CO 2	Apply Routing and API Integration in web applications.
CO 3	Construct a real-world React application
CO4	Apply quantitative techniques to solve a variety of problems and can enhance their employability quotient and to establish a stronger connection with the technical environment in which they operate.
CO5	Interpret solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.

Text Books

1. Robin Wieruch," The Road to React: with React18 and React Hooks", CreateSpace Independent Publishing Platform, 2024 Edition.

2. Stoyan Stefanov, "React: Up & Running: Building Web Applications", O' Reilly Publications, Second Edition, 2021.

3. Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt. Ltd., New Delhi, First Edition 1989, Reprint, 2023.

4. Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning," S.Chand and Company Pvt. Ltd.,New Delhi, First Edition 1994, Reprint, 2016.

Reference Books

1. Zac Gordan, Mikall Angela Hill, RobbieAddair, "React Explained: Your Step-By-Step Guide to React", oSTraining Publishers, 2020 Edition, March 2019.

2. Alex Banks, Eve Porcello, "Learning React: Functional Web Development with React and Redux", O' Reilly Publications, January 2017.

3. Anand P A, "Quantitative Aptitude," Wiley India Pvt. Ltd., New Delhi, Edition, 2016

4. Arun Sharma, "How to Prepare for Logical Reasoning," Tata-McGraw Hill Education Series. New Delhi, First Edition 2016.

5. Sharon Weiner Green, Ira K Wolf, "Barron's GRE," Barron Publishers. First Edition 1995, Reprint, 2016.

CO's- PO's & PSO's MAPPING

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-
CO2	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-
CO3	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-
CO4	1	1	1	-	-	-	-	-	1	-	-	1	-	1	-
CO5	1	1	1	-	-	-	-	-	1	-	-	1	-	1	-
CO	1.6	1.6	1.6	-	2	-	-	-	1	-	-	1.6	-	1	-

SEMESTER VII

MS22701	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the evolution of Management and its principles.
- To discuss the functions of Management and their importance in business.
- Learn the application of the principles in an organization like planning, organizing, directing and controlling.
- Analyze the position of self and company goals towards business.

UNIT I	INTRODUCTION TO MANAGEMENT	9

Definition of Management – Role of Managers in the Workplace – Management Functions, Levels, Roles and Skills – Evolution of Management – Influence of the External Environment and the Organization's Culture – Diversity, Equity, and Inclusion – Types of Business organizations – Managing in a Global Environment – Managing Corporate Social Responsibility and Ethics – Current trends and issues.

UNIT II	PLANNING	9

Foundations of planning – Planning process – Types of planning – Objectives – Setting objectives – MBO – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making process –Entrepreneurial Ventures – Business Plan Development in Entrepreneurship – Contemporary issues in planning.

UNIT III	ORGANIZING AND STAFFING	9

Nature and purpose – Organization structure design – Departmentalization – Delegation of authority – Centralization and decentralization – Managing Human Resources – HR Planning – Recruitment and Decruitment – Selection, Orientation, Training and Development, Performance Management – Career planning, development and management – Managing change and innovation – Recent issues in HRM.

UNIT IV	DIRECTING AND LEADING	9

Understanding and managing individual behavior –Perception, Personality, Attitude, and Learning – Motivating Employees – Motivation theories – Managing Groups and Teams – Team Dynamics – Effective Leadership – quality, styles, skills and theories of leadership – Communication management – Process and Forms of communication – Barrier in communication – Effective communication styles and Negotiation skills.

UNIT V	CONTROLLING	9

Management control – Use of computers and IT in Management control – System and process of controlling – Planning and Control Techniques- PERT- CPM-Productivity problems and management – Control and performance – Direct and preventive control – Levers of control framework – Reporting – Managing Operations – Modern issues in control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Outline the fundamentals of Managerial functions and Business Environment.
CO2:	Explain the various planning processes and become competent when involved in team to achieve success.
CO3:	Demonstrate the concept of organizing for the effective functioning of a management.
CO4:	Practice and develop managerial styles to anticipate the consequences of each leadership style.
CO5:	Apply the controlling techniques to the practical situations concerning the management of people and organizations in real business life.

TEXT BOOKS:

1.	Stephen P. Robbins, Mary A. Coulter and Lori Long, "Management", 16th Edition Pearson Education, 2024.
2.	P C Tripathi, P N Reddy, Ashish Bajpai, "Principles of Management", Tata McGraw Hill, 2021

REFERENCES:

1.	Almas Sabir, "Principles of Management", Partridge Publishing Singapore, 2019.
2.	Harold Koontz, Heinz Weihrich and Mark V. Cannice, "Essentials of Management", Tata McGraw Hill, 2020.
3.	Chandran J S, " Principles of Management- Text & Cases", Third Edition, Sultan & Chand publications, 2024.
4.	Oliver Laasch, "Principles of Management: Practicing Ethics, Responsibility, Sustainability", Second Edition, SAGE Publications Ltd; 2021.
5.	David Bright, "Principles of Management", 2023.

Mapping of Course Outcomes to Programme Outcomes

Course	PO	PSO

Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	1	-	-	2	-	-	1	-	2	-	1	1	-	-	2
CO4	-	1	1	1	2	-	-	1	2	-	-	-	1	1	1
CO5	1	-	-	-	1	1	-	-	-	3	-	1	1	-	1
CO	2	1	1	2	2	1	1	1	2	3	1	1	2	1	1

3-High, 2- Medium, 1-Low

AD22701	MINI PROJECT	L	T	P	C
		0	0	6	3

COURSE OBJECTIVES:

- To allow students to apply the concepts, theories, and methods they have learned in the course to solve real-world problems or create innovative solutions.
- To enhance technical and problem-solving skills by working on a tangible project, often involving design, development, or implementation
- To gain hands-on experience in building prototypes, testing, and refining solutions based on feedback or results
- To develop communication skills by preparing reports, presentations, and possibly demonstrations of the completed project.

METHOD OF EVALUATION

Two internal assessment reviews will be conducted as the part of continuous assessment. Each internal assessment review is to be conducted for 100 marks and will have to be distributed in two parts viz., course specific mini project execution and test with each having a weightage of 60% and 40% respectively. The tests shall be in presentation and execution mode. The total internal assessment marks of 200 shall be converted into a maximum of 40 marks and rounded to the nearest integer.

TOTAL: 90 PERIODS

COURSE OUTCOMES:

CO1	Solve the real-world problems or challenges to think critically and approach issues logically.
CO2	Improve collaboration skills, communication, and the ability to work effectively in a team.
CO3	Discuss presentations, prepare documentation that outlines the objectives, methods, and results.
CO4	Describe their project, which can improve future project work.
CO5	Apply their techniques with peers, or industry professionals that can lead to future collaborations or career opportunities.

SD22701	CODING SKILLS AND QUANTITATIVE APTITUDE TRAINING – PHASE II	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To help students to work with Database.
- To help they create a simple Spring Boot application and gain foundational skills in Spring Boot by exploring Spring Boot Starters, RESTful web services, Dependency Injection, and handling HTTP methods effectively.
- To make them to learn to create and use repositories, perform basic CRUD operations with JPA Repository, and apply these skills in a hands-on project.
- To improve aptitude, problem solving skills and reasoning ability of the students.
- Demonstrate the use of mathematical reasoning by justifying through numerical skills.

UNIT I	DATABASE BASICS & QUANTS – TIME, SPEED AND DISTANCE	12

Introduction to Database- Database Design Principles – SQL Basics – Querying a Database
Quants: Time, Speed and Distance - Time, Speed & Distance - Problems on Trains-Boats & Stream

UNIT II	DEVELOPING BACK END USING SPRING BOOT & QUANTS – PERCENTAGE & INTEREST	12

Introduction to Spring Boot – Creating a simple Spring Boot Application- Bean Scopes and Life Cycle
Quants: Percentage & Interest - Percentage-Interest (Simple Interest, Compound Interest)-Profit & Loss.

UNIT III	Building RESTful Web Services & Quants – Probability	12

Spring Boot Starters – Introduction to REST - Dependency Injection – Handling HTTP Methods
Quants: Probability - Probability-Permutations & Combinations

UNIT IV	DATA PERSISTENCE WITH SPRING DATA JPA & LOGICAL REASONING	12

Path Variables and Request Parameters – Overview of JPA and Hibernate – Setting up Spring Data JPA in a Spring Boot project.
Logical Reasoning: Data Interpretation (Tabulation, Bar Chart, Pie Chart, Line Graphs)- Direction sense test - Linear/Seating Arrangements - Series completion

UNIT V	CREATING AND USING REPOSITORIES & LOGICAL REASONING	12

Creating and using Repositories – Basic CRUD operations with JPA Repository – Project Work.
Logical Reasoning: Logical Venn Diagram/Syllogisms - Odd man out/Finding missing elements - Crypt arithmetic Questions – Puzzles

	TOTAL PERIODS: 60 Hrs.

SUGGESTIVE ASSESSMENT METHODS:

- Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning.
- Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
- Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
- Post-Assessment: Evaluating students' knowledge gained from the Coding Skill and

Quantitative Aptitude – Phase I Skill Development Course.
- For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.
- The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO 1	Design and Query a Database.
CO 2	Utilize Spring Boot Starters, develop RESTful web services, implement Dependency Injection, and effectively handle various HTTP methods.
CO 3	Implement a hands-on project using Spring Boot
CO4	Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate.
CO5	Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.

TEXT BOOKS

1. Craig Walls, "Spring Boot in Action", Manning Publishers, Sixth Edition, March 2022.

2. Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt. Ltd., New Delhi, First Edition 1989, Reprint, 2016.

REFERENCES

1. Alex Antonov, "Spring Boot 2.0 Cookbook", Packt Publishers, Second Edition, February 2018.
2. Felipe Gutierrez, "Pro Spring Boot 2: An authorative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices", ApressPublishers, Second Edition, January, 2018.
3. Anand P A, "Quantitative Aptitude," Wiley India Pvt. Ltd., New Delhi, Edition, 2016.
4. Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning," S.Chand and Company Pvt. Ltd.,New Delhi, First Edition 1994, Reprint, 2016.
5. Arun Sharma, "How to Prepare for Logical Reasoning," Tata-McGraw Hill Education Series. New Delhi, First Edition 2016.

CO PO Mapping

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-
CO2	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-

CO3	2	2	2	-	2	-	-	-	-	-	-	2	-	1	-
CO4	1	1	1	-	-	-	-	-	1	-	-	1	-	1	-
CO5	1	1	1	-	-	-	-	-	1	-	-	1	-	1	-
CO	1.6	1.6	1.6	-	2	-	-	-	1	-	-	1.6	-	1	-

SEMESTER VIII

AD22801	PROJECT WORK / INTERNSHIP	L	T	P	C
		0	0	16	8

COURSE OBJECTIVES:

- Prepare students with the necessary domain knowledge and technical expertise to address real-world business or research problems effectively.
- To effectively gather requirements, analyze needs, and design software solutions to meet project goals and ethics.
- Work collaboratively in small teams, gaining experience in industry-standard practices, project management, and team dynamics.
- Enable students to ethically implement software solutions, conduct thorough testing, and deploy solutions across multiple platforms.
- Develop students' ability to prepare comprehensive project reports and deliver professional presentations to effectively communicate findings and solutions.

PROCEDURE

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 College and submitted to the Head of the department.

The students will be evaluated based on the project reviews, report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 240 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply domain-specific knowledge and technical skills to effectively solve complex business or research problems through innovative software solutions.
CO2:	Conduct thorough requirements gathering, analyze client needs, and design efficient, scalable software solutions, ensuring ethical practices in privacy and security.

CO3:	Work effectively within multidisciplinary teams, applying industry-standard processes, and collaborative tools to achieve project objectives.		
CO4:	Develop, test, and deploy software applications, ensuring functionality, security, and ethical responsibility in the final product.		
CO5:	Prepare comprehensive project reports and deliver clear, and professional presentations to communicate the project goals, methodologies, findings, and outcomes.		

