Meenakshi Sundararajan Engineering College

(An Autonomous Institution)

Managed by I.I.E.T Society, Approved by AICTE, New Delhi,
Affiliated to Anna University, Chennai,
Accredited by NAAC with 'A' grade and NBA for programs applied,
Recognized by UGC with 2(f) & 12(B) status

B.Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE CURRICULUM AND SYLLABUS REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

Powered by

Meenakshi Sundararajan Career Development Cell

Achievers Excellence Program

Meenakshi Sundararajan Innovation and Incubation Centre

MSEC JAPANESE CLUB

Institutions' Innovation Council

Societal Beneficial Innovation

MATLAB Enabled Campus

363, Arcot Road, Kodambakkam, Chennai - 600 024.
www. msec.edu.in

Meenakshi Sundararajan Engineering College

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

Prof. K. R. Sundararajan, a well-known educationalist, established the Indian Institute of Engineering Technology (I.I.E.T) society in the year 1947 in Chennai. The total area of 14 acres was purchased with enormous hardship and was donated to the IIET Society for the cause of education. The society's main objective is to provide quality education and it has been ensured since 1951.

The IIET Society has the following to its credit :-

- An uninterrupted and continuous education since 1951 in its premises
- All Colleges run by the institution are ranked among the top 5 – top 10 programs in Tamil Nadu
- 350 KW Solar Power Plant Generating upto 70% of its electricity needs
- Significant portion of the students are first generation learners
- Campus holds approximately 7000 plus students from the ages of 4 to 35 plus.
- Large Green Campus in the heart of the city of Chennai, Tamil Nadu
- In existence since 1947 – Completed 75 years
- Targeting to be Carbon Neutral from the end of the year 2025

The society currently has the following institutions :-

- **Meenakshi Sundararajan Engineering College(MSEC)** - established in 2001 & affiliated to Anna University offering engineering programs with about 2000 plus students.
- **Meenakshi Sundararajan School of Management(MSSM)** - established in 2000 & affiliated to University of Madras offering MBA programs with about 100 plus students.
- **The NEST School (TNS)**- established in 2022 offering IB (International Baccalaureate) & CAIE (Cambridge) boards.

All of the institutions have earned an enviable name and are rated as one among Top 10 colleges in the Tamil Nadu state in their respective programs. Efforts are on to make the campus carbon neutral in 2 years (end of 2025) by using our community of staff and students.

Meenakshi Sundararajan Engineering College (MSEC) was established by the IIET Society in 2001. MSEC is defined by two keywords "Industry Ready" & "Vibrancy". Creating a new generation of self- actualized learners is our raison d'etre. If children are our future, then education is the key to their future. When education is shaped around them, and not the other way around, we are laying the foundation for a future/world where creativity, diversity and caring, independent-thinkers thrive. Our curricula thrive on continuous learning while interacting with and incorporating real-world situations and challenges.

MSEC's Hallmark of Quality

- Affiliated to Anna University, Chennai
- Approved by AICTE, New Delhi
- Accredited by NBA for programs in:
  - Civil Engineering
  - Computer Science and Engineering
  - Electronics and Communication Engineering
  - Mechanical Engineering
  - Electrical and Electronics Engineering
  - Information Technology
- Accredited by NAAC with a prestigious "A" grade
- Declared under Section 2(f) and 12(B) of the UGC Act
- Conferred with Autonomous status for 10 years (2024-25 to 2033-34) by the University Grants Commission (UGC) on February 1, 2024
- Meenakshi Sundararajan Innovation and Incubation Centre (MSIIC)
- Meenakshi Sundararajan Career Development Cell (MSCDC)
- MSEC Research Centre (MSEC RC)
- Center of Excellence – Industry Tie Up in Specialized Labs
- Industry MOU's – 200 Plus

Vision of the Institute

To impart state-of-the-art technical education, including sterling values and shining character, producing engineers who contribute to nation building thereby achieving our ultimate objective of sustained development of an unparalleled society, nation and world at large.

Mission of the Institute

Meenakshi Sundararajan Engineering college, Chennai constantly strives to be a Centre of Excellence with the singular aim of producing students of outstanding academic excellence and sterling character to benefit the society, our nation and the world at large.

To achieve this, the college ensures

- Continuous upgradation of its teaching faculty to ensure a high standard of quality education and to meet the ever-changing needs of the society
- Constant interaction with its stakeholders
- Linkage with other educational institutions and industries at the national and international level for mutual benefit
- Provision of research facilities and infrastructure in line with global trends
- Adequate opportunities and exposure to the students through suitable programs, to mould their character and to develop their personality with an emphasis on professional ethics and moral values.

We offer following courses:

S.No	Course	Intake
	Undergraduate courses in B.E / B. Tech	
01	B.E Civil Engineering	60
02	B.E Computer Science and Engineering	120
03	B.E Electronics and Communication Engineering	120
04	B.E Electrical & Electronics Engineering	60
05	B.E Mechanical Engineering	60
06	B. Tech Information Technology	120
07	B. Tech Artificial Intelligence & Data Sciences	120
	Postgraduate courses in M.E / M. Tech	
08	M.E. Construction Engineering and Management	18
09	M.E. Computer Science and Engineering	18
10	M.E. Embedded System Technologies	18
11	M.E Energy Engineering	18

DEPARTMENT OF HUMANITIES AND SCIENCE

The H&S Department stands out for its commitment to providing a well-rounded academic experience for first-year students. Covering key subjects like Physics, Chemistry, Mathematics, English, and Tamil. The department boasts a high pass percentage in semester exams, a testament to the hard work and dedication of the faculty. This year, the department enhanced offerings with industry and alumni talks, foreign language courses, engaging games, and specialized coaching for AEP and ICS. Additionally, the department introduced an industry-oriented and department-specific syllabus to better prepare students for future challenges and opportunities

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department at our college, established in 2002, is a beacon of academic excellence and research innovation. Offering both undergraduate program and postgraduate program in M.E. Construction Engineering and Management, the department is committed to integrating advanced technologies and sustainable practices into its curriculum. The department boasts state-of-the-art laboratories and strong industry collaborations. Graduates of the department have made significant contributions to civil engineering, both nationally and internationally, and continue to shape the future of the discipline through unwavering commitment to excellence.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Department of Computer Science and Engineering was established in 2001. It has its mission to inculcate innovative thinking and analytical abilities in addition to imparting quality education in the theory and application of Computer Science and Engineering. The department offers UG and PG programmes with State-of-the-art Computer laboratories equipped with high end hardware and software packages provided with high-speed leased line connectivity. The department takes pride in its academic excellence and outstanding placement records. It has consistently produced 68 university rank holders till 2023 batch and accredited by National Board of Accreditation.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

The Electrical and Electronics Engineering Department, established in 2003, is expanding its offerings to M.E. program in Embedded System Technologies from the 2024-25 academic year. With a focus on knowledge - based training, the department faculty empowers students with a deep understanding of concepts and industry - ready skills. The department forged partnerships with 22 companies through MOUs, facilitating collaboration and knowledge exchange.

The Electrical Technocrats Association (ETA) is a vibrant platform for technical activities, including the publication and showcasing of newsletters by staff and students every fortnight. Our mission is to drive technological advancements, foster research, and address industry needs.

DEPARTMENT OF MECHANICAL ENGINEERING

Meenakshi Sundararajan Engineering College inaugurated the Department of Mechanical Engineering in the academic year 2011-12. The department has well qualified faculties with excellent teaching, training and industrial experience. It has state-of-the-art laboratories which include VMC, CNC Wire Cut, Spark Erosion, 3D CMM etc catering to academic, consultancy and research requirements. The department's endeavor is to develop its students to be industry ready when they graduate. Students of mechanical engineering department gain industrial exposure and are prepared to face future challenges by carrying out their Final Year Project work in various PSU/Private sectors as per their field of interest relevant to their program. The department has a memorandum of understanding with various Institutions, Industries and Research organizations for collaborative research and development work. There is a huge potential in the department for Consultancy as well as Technology and Product incubation.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

The Department of Electronics and Communication Engineering, established in 2001, has grown significantly increasing its sanctioned intake from 60 to 120 in 2010. With NBA accreditation, the department is committed to delivering quality education, producing graduates who excel technically, socially, and professionally. Its state-of-the-art infrastructure, featuring ICT-enabled classrooms and advanced laboratories with cutting-edge tools like Cortex M4, Spartan 6, IoT kits, MATLAB, Cadence and PSPICE that supports academic excellence.