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	2	-	1	-	-	-	-	3	2	-
CO3	-	-	3		3	-	2	-	3	-	-	-	-	2	2
CO4	-	-	-	3	-	2	-	1	-	-	-	-	3	2	2
CO5	-	-	-	-	-	-	-	-	-	3	3	3	1	1	1
CO	3	3	3	3	3	2	2	1	3	3	3	2	3	2	2

3–High, 2– Medium, 1–Low

PROFESSIONAL ELECTIVES

VERTICAL 1:   DATA ANALYTICS

AD22511	HEALTH CARE ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- Understand the health data formats, health care policy and standards.
- Learn the significance and need of data analysis and data visualization.
- Understand the health data management frameworks.
- Learn the use of machine learning and deep learning algorithms in healthcare.
- Apply healthcare analytics for critical care applications.

UNIT I	INTRODUCTION TO HEALTHCARE ANALYSIS	6

Overview - history of healthcare analysis parameters on medical care systems- health care policy-standardized code sets – data formats – machine learning foundations: Tree like reasoning, probabilistic reasoning and bayes theorem, weighted sum approach.

UNIT II	ANALYTICS ON MACHINE LEARNING	6

Machine learning pipeline – pre-processing –visualization – feature selection – training model parameter – Evaluation model: sensitivity, specificity, PPV, NPV, FPR, accuracy, ROC, precision recall curves, valued target variables –Python: variables and types, data structures and containers,

Pandas Data Frame: operations – Scikit –learn: pre-processing, feature selection.		
UNIT III	**HEALTH CARE MANAGEMENT**	**6**
IOT- smart sensors – migration of healthcare relational database to NoSQL cloud database – decision support system – Clinical Prediction Models – Visual Analytics for Healthcare.		
UNIT IV	**HEALTHCARE AND DEEP LEARNING**	**6**
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.		
UNIT V	**CASE STUDIES**	**6**
Predicting Mortality for Cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.		
	TOTAL: 30 PERIODS	

PRACTICAL EXERCISES:

1.	Download, install and explore the features of NumPy, SciPy, Jupyter, Stats Models, Scikit-Learn and Pandas packages.
2.	Working with NumPy arrays and Pandas data frames.
3.	Working with basic plots using Matplotlib to communicate insights from data analysis.
4.	Demonstrate various data pre-processing techniques for a given dataset. Write a python program to compute a) Reshaping the data, b) Filtering the data, c) Merging the data d) Handling the missing values in datasets.
5.	Connecting to medical data and preparing the data for visualization.
6.	Implementation of clinical data mining for clinical data.
7.	Building predictive models for disease risk prediction.
8.	Implementation of ECG data Analysis using Python.
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the use of machine learning concepts for health care analysis.
CO2:	Make use of various software packages to do analytics work on health care data.
CO3:	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications.
CO4:	Design health care data analytical system for real time applications.
CO5:	Design emergency care system using health data analysis.

TEXT BOOKS:

1.	Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, "Big Data Analytics in HealthCare", Springer, 2020.
2.	Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.

REFERENCES:

1.	Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2.	Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
3.	Chandan K.Reddy, Charu C. Aggarwal, "Health Care Data Analysis", First edition, CRC, 2015.
4.	Ewen Harrison and Riinu Pius, " R for Health Data Science", CRC Press, 2021, ISBN: 978-0-367-85542-0, available from https://argoshare.is.ed.ac.uk/healthyr_book/
5.	Marcello Pagano and Kimberlee Gauvreu, "Principles of Biostatistics", Chapman and Hall/CRC, 2nd Edition, 2018.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22512	ENGINEERING PREDICTIVE ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- 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 introduce the text mining tools, technologies and case study which is used in day-to

	day analytics cycle.	
UNIT I	**INTRODUCTION TO PREDICTIVE ANALYTICS**	**6**
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.
UNIT II	**DATA PREPARATION AND ASSOCIATION RULES**	**6**
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.
UNIT III	**MODELLING**	**6**
Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation
UNIT IV	**PREDICTIVE MODELLING**	**6**
Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms.
UNIT V	**TEXT MINING**	**6**
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: 30 PERIODS

PRACTICAL EXERCISES:

1.	Exploring the data visualization tools and installing the data Analysis and Visualization tool.
2.	Performing data preprocessing tasks and demonstrating association rule mining on data sets.
3.	Implementation of clustering algorithms on data sets.
4.	Implementation of the naïve Bayesian classifier for a sample training data set.
5.	Implementation of Simple Linear Regression.
6.	Implementation of k-Nearest Neighbour algorithm to classify the iris data set.
7.	Construction of a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8.	Implementation of decision tree concept in Text Mining.

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:	
At the end of this course, the students will be able to:	
CO1:	Explain terminology, technology and applications of predictive analysis.
CO2:	Apply data preparation techniques to effectively interpret big data.
CO3:	Apply predictive analytics to achieve real text mining.
CO4:	Discuss various descriptive models, their merits, demerits and application.
CO5:	Illustrate the features and applications of text mining.

TEXT BOOKS:

1.	Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", First Edition, Wiley, 2014.
2.	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

REFERENCES:

1.	Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st 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", Wiley, 2014.
4.	Anasse Bari, Mohammad Chaouchi, Tommy Jung, " Predictive Analytics for Dummies", 2nd Edition, 2017.
5.	Kuhn, Max, and Kjell Johnson, "Applied Predictive Modeling", 3rd Edition, Springer, 2019

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22611	**SOCIAL MEDIA WEB ANALYTICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:	
• To understand the concept of semantic web and related applications.	
• To learn knowledge representation using ontology.	
• To understand human behaviour in social web and related communities.	
• To learn visualization of social networks.	

UNIT I	INTRODUCTION	6

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II	MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	6

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	6

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms.

UNIT IV	PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES	6

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	6

Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Explore various social media platform and social media analytics tools.

2.	Explore social media analytics techniques and engagement metrics.
3.	Perform data collection from any of the social media platform of your choice (Facebook, LinkedIn, YouTube, Web blogs etc.)
4.	Perform preprocessing of the data and store it using python.
5.	Analyze and Visualize the Social Media Data collected and preprocessed using various tools.
6.	Perform Hyperlink Analytics – Extract, Analyze and Interpret Hyperlinks
7.	Perform Text and Action analytics in Social Media Data.
8.	Perform Location Analytics in collected Social Media Data.

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Develop semantic web related applications.
CO2:	Represent knowledge using ontology.
CO3:	Extract and mine communities in social network.
CO4:	Predict human behaviour in social web and related communities.
CO5:	Visualize social networks.

TEXT BOOKS:

1.	Matthew Ganis, "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media", 2018.
2.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

1.	Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.
2.	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2018.
3.	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2019.
4.	John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2019
5.	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2017.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22612	TEXT ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- To understand the methods for keyword extraction from documents.
- To learn clustering methods for grouping of documents.
- To explore the methods for classification of documents and E-mails.
- To explore text visualization techniques and anomaly detection.
- To learn about Events and trends in text streams.

UNIT I	TEXT EXTRACTION	6

Introduction- Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords-Benchmark evaluation: precision and recall, efficiency, stop list generation, Evaluation on new articles.

UNIT II	DOCUMENT CLUSTERING	6

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms.

UNIT III	CONTENT BASED CLASSIFICATION	6

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems.

UNIT IV	ANOMALY AND TREND DETECTION	6

Text visualization techniques: Visualization in text analysis, Tag clouds, tag clouds, authorship and change tracking, Data Exploration and the search for novel patterns, sentiment tracking, visual analytics and Future Lens, scenario discovery, adaptive threshold setting for novelty Mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

UNIT V	TEXT STREAMS	6

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Implementation of keyword extraction methods.
2.	Implementation of Multilingual document clustering algorithm.
3.	Implementing K Means algorithm for document clustering.
4.	Implementation of Content-based spam email classification.
5.	Study of text visualization tools and usage of tools in text visualization.
6.	Implementation of trend detection by feature extraction in text streams.
7.	Implementation of Semantic analysis.
8.	Implementation of data-driven semantic embedding.

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Design text extraction techniques.
CO2:	Demonstrate clustering techniques for text mining.
CO3:	Design classification techniques for text mining.
CO4:	Apply visualization techniques and perform anomaly & trend detection.
CO5:	Show event operations in text streams.

TEXT BOOKS:

1.	Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data" Apress, 2020.
2.	Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd Edition, 2021.

REFERENCES:

1.	Miner, Gary, et al., "Practical text mining and statistical analysis for non-structured text data applications", Academic Press, 2012.
2.	Aggarwal, Charu C., and ChengXiangZhai, eds., "Mining text data", Springer Science & Business Media, 2012.
3.	Michael W. Berry and Jacob Kogan, "Text Mining Applications and Theory", Wiley publications, 2010.

4.	Srivastava, Ashok N., and MehranSahami, "Text mining: Classification, clustering, and applications", Chapman and Hall/CRC, 2019.
5.	Miner, G., Delen, D., Elder, J., Fast, A., Hill, T., and Nisbet, A. R., "Practical Text Mining and Statistical Analysis for Non-structured Text Data Applications", Elsevier Inc., 2012. Available online http://www.gbv.de/dms/ilmenau/toc/668584769.PDF.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22711	AUDIO ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- To understand the principles, methods, and applications of analyzing audio data.
- To gain knowledge necessary for processing, interpreting, and extracting meaningful information from diverse audio sources.
- To make use of machine learning approaches in audio analytics.

UNIT I	INTRODUCTION TO AUDIO DATA	6

Overview of audio data types and characteristics - Introduction to audio file formats (e.g., WAV, MP3) - Basics of digital audio representation - Audio signal properties: amplitude, frequency, time domain, frequency domain

UNIT II	SIGNAL PROCESSING FOR AUDIO	6

Signal Processing Models of Audio Perception, Psycho-acoustic analysis, Spatial Audio Perception and rendering, Audio compression methods, Parametric Coding of Multichannel audio, Transform coding of digital audio, audio quality analysis.

UNIT III	SPEECH PROCESSING	6

Introduction to speech processing - Speech recognition fundamentals - Hidden Markov Models (HMMs) in speech recognition - Automatic Speech Recognition (ASR) systems.

UNIT IV	MUSIC INFORMATION RETRIEVAL	6

Overview of Music Information Retrieval - Feature extraction for music analysis - Tempo and beat

analysis - Music genre classification.

UNIT V	MACHINE LEARNING FOR AUDIO ANALYTICS	6

Introduction to machine learning for audio data - Supervised and unsupervised learning approaches - Deep learning for audio analytics - Model evaluation and performance metrics.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Introduction to popular audio processing libraries (Librosa, PyDub, etc…).
2.	Working with Spectrogram to analyze the audio signal.
3.	Extracting features from sound data using python packages.
4.	Implementation of speech recognition using HMM.
5.	Implementation of music genre classification with Python.
6.	Implementation of music classification using Deep Learning.
7.	Implementation of audio analytics real time applications using Python.
8.	Generation of music using Deep Learning.

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the fundamental characteristics of audio data, including its types, file formats, and digital representation.
CO2:	Process and interpret the audio signals.
CO3:	Explain speech recognition fundamentals and various models in speech recognition.
CO4:	Classify the music genre and extract the information from music signal.
CO5:	Explain machine learning techniques and explore the use of deep learning for audio analytics.

TEXT BOOKS:

1.	Meinard Muller, "Fundamentals of Audio and Music Analysis", Springer International Publishing Switzerland 2015.
2.	Ben Gold and Nelson Morgan "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", Wiley, 2nd Edition, 2011.

REFERENCES:

1.	Ricardo B. Rocha,"Music Information Retrieval: Fundamentals and Applications", https://musica.ufmg.br/sysmus2018/wp- content/uploads/ 2018/07/sysmus18-proceedings.pdf
2.	Theodoros Giannakopoulos & Aggelos Pikrakis, "Introduction to Audio Analysis: A Matlab Approach", Academic Press, Inc., United States, 2014.