The Department's industry linkages with renowned organizations including ISRO, DRDO, NLTVC, and Ericson enhance students' technical skills through interactive events.

The Department's achievements include academic excellence, impressive placement records, and students' accomplishments in sports, arts, and culture, with alumni globally represented in top companies like Intel, Yahoo, and Apple.

DEPARTMENT OF INFORMATION TECHNOLOGY

The department of Information Technology was started in the year 2001 with an intake of 60 students focusing on the area. The department has won laurels to to the college. The department constantly strives with the singular aim of producing students with outstanding academic excellence and sterling character to benefit the society, our nation and the world at large. The department's commitment to high academic standards and successful student placements. It has consistently produced 65 university rank holders till 2023 batch and accredited by National Board of accreditation. Campus Agreement has been signed with leading software and hardware giants like Microsoft, IBM, Adobe and HP. The department has received a certificate partnership as a "Center of Excellence" with Virtusa Technology.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

The Department of Artificial Intelligence & Data Science was established in 2021 with an initial intake of 60 students, which was subsequently increased to 120 in 2024. Our department boasts a team of highly qualified, experienced, and competent faculty members and features spacious infrastructure with modern amenities, including six well-equipped computer laboratories with backup and internet facilities. We emphasize continuous knowledge enrichment through seminars, guest lectures, workshops, and skill enhancement programs for both students and faculty, and engage in meticulous academic planning to ensure a well-structured approach to each semester. Additionally, our student-driven club, serves as an incubation center, nurturing innovative ideas and fostering creativity.

INTERNAL QUALITY ASSURANCE CELL (IQAC)

MSEC established the Internal Quality Assurance Cell (IQAC) in 2016 to develop and implement quality standards and benchmarks in key performance areas. In alignment with the National Education Policy (NEP) 2020 and subsequent reforms, the IQAC has been further strengthened to ensure compliance with the new policy directives.

Through IQAC, the institute strive to:

- Maintain and enhance the quality of education and services
- Align with our institution's vision and mission
- Foster a culture of continuous improvement and excellence
- Ensure accountability and transparency in institutional functioning
- Promote innovative practices in teaching, learning, and research
- Develop and implement effective quality benchmarks and parameters
- Facilitate student-centered learning and feedback mechanisms
- Enhance faculty development and capacity building
- Strengthen industry-academia partnerships and collaborations
- Ensure efficient governance and administrative processes
- Promote a culture of sustainability and social responsibility
- Facilitate accreditation and ranking processes
- Identify and mitigate quality assurance risks

CONTROLLER OF EXAMINATION

The institution, granted autonomous status by UGC and Anna University from the academic year 2024-2025, has established the Controller of Examinations (COE) office to oversee assessment processes with confidentiality, ensuring quality and standards. The COE conducts fair examinations, declares results, and manages examination activities for Internal Assessment Tests (IATs) and Semester End Examinations (SEE). Their yearly schedule includes planning, coordinating, conducting, evaluating, and reviewing exams, as well as issuing certificates and transcripts. The COE ensures smooth conduct, maintains exam integrity, and coordinates with stakeholders, adapting to the institution's specific needs and exam cycle.

MEENAKSHI SUNDARARAJAN RESEARCH CENTRE(MSRC)

The MSEC Research Centre has a steadfast commitment to fostering a strong research culture. It empowers students and faculties in their intellectual exploration and discovery. The center aims to advance knowledge, drive neoteric innovation, and contribute to the broader academic and industrial fraternity ultimately aimed at uplifting humankind.

THE MEENAKSHI SUNDARARAJAN CAREER DEVELOPMENT COMMITTEE (MSCDC)

The Meenakshi Sundararajan Career Development Committee (MSCDC) is a strategic group dedicated to fostering students' professional growth and development. Our mission is to support students in achieving their career goals, fostering a culture of professional growth and development.

The MSCDC plays a vital role in aligning individual career goals through various initiatives, including:

1. Career Pathways
2. Specialised Expert Talk & Guidnace on Different Career Pathways
3. Higher Education – Awareness Sessions on various Geographical Locations
4. University Fairs
5. Training / Coaching Programs for different Competitive Exams
6. Repository / Text Books for various Competitive Exams

By providing a career pathway, we help students understand the opportunities available to them and what is required to achieve their career goals. We encourage students as they navigate their professional journey, providing them with the tools, knowledge, and opportunities needed for successful career development.

OFFICE OF STUDENTS AFFAIRS

Our mission is to create a supportive and inclusive educational environment that empowers students to succeed in their academic, personal, and professional lives. We achieve this by:

- Providing individualized support and responding to student needs
- Fostering a culture of academic integrity and excellence
- Promoting personal hygiene, cleanliness, discipline and sprucing
- Encouraging a moral code of conduct and respect for others
- Cultivating a sense of campus decency and decorum
- Modeling exemplary behavior and attitudes

By fulfilling these responsibilities, the institution aims to inspire students to become responsible, successful, and compassionate individuals who make a positive impact in their communities.

COLLEGE COUNSELING SERVICES

College counseling services are essential in supporting students' overall well-being and academic success. These services often encompass various areas, including healthy mind well-being, career guidance, and academic counseling. Here's a breakdown of the typical counseling services available for college students in the institution:

Individual Counseling: One-on-one sessions with RCI registered counselors or psychologists to address personal issues such as stress, anxiety, depression, relationship problems, and any other psychological concerns.
Group Counseling: Support groups where students with similar issues can share experiences and strategies for coping in a safe and supportive environment.
Crisis Intervention: Immediate support for students in distress, trauma response, and any emergency psychological concerns.

TRAINING AND PLACEMENT CELL

Meenakshi Sundararajan Engineering College training and placement cell is committed to providing exceptional placement opportunities for its students. The Placement Cell takes meticulous efforts to ensure that students are recruited by top-notch companies in the industry.
The training pathway is established starting from the first semester with 180 Hours of Placement training which includes Communications Skills, Aptitude Training. Specialised Programming, Guidance on Certifications, Projects, Competitions, Grooming, Etiquette, Group Discussion and Mock Interviews.

The Placement Cell functions under the leadership of Placement Officer, Faculty representatives and Coordinators from each department. The Cell's ultimate aim is to achieve 100% placement. Its Other Functions include

1. Implementation of the training pathway at appropriate semesters
2. Industry Talks
3. Alumni Talks
4. Arranging Internships & Projects
5. Centers of Excellence with Industry
6. Industry Specialised training & guidance

This comprehensive training empowers students to face the campus interviews with confidence through enhancing their employability skills for a successful future.

DEPARTMENT OF PHYSICAL EDUCATION

Our college campus boasts an array of sports facilities, including

- Basketball Court
- Badminton Court
- Pickle Ball Court
- Volleyball
- Cricket / Foot Ball / Athletics Ground
- Tennis Court
- Kho Kho

The institution is much dedicated in nurturing the talent through specific college sports teams :

- Expert coaching and mentorship
- Formation of new sports teams
- Dedicated Sports Hour (1 hour/week)
- Regular Sports Day events - that are meticulously planned for maximum student participation.

DEPARTMENT OF SAFETY AND SECURITY

MSEC's Safety Department include the Chief Security Officer (Retd. Lt. Col), Trained & Certified Safety Officers (18) and Chief Safety Officer.

The department ensures a secure and hazard-free environment within the campus through:

- Monitoring all areas of the campus to ensure a secure environment
- Conducting daily reviews and maintaining a register to track and address any safety issues
- Performing maintenance tasks such as securing compound walls, replacing damaged fencing, and ensuring proper drainage
- Educating the community through regular safety awareness programs and training sessions
- Organizing fire drills and evacuation procedures to prepare for emergencies
- Identifying and mitigating potential hazards to prevent accidents
- Developing and implementing comprehensive safety policies to guide the community
- Continuously monitoring CCTV cameras to quickly respond to any security incidents

The department's proactive approach helps to prevent accidents, minimizes risks, and fosters a culture of safety among students, staff, and faculty members.