3.	M. Schedl, E. Gomez & J. Urbano, "Music Information Retrieval: Recent Developments and Applications", Foundations and Trends in Information Retrieval, Vol. 8, No. 2-3 (2014) 127–261
4.	Bjorn W. Schuller, "Intelligent Audio Analytics", SpringerLink, 2013.
5.	Spanias A, Painter T and Venkatraman A, "Audio Signal Processing and coding", John Wiley & Sons., 2017.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22712	**BUSINESS DATA ANALYTICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with the processes needed to develop, report, and analyze business data.
- To learn how to use and apply Excel and Excel add-ins to solve business problems.

UNIT I	**INTRODUCTION TO BUSINESS ANALYTICS**	**6**

Definition of Business Analytics, Categories of Business Analytical methods and models, Business Analytics in practice, Big Data - Overview of using Data, Types of Data- Business decision modeling.

UNIT II	**DESCRIPTIVE ANALYTICS**	**6**

Overview of Description Statistics (Central Tendency, Variability), Data Visualization - Definition, Visualization Techniques – Tables, Cross Tabulations, charts, Data Dashboards using Advanced MS-Excel or SPSS.

UNIT III	**PREDICTIVE ANALYTICS**	**6**

Trend Lines, Regression Analysis – Linear & Multiple, Predictive modeling, forecasting Techniques, Data Mining - Definition, Approaches in Data Mining- Data Exploration &

Reduction, Data mining and business intelligence, Data mining for business, Classification, Association, Cause Effect Modeling.

UNIT IV	PRESCRIPTIVE ANALYTICS	6

Overview of Linear Optimization, Non-Linear Programming Integer Optimization, Cutting Plane algorithm and other methods, Decision Analysis – Risk and uncertainty methods - Text analytics Web analytics.

UNIT V	PROGRAMMING USING R	6

R Environment - R packages - Reading and Writing data in R - R functions - Control Statements, Frames and Subsets - Managing and Manipulating data in R.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Explore the features of MS-Excel. (i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) (ii) Perform data import/export operations for different file formats.
2.	Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis.
3.	Perform data pre-processing operations i) Handling Missing data ii) Normalization.
4.	Apply and explore various plotting functions on the data set.
5.	Perform bivariate and multivariate analysis on the dataset.
6.	Create a dashboard and perform data analysis.
7.	Explore the features of R programming. (i) Reading and Writing data in R - R functions (ii) Managing and Manipulating data in R.
8.	Explore the measure of central tendency (Mean, Median and Mode) in R Programming.

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the Business Analytics methods in practice
CO2:	Apply and visualize the concepts of Descriptive Analytics.
CO3:	Use Data mining process for business.
CO4:	Explain the concepts of Prescriptive Analytics in business domain.
CO5:	Make use of R programming constructs in data manipulations.

TEXT BOOKS:

1.	James Evans, "Business Analytics", Pearson. Third Edition, 2021.

2.	Ratnoo & Ratnoo, "Essentials of R for Data Analytics", Wiley, 2021.

REFERENCES:

1.	Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams, "Essentials of Business Analytics", Cengage Learning, Second Edition, 2017.
2.	Sahil Raj, "Business Analytics", Cengage Learning, First Edition, 2015.
3.	S.P. Gupta and M.P. Gupta, "Business Statistics", Sultan Chand & Sons Educational Publishers – New Delhi., 18th Edition -2014
4.	S. R. Mani Sekhar and T. V. Suresh Kumar, "Programming With R", Cengage India, 2018.
5.	John Verzani, " Using R for Introductory Statistics", 2nd edition, Chapman & Hall , 2014.

CO- PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

VERTICAL 2

DESIGN AND DEVELOPMENT

AD22521	UI / UX DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basic principles of UI / UX Design.
- To learn the effective user experience with decision making.
- To understand the importance of design principles of good user interface.
- To design web application with multimedia and effects.
- To develop meaningful user interface for mobile applications.

UNIT I	INTRODUCTION	6

Introduction about UX - Five Main Ingredients of UX - Three "Whats" of User Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

UNIT II	USER OBSERVATION AND EXPERIENCE	6

User Research - Subjective Research - Objective Research - Sample Size - Three Basic Types of Questions. Observe a User: Watch How They Choose - Interviews - Surveys -Card Sorting - Creating User Profiles - Bad profile - Useful profile.

UNIT III	USER INTERFACE DESIGN PRINCIPLES	6

Designing Behaviour: Designing with Intention - Rewards and Punishments – Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust – Hidden versus Visible. Basic Visual Design Principles: Visual Weight - Contrast - Depth and Size - Color. Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - One Long Page or a Few Short Pages - Input Types - Labels and Instructions – Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

UNIT IV	WEB INTERFACE DESIGN	6

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

UNIT V	MOBILE INTERFACE DESIGN	6

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.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Study of UI/UX life cycle and UI/UX Tools
2.	Implementation of Navigation Design
3.	Implementation of Admission System in School or College
4.	Implementation of Library Management System
5.	Implement widgets like menu, sub-menu, buttons, text boxes, labels etc
6.	Implement a web interface using Drag and Drop
7.	Implement a web interface using Design Pattern
8.	Implement a Mobile Application Framework

TOTAL: 30 PERIODS

| | | | | | | | | | | | | | | | TOTAL: 60 PERIODS |

COURSE OUTCOMES:

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

CO1:	Define the principles of UI/UX Design.
CO2:	Outline the effective user experience with decision making.
CO3:	Identify the importance of design principles of good user interface.
CO4:	Design web application with multimedia and effects.
CO5:	Develop meaningful user interface for mobile applications.

TEXT BOOKS:

1.	Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., First Edition 2023.
2.	Benjamin Franz, Michaela Kauer-Franz, "Usability and User Experience Design: The Comprehensive Guide to Data-Driven UX Design", Rheinwerk Computing, First Edition, 2024.

REFERENCES:

1.	Jon Yablonski, "Laws of UX: Using Psychology to Design Better Products & Services", 1st Edition, 2020.
2.	Melvin K. Briscoe, "Figma 101: Complete beginner's guide to UI/UX app and web design. Create interactive components with real projects", 2022.
3.	Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, "The Essential of User Interface Design", Wiley Dream Tech Ltd., Edition: 4, 2016.
4.	Benjamin Franz, Michaela Kauer-FranzTabina Hendrick, "UX/UI DESIGN COMPLETE GUIDE 2022: Complete Beginner to Expert Guide That Teaches Everything You Need to Know About UX/UI Design Including Tips & ... Become a Great Designer in Less Than 7 Days", 2022.
5.	Brian Sullivan, "The Design Studio Method: Creative Problem Solving with UX Sketching", Routledge, 2015

CO - PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2
CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

AD22522	WEB SERVICES AND API DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the types of web services, resources, APIs and their architectures.
- To learn about Resources and Design patterns.
- To understand RESTful API design principles.
- To develop, deploy RESTful web service APIs in JAVA.
- To understand the security concerns.

UNIT I	INTRODUCTION	6

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

UNIT II	RESOURCES AND DESIGN PATTERNS	6

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

UNIT III	RESTFUL API DESIGN PRINCIPLES	6

API front End Design, API back-end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices.

UNIT IV	DEVELOPMENT AND DEPOLYMENT	6

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, Microservice API, Best Practices.

UNIT V	PERFORMANCE AND SECURITY	6

Performance and availability - caching - Traffic shaping - Evolution and versioning, Security concerns - Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Study about HATEOAS, REST, URI, Code on Demand
2.	Develop Spring Boot RESTful Web Services
3.	Implement HTTPS in Spring Boot
4.	Implement HATEOAS in Spring Boot.
5.	Build a hypermedia-driven REST service with Spring HATEOAS

6.	Implement RESTful web service applications in Java
7.	Implement Microservice API
8.	Implement Authentication, Validation methods using Web Services
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Name the suitable architecture for a given design problem.
CO2:	Analyze the types of resources and suitable design patterns.
CO3:	Analyze front-end and Back-end API designs.
CO4:	Develop RESTful API web services using JAVA.
CO5:	Demonstrate security practices for preventing security attacks.

TEXT BOOKS:

1.	Mike Amundsen, "RESTful Web API Patterns and Practices Cookbook", O'Reilly Media First Edition, 2022.
2.	Neil Madden, "API Security in Action", Manning Publisher, 2020.

REFERENCES:

1.	JJ Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
2.	Valentin Bojinov, "RESTful Web API Design with Node.js 10", Packt Publishing, Third Edition, 2018
3.	Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.
4.	Harihara Subramanian, Pethuru Raj, "Hands-On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure RESTful web APIs", Packt Publishing, 2019.
5.	Arnaud Lauret, "Design of Web APIs", Manning, 2019

CO - PO & PSO MAPPING

CO	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2
CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22621	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand system requirements for mobile applications.
- To generate suitable design using specific mobile development frameworks.
- To generate mobile application design.
- To implement the design using specific mobile development frameworks.
- To deploy the mobile applications in marketplace for distribution.

UNIT I	INTRODUCTION TO MOBILE APPLICATIONS	6

Web Vs mobile App – Cost of Development – Myths - Mobile Applications – Marketing - MobileUser Interface Design - Effective Use of Screen – Mobile Users - Mobile Information Design -Mobile Platforms - Tools of Mobile Interface Design

UNIT II	ANDROID USER INTERFACE DESIGN	6

Android Architecture – Android SDK Tools - Application Components - Intents - Content providers - Broadcast receivers – Services - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications - Android Localization

UNIT III	ANDROID DATA STORAGE	6

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLiteDatabases

UNIT IV	ANDROID NATIVE CAPABILITIES	6

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location

UNIT V	IOS DESIGN	6

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective C Basics – Building iOS App – Actions and Outlets – Delegates - User Interface Elements – Accelerometer – Location Handling - SQLite Database

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Develop an application that uses GUI components, Font and Colors.
2.	Develop an application that uses Layout Managers and event listeners.
3.	Develop a native calculator application.

4.	Write an application that draws basic graphical primitives on the screen.
5.	Develop an application that makes use of database.
6.	Implement an application that implements Multi-threading.
7.	Develop a native application that uses GPS location information.
8.	Develop a mobile application to send an email.
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the requirements for mobile applications.
CO2:	Design user interface for mobile applications.
CO3:	Categorize mobile data of android applications.
CO4:	Evaluate native capabilities of android applications.
CO5:	Design iOS applications with tools.

TEXT BOOKS:

1.	Mohamed Sarrab, Hafedh Al-Shihi, Naveen Safia, "Handbook of Mobile Application Development: A Guide to Selecting the Right Engineering and Quality Features", Bentham Books, 2021
2.	John Horton, "Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming language", Packt Publishing, 2019.

REFERENCES:

1.	Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, Edition 1, 2012.
2.	Reto Meier, "Professional Android 4 Development", John Wiley and Sons, Edition 3, 2012.
3.	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, Edition: 1, 2013.
4.	Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", Shroff/O'Reilly, 2017
5.	Keith Makan, "Android Security Cookbook", Packt Pub Ltd, 2013.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2

CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22622	DEVOPS AND MICROSERVICES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the basic concepts and terminology of DevOps.
- To gain knowledge on DevOps platform.
- To understand building and deployment of code.
- To be familiar with DevOps automation tools.
- To learn basics of MLOps.

UNIT I	INTRODUCTION	6

Software Engineering - traditional and Agile process models - DevOps -Definition - Practices - DevOps life cycle process - need for DevOps –Barriers

UNIT II	DEVOPS PLATFORM AND SERVICES	6

Cloud as a platform - IaaS, PaaS, SaaS - Virtualization - Containers –Supporting Multiple Data Centers - Operation Services - Hardware provisioning- software Provisioning - IT services - SLA - capacity planning - security - Service Transition - Service Operation Concepts.

UNIT III	BUILDING, TESTING AND DEPLOYMENT	6

Microservices architecture - coordination model - building and testing - Deployment pipeline - Development and Pre-commit Testing -Build and Integration Testing - continuous integration –monitoring - security - Resources to Be Protected - Identity Management

UNIT IV	DEVOPS AUTOMATION TOOLS	6

Infrastructure Automation- Configuration Management - Deployment Automation - Performance Management - Log Management -Monitoring.

UNIT V	MLOPS	6

MLOps - Definition - Challenges -Developing Models - Deploying to production - Model Governance - Real world examples

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Explore Git and GitHub commands
2.	Practice Source code management on GitHub
3.	Jenkins installation and setup, explore the environment

4.	Explore Docker commands for content management.
5.	Develop a simple containerized application using Docker Integrate Kubernetes and Docker
6.	Install and Explore Selenium for automated testing
7.	Write a simple program in JavaScript and perform testing using Selenium
8.	Develop test cases for the above containerized application using selenium
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate modern software Engineering process.
CO2:	Build with DevOps platform.
CO3:	Illustrate DevOps tools.
CO4:	Experiment with DevOps automation tools.
CO5:	Examine MLOps concepts with real time examples.

TEXT BOOKS:

1.	Gene Kim, Jez Humble, Patrick Debios, and John Willis, " The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations", 2021.
2.	Sanjeev Sharma, "The DevOps Adoption Playbook: A Guide to Adopting DevOps in a Multi-Speed IT Enterprise", 2017

REFERENCES:

1.	Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, Edition: 1, 2016.
2.	Joakim Verona, "Practical DevOps", Packet Publishing, Edition: 2, 2018.
3.	Viktor Farcic, "The DevOps 2.3 Toolkit: Docker Swarm", Packet Publishing, 2018.
4.	Mark Treveil and The Dataiku Team, "Introducing MLOps", O'Reilly Media, Edition: 1, 2020.
5.	Gene Kim and John Willis, "Beyond the Phoenix Project: The Origins and Evolution of DevOps", 2021.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2

CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22721	SOFTWARE DEVELOPMENT PROCESSES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To acquire knowledge on software process management.
- To understand software economics.
- To acquire managerial skills for software project development.
- Implement the design using specific mobile development frameworks.
- To acquire knowledge about real time software development scenarios.

UNIT I	SOFTWARE PROCESS	6

Software Process Maturity Software Maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, TheDefined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

UNIT II	SOFTWARE ECONOMICS AND LIFECYCLE	6

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

UNIT III	SOFTWARE PROCESSES PLANNING	6

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT IV	PROJECT MANAGEMENT AND METRICS	6

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT V	PROJECT MANAGEMENT PRACTICES	6

CCPDS-R Case Study and Future Software Project Management Practices Modern Project

Profiles, Next-Generation software Economics, Modern Process Transitions.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Prepare problem Statement for any real time problem
2.	Prepare an Entity relationship Diagram for Student Result Management System
3.	Prepare a Data Flow Diagram for Library management system
4.	Draw the Use Case Diagram for Bank loan system
5.	Draw a sample activity diagram for Automatic teller machine.
6.	Draw Sequence Diagram using Rational Rose for Ticket reservation
7.	Draw the collaboration Diagram for Fast food billing system
8.	Draw the class Diagram using for College Management System.

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the software process phases in the cycle of software development.
CO2:	Explain knowledge of software economics, project organization, project control and process instrumentation.
CO3:	Analyze the major and minor milestones, artifacts and metrics from management and technical perspective.
CO4:	Design and develop software product using conventional and modern principles ofsoftware project management.
CO5:	Analyze the real time software development processes.

TEXT BOOKS:

1.	Watts S. Humphrey, "Managing the Software Process", Pearson Education, 2020.
2.	Walker Royce, "Software Project Management A Unified Framework", Pearson Education, Edition: 1, 2020

REFERENCES:

1.	Watts S. Humphrey, "An Introduction to the Team Software Process", Pearson Education, 2012.
2.	Bob Hughes & Mike Cotterell, "Software Project Management", Sixth edition, TMH, 2018.
3.	Andrew Stellman & Jennifer Greene, "Applied Software Project Management", O'Reilly, 2016.

| 4. | Jennifer Greene & Andrew Stellman, "Head First PMP", O'Reilly, Edition: 4, 2018. |
| 5. | Richard H. Thayer & Edward Yourdon, "Software Engineering Project Management", 2nd Edition, Wiley India, 2014. |

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2
CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22722	AGILE METHODOLOGIES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- To learn about agile software development.
- To provide an understanding of Agile Software Development and Life Cycle.
- To know the development of Agility and Knowledge management.
- To understand the requirements of Agile Modeling and Generation.
- To know the Quality assurance of Agile product development.

UNIT I	AGILE METHODOLOGY	6

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II	AGILE PROCESSES	6

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III	AGILITY AND KNOWLEDGE MANAGEMENT	6

Agile Information Systems – Agile Decision Making - Earl's Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment,

leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV	AGILITY AND REQUIREMENTS ENGINEERING	6

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V	AGILITY AND QUALITY ASSURANCE	6

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Understand the background and driving forces for taking an Agile Approach to Software Development.
2.	Understand the business value of adopting agile approach.
3.	Understand agile development practices.
4.	Drive Development with Unit Test using Test Driven Development.
5.	Apply Design principle and refactoring to achieve agility
6.	To study automated build tool.
7.	To study Continuous Integration tool.
8.	Perform Testing activities within an agile project

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Illustrate Agile software development.
CO2:	Experiment with Agile Software Development and Life Cycle.
CO3:	Analyze the development of Agility and Knowledge Management.
CO4:	List the requirements of Agile Modeling and Generation.
CO5:	Measure the Quality assurance of Agile product development.

TEXT BOOKS:

1.	Jesse Fewell's, "Untapped Agility: Seven Leadership Moves to Take Your Transformation to the Next Level", Berrett-Koehler Publishers, 2020.
2.	Jim Highsmith, "Wild West to Agile: Adventures in Software Development Evolution and Revolution", Addison-Wesley Professional, 2023

REFERENCES:

1.	Craig Larman, "Agile and Iterative Development: A Manager 's Guide", Addison-Wesley, Edition: 1, 2014.
2.	Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, Edition: 1, 2016.
3.	Robert Galen, Jennifer Fields, Rhiannon Galen-Personick, Mark Summers, "Extraordinarily Badass Agile Coaching: The Journey from Beginner to Mastery and Beyond", 2019.
4.	David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2013.
5.	Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2018.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	-	-	-	1	1	2	2	3	2	1
CO2	2	1	1	3	2	-	-	-	2	2	1	2	2	2	2
CO3	3	2	1	2	2	-	-	-	2	1	1	2	1	3	3
CO4	3	2	3	2	2	-	-	-	3	3	3	2	2	1	2
CO5	3	1	2	3	3	-	-	-	2	2	2	2	3	1	3
AVG	3	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

CS22753	SALESFORCE ADMINISTRATION	L	T	P	C
		2	0	2	3

COURSEOBJECTIVES:

- To understand Salesforce architecture and features.
- To know the customization process in Salesforce.
- To understand the security model.
- To understand the business process automation features
- To understand the reports and dashboard

UNIT I	SALESFORCE FUNDAMENTALS	6

Introduction to CRM- CRM Use Cases - Why Salesforce? - Overview of Salesforce platform and its Architecture - Advantage of Salesforce, Salesforce editions and licenses - Salesforce user interface and navigation - Salesforce Mobile App and Salesforce Lightning Experience -Signing up Developer Edition - Standard Objects - Creating Custom Objects - Fields and data types - Apps Creation.

UNIT II	SALESFORCE DATA MANAGEMENT AND CUSTOMIZATION ESSENTIALS	6

Relationships and junction objects, Roll-up Summary- Creating Formula Fields, Schema Builder. Data Validation - Validation rules. Working with Record Types and Page Layouts - Compact Layout- Lightning Record Pages – Home Page Customization -Path Settings. - List Views - Data import and data management tools.

UNIT III	SECURITY AND DATA ACCESS	6

Public groups and Queues - Organization Security Controls - Passwords, IP restrictions, Network Settings. User Setup and Security - User Creation- Security Model: Profiles - Permission Set - Permission Set Group - Salesforce Sharing model - Organization Wide Defaults (OWD) -   Role Hierarchy - Sharing Rules - Manual Sharing.

UNIT IV	BUSINESS PROCESS AUTOMATION	6

Introduction to Workflow and Process Builder - Work flow rules – Workflow action - Email Alerts and Field Updates. Flows: Types of Flow Screen Flow- Record Triggered Flow- Scheduled Trigger Flow- Auto Launched Flow. uses cases of Process Automation. - Approval Processes.

UNIT V	REPORTS, DASHBOARDS, AND ANALYTICS	6

Creating or customizing a Report –Types of Reports - Summary Report- Tabular Report - Matrix Report - Joined Report. Row Level Formula – Summary Level Formula. Various charts in Reports. Creating and modifying Dashboards – Filters – Various Charts - Standard Dashboards & Dynamic Dashboards. Folder Creation and Sharing.

	30 PERIODS

PRACTICAL EXERCISES:

1. Create Objects, Fields and App
2. Explore Data Types
3. Create Fields and Relationships
4. Create Record Types (create), Page Layout (adding section, field property settings), Page Layout Assignment (assign page layout based on Record types)
5. Create Lightning Record Page, List View, Path Settings
6. Validation Rule
7. Automation I
   a. Screen Flow
   b. Auto Launched Flow
8. Automation II
   a. Record Trigger Flow
   b. Scheduled Trigger Flow
   c. Approval Process
9. Security
   a. Profiles and Permission Set
   b. Org Wide Default
   c. Roles
   d. Sharing Rules
   e. Manual Sharing
10. Reports and Dashboards
   a. Custom Report Types
   b. Dynamic Dashboards
   c. Report and Dashboards Sharing

	30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:	
CO1:	Apply data modelling techniques to design and configure custom objects, fields, and relationships in Salesforce.
CO2:	Apply advanced data management and customization techniques in Salesforce to enhance data organization and user experience
CO3:	Evaluate and recommend appropriate Salesforce user setup and security settings to control access and permissions.
CO4:	Develop advanced automation solutions using Process Builder and Visual Workflow to meet complex business requirements.
CO5:	Evaluate and recommend appropriate reporting and analytics strategies based on business requirements.

TEXT BOOKS:

1.	Enrico Murru, "Salesforce Advanced Administrator Certificate", Packt Publishers, 2019.
2.	Rakesh Gupta, "Mastering Salesforce CRM Administration", Packt Publishers, 2017.

REFERENCES:

1.	Wes Nolte, Jeff Douglas, "Salesforce Handbook", Includes Winter '11 Publishers, 2011.
2.	Tom Wong, Liz Kao, Matt Kauff, "Salesforce.com for Dummies", Fifth Edition, Expert Salesforce.com Consultants, 2015.
3.	Rakesh Gupta, "Learning Salesforce Visual Workflow and Process Builder", Packt Publishers, Second Edition, 2017.
4.	Jonathan Keel, "Salesforce.com Lightning Process Builder and Visual Workflow", Apress, 2016.

Mapping of Course Outcomes to Program Outcomes

Course outcomes	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO2	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO3	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO4	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO5	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-

3-High, 2- Medium, 1-Low

CS22713	**MODERN APPLICATION DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSEOBJECTIVES:

- Create a deep understanding of how Software and Hardware work together.
- Introduce the students to Flutter.

- Introduce the students to Firebase.
- Help the students to solve real life problems with Data Oriented thinking.
- Motivate the students to follow Clean Coding Principles.

UNIT I	Story of Hidden Language	6

Codes and Combinations - Braille and Binary Codes - Anatomy of a Flashlight - Telegraphs and Relays - Bit by bit by bit - Logic and Switches - A binary adding Machines - Bytes and Hex - Assemblage of Memory - From Abaci to Chips - ASCII and a cast of Characters - The Operating System – Languages - High and Low - The Graphical Revolution.

UNIT II	Flutter	6

Dart: Syntax Basics - Types – Functions - Control Flow - Error Handling - Classes & Objects - Class Modifiers – Concurrency - Null Safety - Core Libraries, Flutter: Widgets – Layout - Assets & Media - Platform Integration.