MEENAKSHI SUNDARARAJAN INNOVATION AND INCUBATION CENTRE (MSIIC)

Meenakshi Sundararajan Innovation and Incubation Centre (MSIIC) is a dynamic and forward-thinking organization dedicated to fostering innovation, entrepreneurship, and skill development etc. Our center serves as a catalyst for a transformative change - providing aspiring entrepreneurs with the resources, mentorship, and support that is needed to turn their ideas into successful ventures. MSIIC is dedicated to promoting entrepreneurship and an innovative mindset among students and entrepreneurs at institutions. Through mentorship MSIIC helps to develop talents and support their initiatives, provide knowledge on market access and funding, and empower individuals to identify opportunities, take risks, and create positive change. The institution solely believes in entrepreneurship as a catalyst for innovation and societal impact, providing resources and a supportive environment for individuals to thrive and make a difference in their communities and beyond. Its activities include

1. Managing the 100 Seat Innovation & Incubation Center
2. Guidance to both Internal & External Start-ups from Ideation to Funding
3. Competitions – Identification & Mentoring
4. Conducting Competitions :- 30 Hour Hackathons, All India Hackathons etc.
5. Managing Student Clubs
6. Art & Music Festival
7. Skill Development / Value Added Courses
8. Societal Beneficial Projects

MSEC STUDENTS CLUBS

MSEC Students Clubs were initiated with the objective to provide a platform for students to discover, showcase and improve their interests, strengths and passion. There are 7 clubs in our college namely, AI Epoch Club, Eco Design Club, Adyant Coding Club, Renewables Club, Nodenova IOT Club, Dev Dynasty Web App Development Club and Product Development Club. Clubs foster vibrant student community in the campus by conducting variety of events and activities which include workshops, seminars, technical and non-technical events, campus benefit projects, long term projects such as SAE Baja etc that cater to diverse interests. Clubs help the students to collaborate with different disciplines and exchange knowledge with peer groups.

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Department : AI&DS , R2024, CBCS

Vision of the Department	Mission of the Department
To achieve academic excellence by imparting state-of-the-art technical education to mould engineers who contribute to the society through innovation and research in the field of Artificial Intelligence and Data science.	**Mission 1:** To empower staff and students with the in-depth knowledge of concepts in Artificial Intelligence and data science **Mission 2:** To develop products and solutions through Innovation and research through constant interaction with Society and stakeholders **Mission 3:** To inculcate the practice of ethical and moral standards.

PROGRAM OUTCOMES (PO) and PROGRAM SPECIFIC OUTCOME (PSO)

PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change
PSO1	Design and implementing AI-driven solutions to complex problems by using appropriate AI tools and platforms to create intelligent systems.
PSO2	Develop data analytics and data visualization skills pertaining to knowledge acquisition, knowledge representation and knowledge Engineering
PSO3	Demonstrate an understanding of the ethical considerations and societal impacts of AI and data science

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Department: Artificial Intelligence and Data Science, R2024, CBCS

Curriculum for I to VIII semesters

SEMESTER I								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
	U24IP101	Induction Program -Universal Human Values		30				
THEORY								
1	U24EN101	Technical English	HSMC	30	2	0	0	2
2	U24MA101	Mathematical Foundation for Engineers	BSC	60	3	1	0	4
3	U24PH102	Physics for Information Science I	BSC	45	3	0	0	3
4	U24CY102	Chemistry for Information Science	BSC	45	3	0	0	3
5	U24TA101	தமிழர்மரபு / Heritage of Tamils	HSMC	15	1	0	0	1
THEORY CUM PRACTICAL								
6	U24CS101	Programming in C	ESC	90	2	0	4	4
7	U24CE102	Engineering Graphics and Computer Application	ESC	75	3	0	2	4
PRACTICAL								
8	U24ME101	Engineering Practices Laboratory	BSC	60	0	0	4	2
9	U24TP110	Communication Skill Lab - I	HSMC	30	0	0	2	1
10	U24ED111	Design Thinking -Building Innovation & Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**24.5**

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER II								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
	U24IP201	Value Added Course – II (Biology for AI Engineers)	VAC	24	0	0	0	0
THEORY								
1	U24EN201	Professional English	HSMC	30	2	0	0	2
2	U24MA202	Probability and Statistics	BSC	60	3	1	0	4
3	U24PH202	Physics for Information Science II	BSC	45	3	0	0	3
4	U24TA201	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	15	1	0	0	1
5	U24EC202	Basics of Electrical and Electronics Engineering	ESC	45	3	0	0	3
6	U24CY201	Green and Sustainable Chemistry	BSC	30	2	0	0	2
THEORY CUM PRACTICAL								
7	U24CS201	Python Programming	ESC	90	3	0	3	4.5
PRACTICAL								
8	U24BS101	Physics and Chemistry Laboratory	BSC	60	0	0	4	2
9	U24TP210	Communication Skill Lab – II	HSMC	30	0	0	2	1
10	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
TOTAL				**420**	**17**	**1**	**12**	**23**

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER III								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA302	Discrete Mathematics	BSC	60	3	1	0	4
2	U24AD301	Fundamentals of Data Science and Analytics	PCC	45	3	0	0	3
3	U24MC313	Foreign Language (Japanese / French / German)	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
4	U24AD302	OOPS and Data Structures Design	ESC	75	3	0	2	4
5	U24AD303	Database Design and Management	PCC	75	3	0	2	4
6	U24EC310	Digital Principles and Computer Organization	PCC	75	3	0	2	4
PRACTICAL								
7	U24AD304	Data Science and Analytics Laboratory	PCC	45	0	0	3	1.5
9	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
10	U24ED311	Innovation Tool Kits	EDIC	15	0	0	1	0.5
11	U24RM312	Introduction To Problem Solving	RMC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**22.5**

#Mandatory Course is a Non-credit.

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER IV								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA402	Linear Algebra and Numerical Methods	PCC	60	3	1	0	4
2	U24AD401	Artificial Intelligence	PCC	45	3	0	0	3
3	U24AD402	Machine Learning	PCC	45	3	0	0	3
4	U24MC413	Indological Studies	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5	U24AD403	Introduction to Operating Systems	PCC	75	3	0	2	4
6	U24AD404	Data Exploration and Visualization	PCC	75	3	0	2	4
PRACTICAL								
7	U24AD405	Artificial Intelligence Laboratory	PCC	45	0	0	3	1.5
8	U24AD406	Machine Learning Laboratory	PCC	45	0	0	3	1.5
9	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
10	U24ED411	Idea and Simulation Lab	EDIC	15	0	0	1	0.5
11	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				**480**	**17**	**1**	**14**	**23**

#Mandatory Course is a Non-credit

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER V								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24AD501	Deep Learning	PCC	45	3	0	0	3
2		Open Elective I	OEC	45	3	0	0	3
THEORY CUM PRACTICAL								
3	U24AD502	Big Data Analytics	PCC	75	3	0	2	4
4	U24AD503	Introduction to Java Programming	PCC	75	3	0	2	4
5		Professional Elective I	PEC	60	2	0	2	3
6		Professional Elective II	PEC	60	2	0	2	3
PRACTICAL								
7	U24AD504	Deep Learning Lab	PCC	60	0	0	4	2
8	U24AD505	Summer Internship*	EEC					1
9	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
10	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
11	U24RM512	Domain Specific Experiments / Methodology / Algorithms	RMC	30	0	0	2	1
12	U24MC513	Fitness for Life-Yoga, Food Nutrition	MC#	30	0	0	2	0
TOTAL				**525**	**16**	**0**	**19**	**26.5**

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

#Mandatory Course is a Non-credit.

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER VI								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24CS503	Theory of Computation	PCC	45	3	1	0	4
2		Open Elective II	OEC	45	3	0	0	3
3	U24MC613	Integrated Disaster management	# MC	30	2	0	0	0
THEORY CUM PRACTICAL								
4	U24IT602	Embedded Systems and IOT	PCC	75	3	0	2	4
5	U24AD601	Network Essentials	PCC	75	3	0	2	4
6		Professional Elective III	PEC	60	2	0	2	3
7		Professional Elective IV	PEC	60	2	0	2	3
PRACTICAL								
8	U24TP610	Employability Skills & Problem-Solving Techniques	EEC	30	0	0	2	1
9	U24ED611	Building a Business Model, GTM & Startup Journey	EDIC	15	0	0	1	0.5
10	U24RM612	Technical Writing and Research Ethics	RMC	15	0	0	1	0.5
TOTAL				**465**	**18**	**1**	**12**	**23**

#Mandatory Course is a Non-credit.