UNIT III	Firebase	6

Introduction - Authentication - Firestore Database – Data Modeling - Storage - Hosting – Cloud Messaging - Cloud Functions – In App Messaging - Security Rules - Cost Estimation – Extensions.

UNIT IV	Data Management	6

Understand: Emergence of NoSQL – Data Models – Consistency - Map Reduce, Implement: Key-Value Database – Document Database – Column-Family Database – Graph Database – Schema Migration – Polyglot Persistence – Choosing Database

UNIT V	Three Layer Architecture	6

Introduction – Paradigm Overview - SOLID Principles – Component Principles – Architecture – Boundaries – Policy – Business Rules - Clean Architecture - Details

	30 PERIODS

PRACTICAL EXERCISES

1. Study and Installation of Flutter Multi Platform Environment.
2. Develop a Flutter application using Firebase Authentication.
3. Develop a Flutter application that performs CRUD operations with Firestore Database.
4. Develop a ToDo application with authentication, Firestore, and Image upload.
5. Develop a Flutter application that persists data using Hive.
6. Mini Project.

	30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Create PWA with responsive UI for Mobile view and Desktop view
CO2:	Create PWA with Firebase Auth and Firestore
CO3:	Create PWA using Flutter deploy using Firebase
CO4:	Develop a Architecture for Offline first PWA
CO5:	Develop an Offline first PWA with Flutter, Firebase, Hive

TEXT BOOKS:

1.	Robert Cecil Martin, "Clean Architecture: A Craftman's Guid to Software Structure and Design", Pearson Publication, 2017.
2.	Robert Cecil Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", Pearson Publication, 2008.

REFERENCES:	
1.	Martin Fowler, Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional Publication, 2012.
2.	Charles Petzold, "Code: The Hidden Language of computer Hardware and Software", Second Edition, Pearson Education, 2022.
3.	Documentation of Flutter: docs.flutter.dev
4.	Documentation of Dart: dart.dev/guides
5.	Documentation of Firebase: firebase.google.com/docs

Mapping of Course Outcomes to Program Outcomes

Course outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO2	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO3	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO4	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO5	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-
CO	2	1	1	1	2	-	-	-	-	-	1	1	1	-	-

3-High, 2- Medium, 1-Low

VERTICAL 3

CREATIVE MEDIA

AD22531	AUGMENTED REALITY/ VIRTUAL REALITY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues.
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- To know the intricacies of these platform to develop PDA applications with better optimality.

UNIT I	INTRODUCTION	6

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): 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	CONTENT CREATION CONSIDERATIONS FOR VR	6

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment.

UNIT IV	VR ON THE WEB & VR ON THE MOBILE	6

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics.

UNIT V	APPLICATIONS	6

Medical -military applications-robotics applications- Advanced Real time Tracking- other applications- games, movies, simulations, therapy.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender
2.	Download objects from asset store and apply various lighting and shading effects.
3.	Model three dimensional objects using various modelling techniques and apply textures over them.
4.	Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
5.	Add audio and text special effects to the developed application
6.	Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
7.	Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
8.	Develop simple MR enabled gaming applications.

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Identify problem statements and function as a member of an engineering design team.

CO2:	Utilize technical resources.
CO3:	Design a system to meet given specifications with realistic engineering constraints.
CO4:	Propose technical documents and oral presentations related to design projects.
CO5:	Apply VR in real time applications in the field of gaming and medical.

TEXT BOOKS:	
1.	C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc.,2018
2.	Jason Jerald, "The VR Book: Human-Centred Design for Virtual Reality", Association for Computing Machinery and Morgan & Claypool, New York, NY, USA, 2020.

REFERENCES:	
1.	Dieter Schmalstieg & Tobias Hollerer, "Augmented Reality: Principles and Practice (Usability)", Pearson Education (US), Addison-Wesley Educational Publishers Inc., New Jersey, United States, 2016. ISBN: 9780321883575
2.	Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison-Wesley Professional; 1 edition, 2016.
3.	Robert Scoble & Shel Israel, "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything", Patrick Brewster Press; 1 edition, 2016.
4.	Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O'Reilly Media; 1 edition, 2015.
5.	Jos Dirksen, "Learning Three.js: The JavaScript 3D Library for WebGL" - Second Edition, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

CO - PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
CO2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
CO3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22532	**MULTIMEDIA AND ANIMATION**	L	T	P	C

			2	0	2	3

COURSE OBJECTIVES:

- To re-iterate and explore the basic concepts emphasized in core multimedia courses
- To provide a holistic view about the core and advanced animation principles
- To explore the application avenues for the Multimedia and Animation concepts.

UNIT I	INTRODUCTION TO COMPUTERS & NETWORKS	6

Elements of Multimedia Systems: Text, Image, Audio and Video- Multimedia Hardware: Input Devices, Output Devices and Storage Devices, Multimedia Software - Multimedia communication systems.

UNIT II	CONTENT DEVELOPMENT & DISTRIBUTION	6

Desktop publishing (Coral Draw, Photoshop, Page maker) - Multimedia Animation &Special effects (2D/3D animation, Flash) - Social Networking &Publishing (Blogging, Facebook, Youtube, Instagram etc.) - Content Distribution Systems (CD/DVD, Internet, Radio, Television)

UNIT III	ART & SCIENCE OF MULTIMEDIA	6

Audio fundamentals (Audio quality, formats and devices) - Understanding Image and Video (Resolution, Color, Video standards, formats) - Film and Digital photography (technology, techniques, composition & lighting etc.)- Introduction to Printing technology.

UNIT IV	PROGRAMME PRODUCTION TECHNIQUES	6

The Media Industry: Structure and Strategies - Audio-Video programme production (Concept to Mastering) - Compositing and Audio-Video Editing- Web Design and Publishing (Web design and development).

UNIT V	MEDIA MANAGEMENT & MARKETING	6

Ownership of Media, Media as Business & Media Economics- Income sources of Different Media - Government Policies for Media Ownership - Career avenues in multimedia.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	To study Multimedia Hardware system: a) Input Devices B) Output Devices C) Communication Devices
2.	To study the Multimedia Basic Software Tools
3.	Design a poster for 2019 election and show the difference in resolution and quality for Print and Web
4.	Pick any picture of a magazine cover page make changes using selection tool
5.	Draw a landscape using multiple Layers
6.	Paint a scenery of a park using different tools of Photoshop
7.	Take images from different Images Sources show variation in Resolution
8.	Use Effective Cropping Techniques to design a collage

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:	
CO1:	Explain Multimedia and how it works.
CO2:	Explain multimedia components using various tools and techniques.
CO3:	Outline the way of manipulating multimedia systems.
CO4:	Summarize the types of media format and their properties.
CO5:	Analyze and interpret Multimedia data.
TEXT BOOKS:	
1.	Tay Vaughan, "Multimedia: Making it Work" (with CD), 9th Edition, McGraw Hill Education, 2021.
2.	Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021.
REFERENCES:	
1.	Ranjan Parekh, Principles of Multimedia, 2nd Edition, McGraw Hill Education, 2013.
2.	Malay K. Pakhira, "Computer Graphics, Multimedia and Animation", Second Edition, PHI Learning Pvt. Ltd., 2010.
3.	Atul P. Godse, Dr. Deepali A. Godse, "Multimedia and Animation", Technical Publications, 2020, M12,1 – 218.
4.	Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.
5.	Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
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CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22631	**VIDEO CREATION AND EDITING**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OBJECTIVES:	
• To explore all aspects of video production from story idea to camera techniques to capturing and editing.	
• Develop editing software to manipulate footage and create transitions and effects.	
• To use a variety of hardware and software to capture and edit video and audio elements to produce a short video.	

UNIT I	INTRODUCTION	6

Creating a storyboard -Creating an original sequence - Organizing and planning a sequence - Managing video clips - Identifying audience, purpose, and goals Design skills - Identifying shot techniques - Identifying lighting techniques - Identifying audio techniques -Understanding the video workflow - Using music, voiceover, and images to enhance a story Communication skills -Understanding copyright issues -Communicating message to the audience Technical skills - Adobe Premiere Pro - Basic understanding of Adobe Premiere Pro -Importing video and audio files -Using Project panel - Adding, moving, deleting, and trimming clips - Adding transitions and credits - Adding audio.

UNIT II	ADVANCED VIDEO EDITING	6

Putting clips in motion - Multi-camera editing - Editing and Mixing Audio - Sweeting Sound - Adding Video Effects - Color correction and Grading - Video editing (Trailer, Adv. Making etc...)- Effects.

UNIT III	CREATING AND EDITING EFFECTS	6

Creating Titles using text and images - Adding Sub-titles - Storytelling with images - Editing using video effects - 180-degree dialogue shot editing - Editing a Montage.

UNIT IV	DOCUMENTARY EDITING	6

Shooting and editing a documentary- Shoot/Aquring a footage -Shooting and Editing a documentary-rough cuts - Shooting and Editing a documentary-Syncing Audio and Video - Shooting and Editing a documentary-Final cut and Export to media format.

UNIT V	APPLICATIONS	6

Lyric Video Project- My Crazy Day Project- Lip Dub Project- Cribs Project- Reverse Movie Trailer Project- News Package Elements and Creation.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:	
1.	Practice and use Keyboard shortcuts
2.	Explore the software and its tools
3.	Prepare a log sheet of 3 to 5 minutes of any video footage which you recorded in Mini DV Tape.
4.	Record all the transitions of any news-based program during the editing process and make a separate cd for the same.
5.	Shoot a PTC on any news-based topic and make a rough and fine cut, then place here in a CD

6.	Place here a video footage in cd with using of chroma keying.
7.	Create a package with Montage for news/non-news story (30 sec -1minutes) and place here with cd.
8.	Recreate a scene from a movie.
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate competency in all aspects of broadcast productions.
CO2:	Demonstrate competency in technical aspects of productions.
CO3:	Interpret video footage for selective editing (storytelling).
CO4:	Show videos in a professional manner using digital non-linear editing techniques.
CO5:	Make use of light and sound techniques to enhance video productions.

TEXT BOOKS:

1.	A. Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.
2.	Oges Marques, "Practical Image and Video Processing Using MATLAB", Wiley and Sons (IEEE Press), 2021.

REFERENCES:

1.	Adobe Creative Team ,Adobe Premiere pro CS6 Classroom in a book, Adobe Press, 2017.
2.	Adele Droblas, Adobe Premier Pro CS3 Bible, John Wiley & Son, 2017.
3.	Adobe Creative Team, Adobe Premiere pro CC Classroom in a book, Adobe Press, 2017.
4.	Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5.	Alan C. Bovik, "Handbook of Image and Video processing", Second Edition, Academic Press, 2015.

CO - PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
CO2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
CO3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

AD22632	VISUAL EFFECTS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To develop advanced compositing skills with a focus on various pipeline workflows and shot finishing.
- To practice advanced compositing techniques using plates from actual film projects.
- To learn stereo compositing techniques and workflows.
- Implement the design using specific mobile development frameworks.

UNIT I	NEED FOR AND THE IMPORTANCE OF HUMAN AND VISUAL COMMUNICATION	6

Communication an expression, skill and process, Understanding Communication: SMRC-Model. Types of Media – Traditional media, Print media, Electronic media and any other new media.

UNIT II	FUNDAMENTALS OF DESIGN	6

Definition. Approaches to Design, Centrality of Design, Elements/Elements of Design: Line, Shape, Space, Colour, Texture. Form Etc. Principles of Design: Symmetry. Rhythm, Contrast, Balance Mass/Scale etc. Design and Designers (Need, role, process, methodologies etc.)

UNIT III	BASICS OF GRAPHIC DESIGN	6

Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual thinking, associative techniques, materials, tools (precision instruments etc.) design execution, and presentation.

UNIT IV	INTRODUCTION AND INTERFACE NAVIGATION TO BLACKMAGIC	6

Design Fusion and Adobe After Effects - Creating a Basic animation using effects and Pre-sets - Animating text - Working with shape Layers - Animation - Puppet tools - Color Correction - Building 3D objects - Using 3D features - Camera Tracking - Particle Effect - 3D compositing - Motion Graphics - Keying - Motion Path.

UNIT V	INTRODUCTION TO CHANNELS / NODES OF TRANSFORMATIONS	6

Chroma keying / animation - Rotoscopy - introduction (image) - Rotoscopy - Techniques (video) - Rotopaint / animations - Animating text / 3D text - Particles / camera - Tracking – 2D and 3D camera - Color correction -Match moving – preparing live shoot - Match moving – technique-

application.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Comping 3D elements into footage.
2.	Implementation of creating effect stacks.
3.	Implementation of Point and Planar tracking.
4.	Implementation of Creature and gore effects.
5.	Implementation of Models, explosions and props.
6.	Implementation of Set building and camera tricks.
7.	Create robust and customizable shot lists
8.	Compose VFX for motion

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate and execute delivery guidelines for feature film and television production pipelines.
CO2:	Evaluate key visual effects technologies and how they are used to create advanced visual effects.
CO3:	Compose a shot using multiple render passes created from 3D packages.
CO4:	Construct complex visual effects shots incorporating live action, 2D and 3D generated imagery.
CO5:	Compose stereoscopic footage for use in a 3D production.

TEXT BOOKS:

1.	Brinkmann, Ron, "The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Second Edition, USA: Morgan Kaufmann, 2018.
2.	Wright, Steve, "Digital Compositing for Film and Video", USA: Focal, 2020.

REFERENCES:

1.	Lester E, "Visual Communications: Images with Messages", Thomson Learning, 2000.
2.	Philip Hayward, "Picture this: Media Representation of Visual Arts and artists", University of Luton Press, 2012.
3.	Adobe Creative Team, "Adobe After Effects CS6 Classroom in a Book", 1st Edition, Adobe Press, 2012.
4.	Mark_Christiansen, "Adobe After Effects CS5 Visual", Adobe Press, 2010.
5.	Blackmagic Design, Fusion 7 User Manual, 2014.

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
CO2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
CO3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22731	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

To provide in-depth knowledge about
- Data Compression
- Text Compression and Audio Compression
- Image and Video Compression

UNIT I	**INTRODUCTION**	6

Special features of Multimedia – Graphics and Image Data Representations -Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector qua ntization theory – Evaluation techniques – Error analysis and methodologies

UNIT II	**TEXT COMPRESSION**	6

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III	**AUDIO COMPRESSION**	6

Audio compression techniques - μ- Law and A- Law companding. Speech compression-waveform codecs-source codecs- hybrid codecs-Shorten compressor, Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

UNIT IV	**IMAGE COMPRESSION**	6

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG, JBIG2 Standards

UNIT V	**VIDEO COMPRESSION**	**6**

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Write a program that loads an external jpeg image into a Buffered Image bimg
2.	Load a true color external image called "myImage.jpg" into a buffered image
3.	Create a method that makes 50% opaque the input image
4.	Write an application or applet that Reads a GIF or JPEG image into an Image object Extract a square region of pixels from the centre of the image, the dimensions ofthis region being half those of the image Create a new Image from the extracted data. Displays the new image
5.	Write a program that reads JPEG-compressed grayscale image data into a Buffered lmage and then iterates over all pixels in the image to determine the minimum, maximum and mean grey levels, writing this information to System.out
6.	Create a method that takes two buffered images as arguments and returns the average of the two buffered images
7.	Write a method that takes a buffered image as an argument, convert the buffered image into grayscale and returns the converted image
8.	Display RGB values of the first row of the image starting from column 1 to 10

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the basic data compression algorithms and show how they work on a particular input.
CO2:	Demonstrate compression algorithms.
CO3:	Compare efficiency in terms of speed and compression ratio.
CO4:	Examine models of data.

CO5:	Apply real time video compression.

TEXT BOOKS:

1.	Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 2nd Edition, 2020.
2.	Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis, 2019.

REFERENCES:

1.	David Salomon, "Data Compression – The Complete Reference", Springer Verlag New York Inc., 2nd Edition, 2021.
2.	Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards", CRC press, 2013.
3.	Peter Symes, "Digital Video Compression", McGraw Hill Pub., 2014.
4.	Mark Nelson, "Data compression", BPB Publishers, New Delhi, 2010.
5.	Mark S.Drew, Ze-Nian Li, "Fundamentals of Multimedia", PHI, 1st Edition, 2013.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
CO2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
CO3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22732	**AI IN DRONE TECHNOLOGY**	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of drone concepts.
- To learn and understand the fundaments of design, fabrication and programming of drone.
- To impart the knowledge of an flying and operation of drone.
- To know about the various applications of drone.
- To understand the safety risks and guidelines of fly safely.

UNIT I	**INTRODUCTION TO DRONE TECHNOLOGY**	6

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Opportunities/applications for entrepreneurship and employability.

UNIT II	DRONE DESIGN, FABRICATION AND PROGRAMMING	6

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program -Install program on computer- Running Programs.

UNIT III	DRONE FLYING AND OPERATION	6

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices.

UNIT IV	DRONE COMMERCIAL APPLICATIONS	6

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution.

UNIT V	FUTURE DRONES AND SAFETY	6

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Installation of agriculture drone
2.	MagDrone R4 installation on DJI M300 RTK drone
3.	Study about UAV Flight Planning
4.	Establish Ground Control Points
5.	Boundary setting and Data Collection by using Flight Mapping
6.	Measure UAV Data Processing Orthomosaic Maps using 3D Point Cloud
7.	Calculate Aerial Mapping using Drones
8.	Calculate Topography Mapping Using Drones

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Identify the type of drone technology, drone fabrication and programming.
CO2:	Execute the suitable operating procedures for functioning a drone
CO3:	Select appropriate sensors and actuators for Drones
CO4:	Develop a drone mechanism for specific applications
CO5:	Create the programs for various drones

TEXT BOOKS:

1.	Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and

	Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc.
2.	Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones ", Maker Media, Inc, 2016.

REFERENCES:	
1.	Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.
2.	John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
3.	Sachi Nandan Mohanty, J.V.R. Ravindra, G. Surya Narayana, Chinmaya Ranjan Pattnaik, Y. Mohamed Sirajudeen, "Drone Technology: Future Trends and Practical Applications, First published:22 May 2023, Print ISBN:9781394166534 |Online ISBN:9781394168002 |DOI:10.1002/9781394168002 © 2023 Scrivener Publishing LLC.
4.	Tahir, M., Shah , S. , II , Zaheer , Q. , Aircraft system design for an anti-terrorist unmanned aerial vehicle . 2019 International Conference on Engineering and Emerging Technologies (ICEET) , pp. 1 – 8 , 2019 .
5.	US Military News, 6th generation fighters are coming, Apr. 25, 2021 . [Online]. Available: https://www.youtube.com/watch?v=8YkQs3lm85k&list=PLNGzO_h3wEbN zjJmmQ7q3m7aOQVJBTOJl&index=16 . [Accessed: 29-Jun-2022].

CO- PO & PSO MAPPING

CO	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1	-	-	-	-	1	1	1	2	2	1	2
CO2	2	3	1	3	1	-	-	-	3	2	2	3	3	3	1
CO3	2	2	3	3	2	-	-	-	3	1	1	2	1	1	1
CO4	2	2	1	2	1	-	-	-	1	3	2	1	1	1	2
CO5	2	3	3	2	1	-	-	-	3	1	2	1	3	1	2
AVG	2	2	2	2	1	-	-	-	2	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

VERTICAL 4

COMPUTING TECHNIQUES

AD22541	PARALLEL COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- To understand different parallelism techniques.
- To know parallel architecture.
- To learn about parallel algorithm design.
- To understand parallel programming.
- To learn about the interpretation of parallel programming.

UNIT I	INTRODUCTION	6

Historical progression leading to current state – types of parallelism including temporal, data and functional. Instructional level parallelism – pipelined processors – super scalar processors — VLIW processors — multithreaded processors — proposed future processors including trace, multi scalar and super flow – case studies

UNIT II	PARALLEL ARCHITECTURES	6

Classification — inter connection networks — vector computers – shared memory parallel computers – cache coherence – distributed shared memory parallel computers – message passing parallel computers — cluster of workstations.

UNIT III	PARALLEL ALGORITHMS PLATFORM	6

Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models.

UNIT IV	PARALLEL PROGRAMMING DESGN	6

Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

UNIT V	COMPILER TRANSFORMATIONS AND PERFORMANCE EVALUATION	6

Dependence analysis loop transformations – transformations for parallel computers including data layouts, computational and communication optimization, Performance Metrics –performance lows – scalability – performance measurement books.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Implementation of OpenMP basic programs such as Vector addition, Dot Product.
2.	Implementation of OpenMP loop work-sharing and sections work-sharing.

3.	Implementation of OpenMP combined parallel loop reduction and orphaned parallel loop reduction.
4.	Implementation of OpenMP Matrix multiply (specify run of a GPU card, large scale data. Complexity of the problem need to be specified).
5.	Implementation of MPI with Communication between MPI process.
6.	Implementation of MPI with Advanced communication between MPI process.
7.	Implementation of MPI with Collective operation with 'synchronization'.
8.	Implementation of MPI with Collective operation with 'data movement'.
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the parallel computing techniques.
CO2:	Describe the parallel computing architecture.
CO3:	Illustrate the design of parallel algorithms.
CO4:	Develop parallel program.
CO5:	Evaluate compiler interpretation of parallel programming.

TEXT BOOKS:

1.	V. Rajaraman and C. Siva Ram Murthy, "Parallel Computers — Architecture and Programming", Prentice-Hall of India, Second Edition, 2022.
2.	Subodh Kumar, "Introduction to Parallel Programming", Cambridge University Press, New edition, 2022.

REFERENCES:

1.	Hwang K. Briggs F.A. – Computer Architecture and parallel processing – MCGraw Hill – Third Edition 2017.
2.	Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Pearson Education, Second edition, 2014.
3.	Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2016.
4.	B. Wilkinson and M. Allen, "Parallel Programming – Techniques and applications using networked workstations and parallel computers", Second Edition, Pearson Education, 2015.
5.	M. J. Quinn, "Parallel Computing – Theory and Practice", Second Edition, Tata McGraw-Hill Publishing Company Ltd., 2013.

CO - PO & PSO MAPPING

CO	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	3	1	2	1	1	-	-	-	2	2	2	1	3	2	2
CO3	2	1	1	1	-	-	-	-	1	1	1	3	1	2	1

CO4	2	2	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22542	CLOUD COMPUTING METHODS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the concept of cloud computing.
- To know the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To understand the emergence of cloud as the next generation computing paradigm.

UNIT I	INTRODUCTION	6

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticityin Cloud — On-demand Provisioning.

UNIT II	CLOUD ENABLING TECHNOLOGIES	6

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualizations – Implementation Levels ofVirtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT III	CLOUD ARCHITECTURE, SERVICES AND STORAGE	6

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public,Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV	RESOURCE MANAGEMENT AND SECURITY IN CLOUD	6

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	6

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine —— Open Stack – Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation.

		TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

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

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Summarize the main concepts, key technologies, strengths and limitations of cloud computing.
CO2:	Describe the key and enabling technologies that help in the development of cloud.
CO3:	Illustrate the use of cloud architecture, service and delivery models.
CO4:	Explain the core issues of cloud computing such as resource management and security.
CO5:	Summarize the use of resource management and the security in cloud.
CO6:	Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and usage of cloud.

TEXT BOOKS:

1.	Sunilkumar Manvi, Gopal Shyam, "Cloud Computing Concepts and Technologies", CRC Press, 1st Edition, 2021.
2.	Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:

1.	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2014.

3.	Derrick Rountree and Ileana Castrillo, "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice", Syngress, Edition, November 2013.
4.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.
5.	James Turnbull, The Docker Book, OReilly Publishers, 2014.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	3	-	-	-	-	2	3	3	1	3	1	1
CO2	3	1	3	1	1	-	-	-	2	2	3	1	2	2	2
CO3	2	1	1	1	-	-	-	-	1	1	1	3	1	2	1
CO4	3	2	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	3	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22641	OPTIMIZATION TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models.