Meenakshi Sundararajan Engineering College

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

Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER VII								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		**30**				
THEORY								
1	U24AD701	Information Security	PCC	45	3	0	0	3
2	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
3		Open Elective – III	OEC	45	3	0	0	3
4		Constitution of India	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5		Professional Elective V	PEC	60	2	0	2	3
6		Professional Elective VI	PEC	60	2	0	2	3
PRACTICAL								
7	U24AD702	Summer Internship*	EEC					1
8	U24RM712	Data Collection, Analysis, and Interpretation	RMC	15	0	0	1	0.5
TOTAL				**285**	**16**	**0**	**3**	**16.5**

***Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.**

SEMESTER VIII								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
PRACTICAL								
1	U24AD801	Project Work	EEC	240	0	0	16	8
TOTAL				240	0	0	16	8
OVERALL TOTAL								**166**

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S. No.	Subject Area	Credits per Semester								Total Credits
		1	2	3	4	5	6	7	8	
1	HSMC	4	4					3		11
2	BSC	12	11	4						25
3	ESC	8	7.5	4						21.5
4	PCC			12.5	21	13	12	3		61.5
5	PEC					6	6	3		15
6	OEC					3	3	6		12
7	EEC			1	1	2	1	1	8	14
8	Non-Credit / (Mandatory)			√	√	√	√	√		0
9	EDIC	0.5	0.5	0.5	0.5	0.5	0.5			3
10	RMC			0.5	0.5	1	0.5	0.5		3
Total		24.5	23	22.5	23	25.5	23	16.5	8	**166**

HSMC - Humanities, Social Sciences and Management Courses

BSC - Basic Sciences Courses

ESC - Engineering Sciences Courses

PCC - Professional Core Courses

PEC - Professional Elective Courses

OEC - Open Elective Courses

EEC - Employability Enhancement Courses

MC - Mandatory Courses / Non-Credit

EDIC - Entrepreneurial Development and Innovation Courses (EDIC)

RMC - Research Methodology Courses

EDIC – ENTREPRENEURIAL DEVELOPMENT AND INNOVATION COURSES (EDIC)								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
1	U24ED111	Design Thinking - Building Innovation and Solutioning Mindset	EDIC	15	0	0	1	0.5
2	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
3	U24ED311	Innovation tool kits	EDIC	15	0	0	1	0.5
4	U24ED411	Idea & simulation lab	EDIC	15	0	0	1	0.5
5	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
6	U24ED611	Business Management - Go To Market & Startup Journey	EDIC	15	0	0	1	0.5
PLACEMENT TRAINING BY EDUTECH								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
1	U24TP110	Communication Skills Laboratory – I	HSMC	30	0	0	2	1
2	U24TP210	Communication Skills Laboratory – II	HSMC	30	0	0	2	1
3	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
4	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
5	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
6	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1

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RMC – RESEARCH METHODOLOGY COURSES								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
1	U24RM312	Introduction To Problem Solving	RMC	15	0	0	1	0.5
2	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
3	U24RM512	Domain Specific Experiments/ Methodology/ Algorithms	RMC	15	0	0	2	1
4	U24RM612	Technical Writing And Research Ethics	RMC	15	0	0	1	0.5
5	U24RM712	Data Collection, Analysis And Interpretation	RMC	15	0	0	1	0.5

SEMESTER I								
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
	U24IP101	Induction Program -Universal Human Values		30				
THEORY								
1	U24EN101	Technical English	HSMC	30	2	0	0	2
2	U24MA101	Mathematical Foundation for Engineers	BSC	60	3	1	0	4
3	U24PH102	Physics for Information Science I	BSC	45	3	0	0	3
4	U24CY102	Chemistry for Information Science	BSC	45	3	0	0	3
5	U24TA101	தமிழர்மரபு / Heritage of Tamils	HSMC	15	1	0	0	1
THEORY CUM PRACTICAL								
6	U24CS101	Programming in C	ESC	90	2	0	4	4
7	U24CE102	Engineering Graphics and Computer Application	ESC	75	3	0	2	4
PRACTICAL								
8	U24ME101	Engineering Practices Laboratory	BSC	60	0	0	4	2
9	U24TP110	Communication Skill Lab - I	HSMC	30	0	0	2	1
10	U24ED111	Design Thinking -Building Innovation & Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**24.5**

#Mandatory Course is a Non-credit.

U24IP101	INDUCTION PROGRAMME
Modules	
1	**Universal Human Values I (UHV I)**
To help the student to see the need for developing a holistic perspective of life.	
To sensitize the student about the scope of life – individual, family (interpersonal relationship), society and nature/existence.	
Strengthening self-reflection.	
To develop more confidence and commitment to understand, learn and act accordingly.	
2	**Physical Health and Related Activities**
To understand the basic principles to remain healthy and fit.	
To practice them through exercise, games etc.	
Involving health center, staff, sports coaches, faculty, staff, students' sports team etc.	
3	**Familiarization of Department/ Branch and Innovation**
To get a broad perspective about goals of institution, department/branch in the context of the world, the nation, the state, and region.	
To get an idea of how the institution operates to fulfill its goals through various disciplines of education, research, development, and practice.	
To get an idea of how students can connect /participate in it.	
4	**Visit to a Local Area**
For a student to relate to the social environment of the educational institution as well as the surroundings, a place wherein their most significant years students will scribble some indelible memories, an absolute necessity is generated for city visits to let students understand the environment through interaction with the people, place and history.	
5	**Lectures by Eminent People**
Guest lectures are a great way to help the students gain a perspective on many different things in the world. Eminent personalities in different fields of expertise like academics, sports, industry, business etc. can share their story and talk about important subjects like career, entrepreneurship, government policies and technology.	
6	**Proficiency Modules**
This module is to help fill the gaps in basic competency required for further inputs to be absorbed. It includes efforts to make the student proficient in interpersonal communication and expression.	
7	**Literature / Literary Activities**
To develop the clarity of humanistic culture and its expression through literature, students may be exposed to local, regional, national, or international literature. It will help them in understanding traditional and contemporary values and thought.	
8	**Creative Practices**
This module is to help develop the clarity of humanistic culture and its creative, joyful expression. The students can choose one skill related to visual arts or performing arts.	
9	**Extra-Curricular Activities**
Wellness Sessions	
10	**Extra Activities**
Anti-Ragging Briefing	
Informal Interactions	
Club / Council / Committee/ Scholarship Briefings	

U24EN101	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES	
1	Demonstrate communicative competence in academic and professional contexts.
2	Develop the basic reading and writing skills of first year engineering and technology students.
3	Apply key grammar concepts in reading and writing tasks.
4	Produce effective language for professional contexts.
5	Construct clear, concise, and coherent language for a variety of contexts.

UNIT 1 EFFECTIVE READING AND WRITING COMMUNICATION	**6**
Reading: Comprehension of short technical texts – Skimming and scanning **Writing:** Precis Writing, Email Writing **Grammar:** Tenses, Question types: Wh/ Yes or No **Vocabulary development:** Root words – Prefixes & Suffixes, Standard Abbreviations & Acronyms	
UNIT 2 NARRATION AND SUMMATION	**6**
Reading: Reading biographies, travelogues, newspaper reports **Writing:** Paraphrasing, Formal and informal Letter **Grammar:** Prepositions, Subject-verb Agreement **Vocabulary development:** One-word substitution	
UNIT 3 LANGUAGE DEVELOPMENT	**6**
Reading: Reading reviews, advertisements **Writing:** Writing Instructions, Report writing (Industrial report, Survey report & Accident report) **Grammar:** Discourse Markers, Degrees of comparison **Vocabulary development:** Compound nouns, Homophones and homonyms	
UNIT 4 RECOMMENDATIONS AND TRANSCODING	**6**
Reading: Non-verbal communication (tables, pie charts etc.) **Writing:** Writing recommendations, Transferring information (chart, graph etc.) **Grammar:** Error corrections **Vocabulary development:** Fixed and semi fixed expressions	
UNIT 5 LANGUAGE FOR WORKPLACE	**6**
Reading: Reading Editorial columns **Writing:** Writing minutes of meeting **Grammar:** Simple, compound and complex sentences **Vocabulary development:** Verbal analogies	
TOTAL PERIODS	**:30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	To use appropriate words in a professional context
CO2	To gain understanding of basic grammatical structures and use them in the right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To write definitions, descriptions, narrations and essays on various topics

CO5	To expand vocabulary and technical language competency

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

REFERENCES	
1.	Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2.	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3.	English For Technical Communication (With CD) By AyshaViswamohan, McGraw Hill Education, ISBN: 0070264244.
4.	Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	0	0	0	0	0	0	1	3	3	1	2	-	-	-
CO2	0	0	0	0	1	0	1	2	3	2	2	-	-	-
CO3	0	0	0	0	0	0	1	1	2	1	1	-	-	-
CO4	0	0	0	0	1	0	2	3	3	3	2	-	-	-
CO5	0	0	0	0	1	0	2	2	3	3	2	-	-	-
AVG	**-**	**-**	**-**	**-**	**0.6**	**-**	**1.4**	**2.2**	**2.8**	**2.0**	**1.8**	**-**	**-**	**-**

U24MA101	MATHEMATICAL FOUNDATION FOR ENGINEERS	L	T	P	C
		3	1	0	4

Course Objectives

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

UNIT 1 MATRICES **9+3**

Introduction - characteristic equation - Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors (without proof) – Cayley - Hamilton theorem (statement and applications only) – Diagonalization of matrices by orthogonal transformation –Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms .

UNIT 2 DIFFERENTIAL CALCULUS **9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum,product, quotient, chain rules) - The equations of tangent line and normal line, velocity and acceleration - Interval of increasing and decreasing functions-Maxima and Minima of functions of one variable - Intervals of concavity and convexity.

UNIT 3 FUNCTIONS OF SEVERAL VARIABLES **9+3**

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 – Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

UNIT 4 INTEGRAL CALCULUS **9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT 5 MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – change of variables from cartesian to polar in double integrals - Triple integrals – Volume of solids.

TOTAL PERIODS **60**

Course Outcomes

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

CO1	Use the matrix algebra methods for solving practical problems
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems

TEXT BOOKS

1.	Veerarajan.T,"Engineering Mathematics,for semester I and II", Updated second Edition,Tata Mcgraw Hill Education , private Limited ,2019.
2.	Grewal B.S and Grewel J.S .“Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 45th Edition, 2020.
3.	Engineering Mathematics: First year.Calculus and analytical geometry,volume 2,M.K.Venketaraman,National Publishing company,1965.
4.	Won Y.Yang,Young K.Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho lm, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.

REFERENCES

1.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Kandasamy.P.,Thilagavathy.K and Gunavathy.K.,"Engineering Mathematics For First Year B.E/B.Tech,Seventh Edition 2008 S.Chand and Co.,New Delhi.
3.	Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics,semester-I”, ninth Edition, Laxmi Publications Pvt. Ltd, 2016.

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(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	3	1	-	-	-	-	-	-	-	1	-	-
CO 4	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	3	1	-	-	-	-	-	-	-	1	-	-
AVG	3	2.6	2.6	1	1	-	-	-	-	-	-	1	-	-

U24PH102	PHYSICS FOR INFORMATION SCIENCE I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To comprehend and identify different crystal structures and their imperfections.
2	To explain the elastic properties of materials and understand their significance.
3	To develop knowledge about the sound waves
4	To develop an understanding of quantum mechanical phenomena and their applications.
5	To explain the origin of laser action, production of laser, fibre optics and their applications.

UNIT 1 CRYSTAL PHYSICS **9**

Single crystalline, polycrystalline and amorphous materials– single crystals -Seven type of crystal system- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures ,Crystal growth--Bridgmann technique,czochralski technique

UNIT 2 PROPERTIES OF MATTER **9**

Properties of matter: Elasticity- Hooke's law - Relationship between three moduli of elasticity– stress -strain diagram– Poisson's ratio –Factors affecting elasticity– Torsional stress & deformations – Twisting couple – Torsion pendulum- theory and experiment– bending of beams -bending moment–uniform and nonuniform bending: theory and experiment.

UNIT 3 ULTRASONICS **9**

Ultrasonics: Production of ultrasonics by Magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays.Applications of ultrasonic waves: SONAR.

UNIT 4 QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect. Theory and Experiential verification - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states.

UNIT 5 PHOTONIC AND FIBRE OPTICS **9**

Photonics: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients –Conditions for Laser action - Types of lasers – Nd YAG and CO2 lasers. Laser applications: Laser welding ,laser marking,surface texturing.Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) –Losses in fibers -

TOTAL PERIODS **:45**

Course Outcomes

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

CO1	Explain the different crystal structures and describe how crystal imperfections affect the mechanical, electrical, and optical properties of materials. Analyze various crystal structures and examine how crystal imperfections influence the mechanical, electrical, and optical properties of materials
CO2	Demonstrate and explain the fundamental concepts of elasticity, including stress–strain relationships and elastic constants, to understand the mechanical behavior of materials.
CO3	Analyze the applications of ultrasonics to engineering and medical disciplines.
CO4	Explain quantum concepts and describe their role in interpreting blackbody radiation, the Compton effect, and the wave equation for matter waves.

CO5	Elucidate the principles, construction, and working of lasers, and evaluate their applications in industry, medicine, and telecommunication.

TEXT BOOKS

1.	Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publishers, 2012.
2.	Serway R A, Jewett J W, "Physics for Scientists and Engineers", Cengage Learning, 2010

REFERENCES

1.	Halliday D, Resnick R, Walker J, "Principles of Physics", Wiley, 2015.
2.	Tipler P A, Mosca G, "Physics for Scientists and Engineers with Modern Physics", WH Freeman,2007
3.	Avadhanulu M N, Kshirsagar P G, "A Textbook of Engineering Physics", S Chand & Co Ltd, Ninth Revised Edition, 2012.

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(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO5	3	2	-	2	-	-	-	-	-	-	2	-	-	-
AVG	**3**	**2**	-	**2**	-	-	-	-	-	-	**1**	-	-	-

U24CY102	CHEMISTRY FOR INFORMATION SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To impart fundamental knowledge of water chemistry, polymers, batteries, nanomaterials, phase equilibria, spectroscopy, sensors, and photochemical reactions relevant to engineering applications
2	To develop the ability to apply chemical principles for water quality analysis, hardness and alkalinity calculations, polymer molecular weight determination, and performance evaluation of batteries.
3	To enable analytical understanding of boiler-related problems, water treatment processes, polymerization mechanisms, nanomaterial synthesis methods, phase diagrams, and sensor working mechanisms.
4	To provide critical evaluation skills for selecting appropriate materials, energy storage devices, polymers, nanomaterials, spectroscopic techniques, and sensor technologies for engineering and industrial use.
5	To encourage problem-solving and design thinking for recommending suitable chemical treatments, materials, analytical tools, and technologies addressing industrial, environmental, medical, and electronic challenges.

UNIT1 WATER TECHNOLOGY — **9**

Introduction-characteristics of water – Hardness – Types of hardness - Estimation by EDTA (problems on hardness) –Alkalinity – Determination (problems on alkalinity) – Boiler feed water – Requirements – Priming and foaming, Scales and sludges Caustic embrittlement and Boiler corrosion – Application - External conditioning (Ionexchange,zeolite) – Internal conditioning (Carbonate,phosphate,calgon,sodiumaluminate conditioning) — Brackish water treatment - Reverse osmosis.

UNIT2 POLYMER CHEMISTRY — **9**

Polymers and Polymerization: definition, classification - types of polymerization: addition and condensation – mechanism of addition polymerization (cationic, anionic, free radical and coordination polymerization)- Moulding of polymers into articles-injection-Properties: Glass Transition temperature.-Thermoplastic and thermosetting polymers-conducting polymers-definition,types and applications.

UNIT3 ENERGY STORAGE DEVICES AND NANOMATERIALS — **9**

Batteries – Types of batteries – Characteristics-Definition of Electricity storage density and power discharge rate--Principle,working and applications of lead-acid battery, Ni–Cd and lithium ion batteries – Fuel cell. Nanomaterials-Classification-Properties and uses-. Synthesis–Top down method(ball milling), Bottom up methods – Laser Evoparation method -chemical vapour deposition, - Applications of nanomaterials - Application - A Case Study – Medicine,Agriculture,Industry and Electronics.

UNIT4 PHASE RULE AND SPECTROSCOPY — **9**

Phase rule - Introduction, definition of terms - phase, components and degree of freedom - phase diagram- one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system Introduction-importance of spectroscopy-types of spectroscopy-Spectrum-Electromagnetic radiation-Electromagnetic spectrum-Absorption of Electromagnetic radiation-Types of energy present in molecules-Molecular spectra-Energy level diagfram-Ultraviolet (UV) and visible spectroscopy-Infra red spectroscopy.