UNIT I	LINEAR MODELS	6

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods tosolve LPP- Simplex Method- Big M method, Two-Phase method

UNIT II	INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS	6

Integer programming: Branch and bound method- Transportation and Assignment problems - Travelling salesman problem.

UNIT III	PROJECT SCHEDULING	6

Project network -Diagram representation – Floats - Critical path method (CPM) –
PERT- Cost considerations in PERT and CPM

UNIT IV	CLASSICAL OPTIMISATION THEORY	6

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method,
Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

UNIT V	QUEUING MODELS	6

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents
of a Queuing system, Service facility, Queue discipline, Single channel models, multiple
service channels.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Implementation of optimization.
2.	Introduction to MATLAB (Study Experiment)
3.	Implementation of Classical Optimization Techniques.
4.	Implementation of Unconstrained Optimization: Elimination Methods.
5.	Implementation of Unconstrained Optimization: Interpolation Method.
6.	Implementation of Unconstrained Optimization: Direct Root Methods.
7.	Implementation of Constrained Optimization: Equality Constraints.
8.	Implementation of Constrained Optimization: Inequality Constraints.

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Solve linear programming problems (LPP).
CO2:	Apply Transportation and assignment techniques.
CO3:	Identify and solve project scheduling using PERT and CPM.
CO4:	Examine the constrained and unconstrained problems.
CO5:	Evaluate the various queuing models.

TEXT BOOKS:

1.	Frederick S. Hillier, Gerald J. Lieberman, Bodhibroto Nag, Preetam Basu, "Introduction to Operations Research (SIE)", 11th Edition, Tata McGraw Hill, 2021.
2.	Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCES:

1.	ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.

2.	J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3.	Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4.	Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt. Ltd. New Delhi, 2014.
5.	Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2013.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	3	-	-	-	-	2	3	3	1	3	1	1
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CO3	2	1	1	1	-	-	-	-	1	1	1	3	1	2	1
CO4	3	2	2	2	-	-	-	-	2	1	2	2	1	2	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	3	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22642	**BIO-INSPIRED OPTIMIZATION TECHNIQUES**	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:
- To understand fundamental topics in bio-inspired optimization techniques.
- To Learn the collective systems such as ACO, PSO, and BCO.
- To develop skills in biologically inspired algorithm design with an emphasis on solvingreal world problems.
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

UNIT I	**INTRODUCTION**	6

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

UNIT II	SWARM INTELLIGENCE	6
Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards ArtificialAnts – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.		

UNIT III	NATURAL TO ARTIFICIAL SYSTEMS	6
Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.		

UNIT IV	SWARM ROBOTICS	6
Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.		

UNIT V	CASE STUDIES	6
Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesman problem.		

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

PRACTICAL EXERCISES:	
1.	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4.	Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6.	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the

	accuracy, precision, and recall for your data set.
7.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

COURSE OUTCOMES

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

CO1	Infer with the basics of several biologically inspired optimization techniques.
CO2	Define the basics of several biologically inspired computing paradigms.
CO3	Demonstrate bio-inspired computing method for any application and data set.
CO4	Compare the major bio-inspired computing methods.
CO5	Demonstrate Swarm Intelligence algorithms and Bio-inspired technique with other traditional algorithms.

TEXT BOOKS

1.	A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, First Edition, Reprint 2021.
2.	Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2020.

REFERENCES

1.	Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2014.
2.	Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2012.
3.	Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Inc., 2015.
4.	Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2018.
5.	C. Ebelhart et al., "Swarm Intelligence", Morgan Kaufmann, 2014.

CO – PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1

CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 – low, 2 – medium, 3 – high, '-' – no correlation

AD22741	AI AND ROBOTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To study the Robot Locomotion and types of robots.
- To explore the kinematic models and constraints
- To learn sensors of robots and image processing for robotics.
- To understand the methods for mobile robot Localization.
- To study the Path planning and Navigation of Robots.

UNIT I	ROBOT LOCOMOTION	6

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

UNIT II	MOBILE ROBOT KINEMATICS	6

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace –advanced kinematics ─ motion control.

UNIT III	ROBOT PERCEPTION	6

Sensors for mobile robots – computer vision for robots – image processing for robotics – place recognition – range data.

UNIT IV	MOBILE ROBOT LOCALIZATION	6

Introduction to localization ─ noise and aliasing ─ localization-based navigation ─ belief representation – map representation – probabilistic map-based localization – autonomous map building.

UNIT V	ROBOT PLANNING AND NAVIGATION	6

Planning and navigation – planning and reacting – path planning – obstacle avoidance – navigation architectures.

	TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1.	Implementation of toy problems.

2.	Developing agent programs for real world problems.
3.	Implementation of constraint satisfaction problems.
4.	Implementation and Analysis of DFS and BFS for an Application.
5.	Implementation of block world problem.
6.	Implementation of learning algorithms for an application.
7.	Development of ensemble model for an application.
8.	Implementation of NLP programs.

TOTAL: 30 PERIODS

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Illustrate the types of Robots.
CO2	Summarize the kinematics of Robots.
CO3	Analyze the image processing algorithms.
CO4	Apply Localization algorithms.
CO5	Develop Path planning methods for navigation.

TEXT BOOKS:

| 1. | Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2022. |
| 2. | R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, "Introduction to Autonomous Mobile Robots", Second Edition, MIT Press, Second Edition, 2011. |

REFERENCES:

1.	Dan W. Patterson, "Introduction to AI and ES", Pearson Education, January 2015.
2.	Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, July 2017.
3.	Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2017.
4.	S K Saha, Introduction to Robotics, Tata McGraw-Hill, Second Edition, 2017.
5.	Mikell P. Groover, "Industrial Robotics", McGraw Hill, 2nd edition, 2017.

CO - PO & PSO MAPPING

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3

CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22742	ARTIFICIAL NEURAL NETWORKS AND ITS APPLICATIONS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

UNIT I	INTRODUCTION	6

A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT II	SINGLE LAYER PERCEPTRONS	6

Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT III	BACK PROPAGATION	6

Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT IV	SELF-ORGANIZATION MAPS (SOM)	6

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification.

UNIT V	NEURO DYNAMICS	6

Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment.

	TOTAL: 30 PERIODS
PRACTICAL EXERCISES	

1.	Write a program to implement DFS
2.	Write a program to implement BFS
3.	Write a Program to find the solution for travelling salesman Problem
4.	Write a program to implement Simulated Annealing Algorithm
5.	Write a program to find the solution for wampus world problem
6.	Write a program to implement Hill Climbing Algorithm
7.	Build a bot which provides all the information related to you in college
8.	Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Define the fundamentals such as neural networks and their applications.
CO2	Summarize how to train the neural networks to solve linear separability with perceptions.
CO3	Illustrate the use of Back propagation algorithm and setting the parameter values.
CO4	Analyze the clustering process using neural networks and Adaptive Pattern Classification.
CO5	Apply the principles of Artificial Neural Networks and Neuro dynamics.

TEXT BOOKS:

1.	Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson Education India, 2020.
2.	Alma Y Alanis, Nancy Arana-Daniel, Carlos Lopez-Franco, "Artificial Neural Networks for Engineering Applications" ,1st Edition, Academic Press, 2019.

REFERENCES:

1.	B. Vegnanarayana, "Artificial Neural Networks" - Prentice Hall of India P Ltd 2014.
2.	Li Min Fu, "Neural Networks in Computer Intelligence", Mc Graw Hill Education 2013.
3.	Deb S.R., "Robotics Technology and Flexible Automation", 2nd edition, Tata McGraw – Hill Publis Robotics: Control and Programming. 2014.
4.	Jacek M. Zurada, "Introduction to Artificial Neural Systems", JAICO Publishing House Ed. 2012.
5.	S K Saha, Introduction to Robotics, Tata McGraw-Hill, ISBN: 9789332902800, Second Edition, 9789332902800, 2019

CO - PO & PSO MAPPING

CO	POs 1	2	3	4	5	6	7	8	9	10	11	12	PSOs 1	2	3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

(LIST OF SUBJECTS OFFERED BY AI&DS TO OTHER DEPARTMENT STUDENTS)

OPEN ELECTIVE COURSE - I

AD22681	INTRODUCTION TO AI AND ML	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- Acquire advanced Data Analysis skills.
- Stay industry relevant and grow in your career.
- Create AI/ML solutions for various business problems.
- Build and deploy production grade AI/ML applications.
- Apply AI/ML methods, techniques and tools immediately.

UNIT I	INTRODUCTION TO DATA SCIENCE AND AI & ML	9

Data Science, AI & ML - Use Cases in Business and Scope - Scientific Method - Modeling Concepts - CRISP-DM Method.

UNIT II	DATA EXPLORATION METHODS	9

Data exploration (histograms, bar chart, box plot, line graph, scatter plot) -Qualitative and Quantitative Data - Measure of Central Tendency (Mean, Median and Mode), - Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles), Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation).

UNIT III	STATISTICAL ANALYSIS	9

Initial Data Analysis - Relationship between attributes: Covariance, Correlation Coefficient, Chi Square -Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution) and other statistical graphs Probability -Probability (Joint, marginal and conditional probabilities).

UNIT IV	FOUNDATIONS FOR AI	9

AI- Application areas - AI Basics (Divide and Conquer, Greedy, Branch and Bound, Gradient Descent) - NN basics (Perceptron and MLP, FFN, Back propagation).

UNIT V	FOUNDATIONS FOR ML	9

ML Techniques overview - Validation Techniques (Cross-Validations) -Feature Reduction / Dimensionality reduction - Principal components analysis (Eigen values, Eigen vectors, Orthogonality).

		TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Summarize the concepts of Data Science.
CO2:	Apply data exploration methods.
CO3:	Apply AI/ML methods, techniques and tools.
CO4:	Develop AI applications.
CO5:	Develop ML solutions for various business prob.

TEXT BOOKS:

1.	Marco Gori, Alessandro Betti, Stefano Melacci, "Machine Learning: A Constraint-Based Approach", Elsevier Science, Second Edition, 2023.
2.	Ethem Alpaydin, "Introduction to Machine Learning", Second Edition, MIT Press, 2020.

REFERENCES:

1.	Vinod Chandara S S and Anand Hareendran S, "Artificial Intelligence and Machine Learning", Prentice Hall India Learning Private Limited, 2018.
2.	Oliver Theobald, "Machine Learning For Absolute Beginners: A Plain English Introduction", Scatterplot Press , Second Edition, 2017.
3.	Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2016.
4.	Stuart Russell & Peter Norvig, "Artificial Intelligence – A Modern Approach", CreateSpace Independent Publishing Platform, 2016.
5.	N. Gupta, R. Mangla, "Artificial Intelligence Basics: A Self-Teaching Introduction", Mercury Learning and Information, 2020.

CO's- PO's & PSO's MAPPING

CO's	PO's 1	2	3	4	5	6	7	8	9	10	11	12	PSO's 1	2	3
1	2	2	3	3	1	-	-	-	2	3	3	1	2	1	1
2	2	1	1	1	1	-	-	-	2	2	3	1	3	2	2
3	3	1	2	1	-	-	-	-	2	1	1	3	1	2	1
4	3	2	2	2	1	-	-	-	2	1	2	2	1	3	3
5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	3	2	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22682	INTRODUCTION TO BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide an in-depth coverage of various topics in big data.
- To focus on the state-of-the-art technologies, tools, architectures, and systems that constitutes big-data computing solutions.
- To illustrate big data solution for wide spectrum of emerging technologies.
- To illustrate the concept of Indexing and data storage.

UNIT I	BIG DATA OVERVIEW	9

Big Data Overview - Big Data Attributes - Relationship Between Cloud Computing and Big Data - Relationship Between IoT and Big Data - Examples of Big Data Analytics.