UNIT5 SENSORS AND PHOTOCHEMISTRY — **9**

Sensors, types of sensors. Chemical Sensors – characteristics and elements - Carbon dioxide, glucose detector, Mosquito, and Pregnancy test. Electrochemical sensors – potentiometric sensors, amperometric sensors, polarization techniques - Working Principles and Applications.Integrated and Smart sensors,Definitions and applications of various smart sensors-types- , Humidity sensor, UV sensor and Ultra Sonic Sensors.
ntroduction-Photochemical reaction-Laws of Photochemistry-Grothus -Draper law-Stark-Einstein law-and Lambert-Beer law-(No Problems)-Photophysical processess Internal conversion-Intersystem crossing-Fluoroscence and Phosphorescence-Chemiluminescence and Photosensitization.

TOTAL PERIODS — **45**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the fundamental concepts of water chemistry, polymers, batteries, nanomaterials, phase rule, spectroscopy, sensors, and photochemical reactions.
CO2	Apply principles of water analysis, hardness & alkalinity calculations, polymer molecular weight determination, and battery performance calculations.
CO3	Analyze boiler troubles, water treatment methods, polymerization mechanisms, phase diagrams, sensor mechanisms, and nanomaterial synthesis techniques.
CO4	Evaluate various materials, energy storage systems, polymers, nanomaterials, spectroscopic tools, and sensors for engineering and technological applications.
CO5	Design and recommend suitable chemical, material, and analytical solutions for industrial, environmental, medical, and electronic applications.

TEXT BOOKS

1.	P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.
4.	Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013
5.	Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology,Implementation applications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES

1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.
4.	Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body,Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013
5.	Guang-Zhong Yang, Body Sensor Networks, Springer, 2006

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	-	-	1	-	-	-	-
CO2	3	3	1	2	1	-	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	1	-	-	-	-	-	-	-
CO4	2	2	3	2	2	2	2	-	-	1	-	-	-	-
CO5	2	2	3	3	3	2	2	-	1	1	1	-	-	-
AVG	**2.6**	**2.4**	**2**	**2**	**1.8**	**1.2**	**1**	**-**	**0.2**	**0.6**	**0.2**	**-**	**-**	**-**

U24TA101	தமிழர் மரபு/ HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

அலகு I மொழி மற்றும் இலக்கியம் UNIT I LANGUAGE AND LITERATURE	3

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

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land -

Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE	3

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

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

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் UNIT III FOLK AND MARTIAL ARTS	3

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

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

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் UNIT IV THINAI CONCEPT OF TAMILS	3

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

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

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	
TOTAL PERIODS	**15**

TEXT BOOK CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2.கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3.Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).

4.Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)

5.Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

6.The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).

7.Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

8.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

9.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

U24CS101	PROGRAMMING IN C	L	T	P	C
		2	0	4	4

COURSE OBJECTIVES

1	To understand the structure and syntax of C Language
2	To develop C programs using arrays and strings
3	To develop modular applications in C using functions
4	To develop applications in C and apply the concept code reusability using pointers and structures
5	To do input/output and understand the basics of file handling mechanisms in C

UNIT1 BASICS OF C PROGRAMMING — **6+12**

Introduction to Problem Solving: Algorithm, Flowchart, Pseudocode. Programming Basics: Applications of C Language-Structure of C program -Identifiers-Data Types – VariablesConstants – Keywords – Operators – Input/output statements, Decision making statements - Looping statements - Expressions-Precedence and Associativity – Expressions Evaluation, Type conversions.
Practical:
1.Algorithm, pseudocode, flowcharts for simple scientific and statistical problems
2.I/O statements, operators, expressions and decision-making constructs (if, if-else, break, continue
3.C Programming using Simple statements and expressions

UNIT2 ARRAYS AND STRINGS — **6+12**

Arrays: Introduction – Declaration of Arrays – Storing Values in Array – Accessing elements of the Array– Calculating the length of the Array – Operations on Array – one dimensional arrays – Two dimensional Arrays – String: Declaring, Initializing, Printing and reading strings, String input and output functions, String handling functions, Arrays of strings.
Practical:
1.Create simple programs for one dimensional and two dimensional arrays.
2.Practice all string handling functions.

UNIT 3 FUNCTION AND STORAGE CLASS — **6+12**

Library functions: Math functions, other miscellaneous functions such as getchar(), putchar(), malloc(), calloc(). User defined functions - function definition, functions declaration, function call, scope of variables - local variables, global variables. Function parameters: Parameter passing- call by value & call by reference, function return values, Passing arguments to Functions. Recursive functions. Storage classes-auto, register, static, extern, scope rules.
Practical:
1.Implementation of C Program using user defined functions (Pass by value and Pass by reference).
2.Implementation of Recursion Function

UNIT4 STRUCTURES AND POINTERS — **6+12**

Basics of structures-structure data types, type definition, accessing structures, Structure operations, Complex structures-nested structures, structures containing arrays, Array of structures, Structures and Functions, Unions. Pointers: Understanding Computer Memory Memory Management-Dynamic memory Allocation-Memory leaks-Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Generic Pointers - Passing Arguments to Functions using Pointer – Pointer and Arrays –Use of pointers in self-referential structures, notion of linked list
Practical:
1.C Programming using Pointers.
2.Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.

UNIT 5 MACROS AND FILE PROCESSING — **6+12**

Pre-processor Directives: Introduction to preprocessor directives in Simple macros using `#define`, conditional macros using `#ifdef`, `#ifndef`, `#endif`, `#else`, and `#elif`. Files: Introduction to Files – Opening a file – Reading Data from Files – Writing Data to Files – Detecting the End-of-file –Closing a file – Sequential access file-Random Access Files

– Binary Files – Command line arguments.
Practical: 1.Programming using macros and storage classes 2.Implementation of Command line Arguments like argc,argv 3.Files- reading and writing, file operations, random access 4.Develop an application for any one of the following scenarios : Student Management System /Stock Management System/ Banking Application / Ticket Reservation System

TOTAL PERIODS	**:90**

Course Outcomes

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

CO1	Create simple applications in C using basic constructs
CO2	Create C programs using arrays and strings
CO3	Create modular applications in C using functions.
CO4	Create modular applications in C using structures and pointers.
CO5	Create applications using macros and file processing

TEXT BOOKS

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

REFERENCES

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

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	2	2	-	-	-	1	-	1	-	2	2	1
CO4	2	2	2	2	1	1	-	1	1	1	1	2	2	-
CO5	2	2	2	2	1	1	-	1	1	1	1	2	2	1
AVG	2	2	2	2	1	1	-	1	1	1	1	2	2	1

U24CE102	ENGINEERING GRAPHICS AND COMPUTER APPLICATION	L	T	P	C
		6	-	9	4

Course Objectives

1	To learn the construction of engineering curves and projection techniques for constructing conic curves, points, and lines.
2	To understand the techniques for projecting and visualizing surfaces and solids in various orientations.
3	To determine the true shape of sectioned solids and develop their lateral surfaces.
4	To develop skills in 3D projection and perspective projection techniques for simple solids.
5	To introduce simulations, 2D/3D transformations and their applications in engineering graphics.

UNIT 1 PLANE CURVES , PROJECTION OF POINTS AND STRAIGHT LINES	**6+9**
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method. Orthographic projection- principles-Principal planes-First angle projection-projection of points and straight lines inclined to both the principal planes	
UNIT II PROJECTION OF PLANES AND SOLIDS	**6+9**
Projection of planes inclined to both the principal planes -. Projection of simple solids like prisms, pyramids, cylinder, and cone. When the axis is inclined to one of the principal planes and parallel to the other by rotating object method.	
UNIT III PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	**6+9**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other —obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.	
UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTION	**6+9**
Principles of isometric projection — isometric scale —Isometric projections of simple solids - Freehand sketching of multiple views from pictorial views of objects. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.	
UNIT V GEOMETRIC MODELLING	**6+9**
Role of simulations in engineering graphics, Introduction to Blender and Sketch, basic operations and commands, creating 2D drawings and 3D models: 2D Geometric transformations -2D viewing – Line, Polygon clipping, 3D Viewing – 3D Object representations – 3D Transformations	
TOTAL PERIODS	**75**

Course Outcomes

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

CO1	Master basic geometric constructions essential for engineering applications and projecting straight lines.
CO2	Acquire skills in planes, and solids using first angle projection.
CO3	Learn techniques for sectioning solids and developing their surfaces.
CO4	Understand principles of isometric and perspective projection for realistic representation.
CO5	Understand the role of simulations in engineering graphics and perform geometric transformations.

TEXT BOOKS

1.	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House,53 Edition, 2019.

2.	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015
4.	John Molnar P E, “Building Construction Drafting and Design”, CBS, 1987

REFERENCES

1.	Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019
2.	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	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.
4.	Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	–	2	–	–	–	–	–	–	2	–	2
CO2	3	1	2	–	2	–	–	–	–	–	–	2	–	2
CO3	3	1	2	–	2	–	–	–	–	–	–	2	–	2
CO4	3	1	2	–	2	–	–	–	–	–	–	2	–	2
CO5	3	1	2	–	2	–	–	–	–	–	–	3	–	3
AVG	**3**	**1**	**2**	**–**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**2.2**	**–**	**2.2**

U24ME101	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
The main learning objective of this course is to provide hands on training to the students in:	
1	Draw pipe line plan; layout and connect various pipe fittings used in common household plumbing work
2	To make wood joints commonly used in household wood.
3	To make various electrical connections in typical household electrical wiring installations.
4	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
5	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
GROUP – A (CIVIL & ELECTRICAL)	
PART I CIVIL ENGINEERING PRACTICES 15	
LIST OF EXPERIMENTS IN PLUMBING WORK	
1	a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
	b) Preparing plumbing line sketches.
	c) Laying pipe connection to the suction side of a pump
	d) Laying pipe connection to the delivery side of a pump.
	e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
LIST OF EXPERIMENTS IN WOOD WORK	
2	a) Sawing,
	b) Planing and
	c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.
Wood Work Study	
3	a) Studying joints in door panels and wooden furniture
	b) Studying common industrial trusses using models.
	PART II ELECTRICAL ENGINEERING PRACTICES 15
LIST OF EXPERIMENTS	
4	a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
5	b) Staircase wiring
6	c) Fluorescent Lamp wiring with introduction to CFL and LED types.
7	d) Energy meter wiring and related calculations/ calibration
8	e) Study of Iron Box wiring and assembly
	f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
	g) Study of emergency lamp wiring/Water heater
GROUP – B (MECHANICAL AND ELECTRONICS)	
PART III MECHANICAL ENGINEERING PRACTICES 16	
LIST OF EXPERIMENTS IN WELDING WORK	
9	a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
	b) Practicing gas welding.
LIST OF EXPERIMENTS IN BASIC MACHINING WORK	
10	a) (simple)Turning.

	b) (simple)Drilling.
	c) (simple)Tapping.
LIST OF EXPERIMENTS IN ASSEMBLY WORK	
11	a) Assembling a centrifugal pump.
	b) Assembling a household mixer.
	c) Assembling an airconditioner.
LIST OF EXPERIMENTS IN SHEET METAL WORK	
12	a) Making of a square tray
LIST OF EXPERIMENTS IN FOUNDRY WORK	
13	a) Demonstrating basic foundry operations.
PART IV ELECTRONIC ENGINEERING PRACTICES	**15**
LIST OF EXPERIMENTS IN SOLDERING WORK	
14	a) Soldering simple electronic circuits and checking continuity.
LIST OF EXPERIMENTS IN ELECTRONIC ASSEMBLY AND TESTING WORK	
15	a) Assembling and testing electronic components on a small PCB
LIST OF EXPERIMENTS IN ELECTRONIC EQUIPMENT STUDY	
16	a)Study an elements of smart phone
17	b)Assembly and dismantle of LED TV
18	c)Assembly and dismantle of computer/ laptop
TOTAL	**60**

COURSE OUTCOMES:

	Upon completion of this course, the students will be able to:
1	To practice and Experience the plumping work
2	To gain practical experience in carpentry by crafting a variety of joints.
3	To acquire knowledge in the methodology and techniques of wiring for electrical connections.
4	To gain knowledge in welding, sheet metal fabrication, and lathe operations.
5	To learn about electronic components, equipment, and their functions—such as resistors, color coding, measuring AC signal parameters, gates, circuits, and more.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

U24TP110	COMMUNICATION SKILLS LAB I	L	T	P	C
		0	0	2	1

Course Objectives	
1	Demonstrate communicative competence in academic and professional contexts.
2	Apply language skills effectively in academic and workplace contexts.
3	Apply appropriate listening strategies to comprehend different types of audio materials such as lectures, discussions, and videos.
4	Express opinions effectively by using language across various media.
5	Demonstrate English language proficiency through participation in listening and speaking activities relevant to authentic contexts.

UNIT I	6
Listening: Listening as a key skill- its importance -Listening for general information-specific details - Introduction to classmates – Audio / video (formal & informal) **Speaking:** Making telephone Calls, Introducing a friend, Making polite requests, polite offers and replying to polite requests - Understanding basic instructions for filling out a bank application	
UNIT II	**6**
Listening: Listen to a process information **Speaking:** Small talk on general topics and current scenario	
UNIT III	**6**
Listening: Listen to event narration and stories **Speaking:** Picture description- describing locations in workplaces	
UNIT IV	**6**
Listening: Listening to discussions and debates **Speaking:** Role Play	
UNIT V	**6**
Listening: Listening/watching documentaries **Speaking:** Formal and informal talk -making predictions- talking about a given topic-giving opinions	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	To listen and comprehend complex academic texts
CO2	To speak fluently and accurately in formal and informal communicative contexts
CO3	To express their opinions effectively in both oral and written medium of communication
CO4	Ability to listen/view and comprehend different spoken discourses/excerpts different accents and to speak clearly in simple language
CO5	Ability to read and evaluate texts critically

List of experiments	
1	Self-Introduction / Introducing a friend
2	Small talk
3	Narrating an event or story
4	Discussion/debate on a given topic
5	Listening to TED Talks (Being an active listener: giving verbal and non-verbal feedback)

ASSESSMENT PATTERN	
End Semester Listening & Speaking activity will be conducted.	
TEXT BOOKS	
1.	Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2.	Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010
REFERENCES	
1.	Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010
2.	Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014
3.	Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4.	English and Soft Skills, Dr. S.P. Dhanavel, Orient BlackSwan, 2013
5.	Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	0	0	0	0	0	0	1	2	3	2	2	-	-	-
CO2	0	0	0	0	0	1	1	2	3	3	2	-	-	-
CO3	0	0	0	0	0	1	2	1	1	1	2	-	-	-
CO4	0	0	0	0	0	0	1	2	3	2	2	-	-	-
CO5	0	0	0	0	0	1	2	2	2	2	2	-	-	-
AVG	**0**	**0**	**0**	**0**	**0**	**0.6**	**1.4**	**1.8**	**2.4**	**2.0**	**2**	**-**	**-**	**-**

U24ED111	DESIGN THINKING - BUILDING INNOVATION SOLUTIONING MINDSET	L	T	P	C
		0	0	1	0.5

Course Objectives

1	Expose the students to the fields of innovation and entrepreneurship and strengthen their interest in these fields.
2	To discuss the relevance and importance of innovation and entrepreneurship to the students to improve their everyday life and future careers.
3	Illustrate the macro perspective of innovation in entrepreneurship .
4	To Design the entrepreneurship process.
5	Develop innovation and entrepreneurship processes to improve students to the skill set .

UNIT 1	**1**
What is innovation - Why is innovation important -Types of innovation - The Innovation process	
UNIT 2	**2**
Introduction to Problem Solving-The role of problem - solving in innovation and product development -The importance of real-time problem statements- Problem Identification and Definition	
UNIT 3	**2**
What is entrepreneurship (and how is it different from innovation) -Types of entrepreneurship -The Human side of entrepreneurship	
UNIT 4	**2**
Misconceptions about entrepreneurship -The process of developing entrepreneurship - Module building entrepreneurship mindset- Developing a solution thinking mind set to identify tools and techniques	
UNIT 5	**8**
● 5 Hours: 60 Students * 5 Minutes Each – Team of Three Students (15 Minutes Per Team) – Collaborative Work To Research & Present 20 Case Studies: ○ Design Thinking (8 Case Studies), ○ Innovation (4 Case Studies) & ○ Entrepreneurship (8 Case Studies) ● 3 Hours: Faculty Facilitated `Design Thinking' Case Studies	
TOTAL PERIODS	**15**

Course Outcomes

At the end of the course, the student will be able to	
CO1	Understand basic concepts in the fields of innovation and entrepreneurship
CO2	Understand what a business model is and the process of problem solving.
CO3	Summarize the learning in developing an entrepreneurial idea, formed through innovative practices.
CO4	Model the correct problem solving methodologies with tools and techniques.
CO5	Design innovative solutions for real time problems.