UNIT II	BIG DATA GENERATION AND ACQUISITION	9

Big Data Generation - Enterprise Data, IoT Data, Internet Data, Data Generation from Other Fields, Big Data Acquisition- Data Collection, Data Transportation, Data Pre-processing, Clustering - Classification – Regression

UNIT III	BIG DATA ANALYSIS	9

Architecture for Big Data Analysis - Real-Time vs. Offline Analysis, Analysis at Different Levels, Tools for Big Data Mining and Analysis, Text Data Analysis, Web Data Analysis, Multimedia Data Analysis.

UNIT IV	DATA STORAGE AND INDEXING	9

Big Data Visualization - Storage System for Massive Data, Distributed Storage System, Storage Mechanism for Big Data - Database Technology, Design Factors, Indexing.

UNIT V	BIG DATA APPLICATIONS	9

Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network-Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Summarize the concept of big data analytics.
CO2:	Explain big data generation and data acquisition.
CO3:	Interpret the core concepts of big data analysis at various levels.
CO4:	Illustrate the concept of indexing and data storage.
CO5:	Apply the concept of big data in emerging fields.

TEXT BOOKS:

1.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Elsevier, 2023.
2.	T. H. Davenport, "Big Data at Work: Dispelling the Myths, Uncovering the Opportunities", Harvard Business Review, 2020.

REFERENCES:

1.	Vahid Dastjerdi, Amir laboratory, University of Melbourne, "Big Data: Principles and Paradigms", Morgan Kaufmann Publishers In, 2018.
2.	P. Simon, "Too Big to Ignore: The Business Case for Big Data", Wiley, 2019.
3.	Dawn E. Holmes, "Big Data: A Very Short Introduction", Oxford University Press, 2019.
4.	B. Devlin, "Business UnIntelligence: Insight and Innovation Beyond Analytics and Big Data", Technics Publications, 2018.

5.	James Warren, Nathan Marz, "Big Data:Principles and best practices of scalable real-time data systems", Manning Publications, 2018.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	3	2	-	-	-	-	2	1	2	1	2	3	3
2	2	3	2	3	1	-	-	-	1	2	2	1	3	3	3
3	2	2	2	1	1	-	-	-	2	3	1	2	2	1	2
4	2	2	3	1	-	-	-	-	1	2	1	2	2	2	2
5	3	2	3	2	1	-	-	-	2	3	1	1	2	1	1
AVG	2	2	2	2	1	-	-	-	2	2	1	1	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

OPEN ELECTIVE – II

AD22781	**FUNDAMENTAL OF ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:
- To learn the basic AI approaches
- To develop problem-solving agents
- To perform logical and probabilistic reasoning
- To create the programming App
- To learn the machines to make informed decisions and inferences under uncertainty

UNIT I	**INTRODUCTION TO AI AND INTELLIGENT AGENTS**	**9**

Introduction to AI – The Foundations of Artificial Intelligence - The History of Artificial Intelligence- The State of the Art- Risks and Benefits - Agents and Environments – concept of rationality – nature of environments – structure of agents.

UNIT II	**PROBLEM SOLVING**	**9**

Solving Problems by Searching- Problem-solving agents – search algorithms – uninformed search strategies - Heuristic search strategies – heuristic functions. Search in Complex Environments- Local search and optimization problems – local search in continuous space.

UNIT III	GAME PLAYING AND CSP	9

Game theory – optimal decisions in games – alpha-beta search – monte-Carlo tree search – Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – the structure of CSP.

UNIT IV	LOGICAL REASONING	9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – Applications

UNIT V	ALGORITHM IMPLEMENTATION	9

Implement basic search strategies 8-Puzzle Problem, Crypt arithmetic – Implement A* Algorithm, Mini-Max algorithm for game playing- Implement constraint satisfaction problems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Explain intelligent agent frameworks
CO2:	Apply problem solving techniques
CO3:	Apply game playing and CSP techniques
CO4:	Solve the problems based on formal logic and predefined rules.
CO5:	Make decisions, predictions, and inferences based on uncertain

TEXT BOOKS:

1.	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth edition, Pearson Education, 2021.
2.	Ryan Richardson Barrett, "Artificial Intelligence in Short", 2024.

REFERENCES:

1.	Tom Taulli , "Artificial Intelligence Basics", First Edition, APress, 2019.
2.	Melanie Mitchell, "Artificial Intelligence", Picador Paper, 2020.
3.	Andrew Lowe, Steve Lawless, "Artificial Intelligence Foundations", BCS, The Chartered Institute for IT, 2020.
4.	Prof. Deepak K. Sharma, Kusuma Varanasi,Mukta Mahesh Deshpande, "Artificial Intelligence Foundations", 2024.
5.	Eric Frick, "Introduction to Artificial Intelligence", Frick Industries LLC, 2024.

CO's- PO's & PSO's MAPPING

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1

AVg.	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22782	DATA VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To learn the basics of data and basic libraries
- To implement data visualization using Matplotlib.
- To understand univariate data exploration and analysis.
- To apply bivariate data exploration and analysis
- To use Data visualization techniques for multivariate and time series data.

UNIT I	INTRODUCTION TO DATA AND BASIC LIBRARIES	9

Data – facets of data– Data preprocessing– Basic Statistical descriptions of Data – Essential Data Libraries for data analytics: Pandas, NumPy, SciPy, Matplotlib.

UNIT II	VISUALIZING USING MATPLOTLIB	9

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors–customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT III	UNIVARIATE ANALYSIS	9

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV	BIVARIATE ANALYSIS	9

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations

UNIT V	MULTIVARIATE AND TIME SERIES ANALYSIS	9

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

	TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Understand the fundamentals of Data libraries.
CO2:	Implement the data visualization using Matplotlib
CO3:	Understand univariate data exploration and analysis
CO4:	Apply bivariate data exploration and analysis
CO5:	Apply Data visualization techniques for multivariate and time series data

TEXT BOOKS:

1. Jaejin Hwang, "Data Analytics and Visualization in Quality Analysis using Tableau ", CRC Press, First Edition, 2021.
2. Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, "Data Visualization: Storytelling Using Data", Wiley, 2022.

REFERENCES:

1. Jonathan Schwabish, "Better Data Visualization" , Columbia Univ Press, 2021

2.	Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3.	Sharada Sringeswara; Purvi Tiwari; U. Dinesh Kumar, "Data Visualization: Storytelling Using Data", Wiley Publication, 2022
4.	OREILLY, "Fundamentals of Data Visualization" A Primer of making informative and compelling figures, Claus O Wilke. 2019
5.	Abha Belorkar, Sharath Chandra Guntuku, Shubhangi Hora and Anshu Kumar, "Interactive Data Visualization with Python" Second Edition, 2019

COURSE WEBSITE:

1.	https://web.njit.edu/~chasewu/Courses/Fall2016/CS644BigData/CS644_BigData_Fall16. Html.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	3	-	-	-	-	2	3	3	3	2	2	2
2	2	2	2	1	1	-	-	-	3	2	3	1	3	1	3
3	2	1	2	1	1	-	-	-	3	2	1	2	2	2	1
4	2	2	2	1	-	-	-	-	1	2	1	3	1	3	2
5	3	1	1	2	1	-	-	-	3	2	1	2	2	2	3
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

OPEN ELECTIVE – III

AD22783	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To interpret the fundamental aspects and principles of AR/VR technologies.
- To relate the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To examine the scientific, technical, and engineering aspect of augmented and virtual reality system.
- To demonstrate the knowledge about AR/VR application development.
- To execute the technologies involved in the development of AR/VR based applications.

UNIT I	INTRODUCTION	9

Introduction to Virtual Reality-Trajectories and Hybrid Space-Three I's of VR – Early Commercial VR Technology– Five Classic Components of VR System - Input Devices: 3D Position Trackers– Navigation and Manipulation Interfaces – Gesture Interfaces –Output Devices: Graphics Display— Sound Displays ― Haptic Feedback**.**

UNIT II	VR MODELING	9

Modeling – Geometric Modeling – Kinematics Modeling - Physical Modeling – Behavior Modeling – Model Management.

UNIT III	VISUAL COMPUTATION IN VIRTUAL REALITY	9

Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG - Development Tools and Frameworks in Virtual Reality - World

Toolkit - Human Factors in VR - VR Health and Safety Issues – VR and Society.

UNIT IV	UNITY DEVELOPMENT ENVIRONMENT	9

Introduction to Unity - Game Objects and Components - Scripting Basics- C# Coding Fundamentals - Materials and Lighting - Camera and User Interface - Physics in Unity – Animation - Sound Effects - Scene Building and Interaction.

UNIT V	AUGMENTED REALITY	9

Introduction to Augmented Reality-Technology and Features of Augmented Reality-AR Vs VR-Computer vision for AR-Interaction- Modelling and Annotation- Navigation-Wearable devices-Designing AR Experiences- AR Applications and Use Cases.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Interpret the basic concepts of AR and VR
CO2:	Apply the tools and technologies to AR/VR
CO3:	Demonstrate Knowledge of virtual world with the principles of 3D depth perception for creating immersive virtual environment
CO4:	Develop AR/VR applications in different domains
CO5:	Demonstrate AR models using modeling techniques for different applications.

TEXT BOOKS:

1.	Indika Wijesooriya, "Mastering Augmented Reality Development with Unity: Create immersive and engaging AR experiences with Unity", 2023
2.	Geroimenko, Vladimir, "Augmented Reality in Education: A New Technology for Teaching and Learning", Springer Nature Switzerland AG, First Edition, 2021

REFERENCES:

1.	Dr. Rajiv Chopra, Damandeep Singh, "Virtual and Augmented Reality", Khanna Book Publishing, 2021
2.	Chetankumar G Shetty, "Augmented Reality", First Edition, McGraw Hill, 2020.
3.	Osslan Osiris Vergara Villegas, Vianey Guadalupe Cruz Sánchez, "Augmented Reality" First Edition, CRC Press, 2024.
4.	David J. Chalmers ,"Reality+: Virtual Worlds and the Problems of Philosophy", WW Norton Publisher,ISBN-13 978-1324050346, 2023.
5.	Colin Goldberg, Paul D Miller aka DJ Spooky, "Metagraphs: Augmented Reality", Independently publisher, 2023.

CO's- PO's & PSO's MAPPING

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	-	3	-	-	-	2	2	1	2	2	1	2
2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3
AVG.	3	2	2	2	3	-	-	-	2	2	1	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

AD22784	FUNDAMENTALS OF MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified.
- To execute the programs based on machine learning algorithms.

UNIT I	INTRODUCTION TO MACHINE LEARNING	8

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II	SUPERVISED LEARNING	11

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression-Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

UNIT III	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9

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

UNIT IV	NEURAL NETWORKS	9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation–Unit saturation (aka the vanishing gradient problem) – ReLU, hyper- parameter tuning, batch normalization, regularization, dropout-Applications

UNIT V	CASE STUDY	8

Bayesian network to diagnose CORONA infection using standard WHO Data Set- Use data set for clustering using the k-Means algorithm- Compare the results of these two algorithms-Classify a sample dataset using decision tree-Build a Neural Network with sample dataset

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1:	Explain the basic concepts of machine learning.
CO2:	Compare machine learning models.
CO3:	Construct unsupervised learning algorithms.

CO4:	Construct supervised learning models.
CO5:	Explain the classification algorithms.

TEXT BOOKS:

1.	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2.	Norman Matloff , "The Art of Machine Learning", 2024.

REFERENCES:

1.	Vadim Smolyakov, "Machine Learning Algorithms in Depth", Manning,2024.
2.	David Ping , "The Machine Learning Solutions", Packet Publication, 2024.
3.	Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 2017.
4.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
5.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

CO – PO & PSO MAPPING

CO	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO 2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO 3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO 4	2	1	2	2	-	-	-	-	2	1	2	2	1	3	3
CO 5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	1
AVG	2	1	2	2	1	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

HOD   Dean (Academics)   Principal

Dr. R. Jemila Rose   Dr. R. P. Anto Kumar   Dr. J. Maheswaran