TEXTBOOKS	
	Lorraine Marchand,"The Innovation Mindset: Eight Essential Steps to Transform Any Industry",Columbia Business School Publishing (13 September 2022)

REFERENCES	
	Peter F. Drucker," Innovation and Entrepreneurship"
	Martha Corrales-Estrada "Innovation and Entrepreneurship: A New Mindset for Emerging Markets",Emerald Publishing Limited (27 September 2019)

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	-	2	1	1	2	2	1	2	-	-	-
CO2	1	2	2	-	2	1	-	2	2	1	2	-	-	-

CO3	-	1	3	1	2	1	-	2	2	1	2	-	-	-
CO4	-	2	3	2	3	-	-	2	2	1	2	-	-	-
CO5	-	2	3	2	3	1	-	2	3	2	2	-	-	-
AVG	**1**	**1.6**	**2.6**	**1.6**	**2.4**	**1**	**1**	**2**	**2.2**	**1.2**	**2**	-	-	-

SEMESTER II								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
	U24IP201	Value Added Course – II (Biology for AI Engineers)	VAC	24	0	0	0	0
THEORY								
1	U24EN201	Professional English	HSMC	30	2	0	0	2
2	U24MA202	Probability and Statistics	BSC	60	3	1	0	4
3	U24PH202	Physics for Information Science II	BSC	45	3	0	0	3
4	U24TA201	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	15	1	0	0	1
5	U24EC202	Basics of Electrical and Electronics Engineering	ESC	45	3	0	0	3
6	U24CY201	Green and Sustainable Chemistry	BSC	30	2	0	0	2
THEORY CUM PRACTICAL								
7	U24CS201	Python Programming	ESC	90	3	0	3	4.5
PRACTICAL								
8	U24BS101	Physics and Chemistry Laboratory	BSC	60	0	0	4	2
9	U24TP210	Communication Skill Lab – II	HSMC	30	0	0	2	1
10	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
TOTAL				**420**	**17**	**1**	**12**	**23**

U24EN201	PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives	
1	Demonstrate understanding of reading and writing skills through meaningful language activities.
2	Apply technical vocabulary to communicate effectively in technical and professional contexts.
3	Apply key grammar concepts to produce clear, accurate, and effective written communication.
4	Evaluate writing examples based on purpose, audience, and context.
5	Apply knowledge of job applications and interviews to prepare for internships and placements.

UNIT 1 APPLIED LANGUAGE SKILLS	**6**
Reading: Reading user manuals, brochures, posters, pamphlets **Writing:** Review Writing (Book Review and Movie Review) **Grammar:** Tenses, Prepositional phrases **Vocabulary Development:** Technical vocabulary (synonyms and antonyms)	
UNIT 2 PRACTICAL WRITING AND GRAMMAR SKILLS	**6**
Reading: Reading longer technical texts **Writing:** Writing response to a complaint letter **Grammar:** Active and passive voice, Infinitives and Gerunds **Vocabulary Development:** Sequence words, Misspelled words	
UNIT 3 PROFESSIONAL WRITING AND ANALYTICAL READING	**6**
Reading: Case Studies, Excerpts from literary texts, news reports etc. **Writing:** Letter to the Editor, Checklists **Grammar:** If Conditionals, Articles **Vocabulary Development:** Collocation, Cause and effect expression	
UNIT4 DEVELOPING WRITING AND LANGUAGE SKILLS	**6**
Reading: Reading for detailed comprehension, newspaper articles **Writing:** Essay writing **Grammar:** Reported speech, Modals **Vocabulary Development:** Conjunctions	
UNIT 5 LANGUAGE SKILLS FOR CAREER SUCCESS	**6**
Reading: Company profiles, Statement of purpose, an excerpt of interview with professionals **Writing:** Job / Internship application – Cover letter & Resume **Grammar:** Relative Clauses, Numerical adjectives **Vocabulary Development:** Single sentence definition	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO 1	Read and comprehend various forms of technical and informational texts and extract the necessary information for application or analysis.
CO 2	Improve their vocabulary to articulate ideas clearly and effectively in professional and academic contexts.
CO 3	Use grammar accurately in written communication.
CO 4	Demonstrate proficiency in writing clear, structured responses, reviews, essays, and professional documents using appropriate tone, format, and language.
CO 5	Create professional documents as well as communicate effectively in professional scenarios, ensuring success in job and internship applications.

TEXT BOOKS	
1.	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2.	English for Science & Technology Cambridge University Press, 2021.
3.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
REFERENCES	
1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi
3.	Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

CO-PO,PSOMapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs)andProgrammeSpecificOutcomesPSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	0	0	0	0	1	0	1	2	3	2	2	-	-	-
CO2	0	0	0	0	1	0	1	3	3	2	2	-	-	-
CO3	0	0	0	0	1	0	1	1	3	2	2	-	-	-
CO4	0	0	0	0	1	1	2	3	3	3	2	-	-	-
CO5	0	0	0	0	1	1	2	2	3	3	3	-	-	-
AVG	0	0	0	0	1.0	0.4	1.4	2.2	3	2.4	2.2	-	-	-

U24MA202	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	-	4

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

UNIT 1 PROBABILITY AND RANDOM VARIABLES	**9+3**
Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.	
UNIT 2 TWO- DIMENSIONAL RANDOM VARIABLES	**9+3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).	
UNIT 3 TESTING OF HYPOTHESIS	**9+3**
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.	
UNIT 4 DESIGN OF EXPERIMENTS	**9+3**
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - Two square factorial design.	
UNIT 5 STATISTICAL QUALITY CONTROL	**9+3**
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.	
TOTAL HR	**60**

Course Outcomes

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

CO1	Understand the fundamental concepts of probability with a through knowledge of standard distributions that can describe certain real-life phenomenon.
CO2	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems

CO4	Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
CO5	Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS

1.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill,4th Edition, 2007.
2.	Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3.	John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992.
4.	Won Y.Yang,Young K.Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho lm, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.

REFERENCES

1.	Gupta. S.C. and Kapoor. V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand &Sons, New Delhi, 12th Edition, 2020.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning,New Delhi, 8th Edition, 2014.
3.	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition,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/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs

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

U24TA201	தமிழரும் தொழில் நுட்பமும் / TAMILS AND TECHNOLOGY	L	T	P	C
		0	0	0	1

அலகு I: நெசவு மற்றும் பானைத் தொழில்நுட்பம் **UNIT I: WEAVING AND CERAMIC TECHNOLOGY**	3
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு மற்றும் சிவப்பு பானைகள் (BRW) – பானைகளில் கீறல் குறியீடுகள் Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries	
அலகு II : வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **UNIT II : DESIGN AND CONSTRUCTION TECHNOLOGY**	3
சங்க காலத்தில் வீடு மற்றும் கட்டிட வடிவமைப்பு – சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தின் கட்டிடப் பொருட்கள் மற்றும் நடுகற்கள் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரத்தின் சிற்பங்கள் மற்றும் கோவில்கள் – சோழர் காலப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் கால கோவில்கள் – வகை ஆய்வு (மதுரை மீனாட்சி அம்மன் ஆலயம்) – திருமலை நாயக்கர் மஹால் – செட்டிநாடு வீடுகள் – பிரிட்டிஷ் காலத்தில் தராசில் இந்தோ–சராசெனிக் கட்டிடக் கலை Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	
அலகு III : உற்பத்தித் தொழில் நுட்பம் **UNIT III : MANUFACTURING TECHNOLOGY**	3
கப்பல் கட்டும் கலை – உலோகவியல் ஆய்வுகள் – இரும்புத் தொழிற்சாலை – இரும்பு உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணியுருவாக்கத் தொழிற்சாலைகள் – கல் மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் / எலும்பு மணிகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள் Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram	
அலகு IV : வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் **UNIT IV : AGRICULTURE AND IRRIGATION TECHNOLOGY**	3
அணை, ஏரி, குளங்கள், மதகு – சோழர் காலக் குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடைப் பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகங்கள் Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society	
அலகு V: அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் **UNIT V: SCIENTIFIC TAMIL & TAMIL COMPUTING**	3

அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்னூலாக்கம் செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் மெய்நிகர் கல்விக்கழகம் – தமிழ் மின்னூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

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

TOTAL PERIODS	**15**

TEXT BOOKS

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

U24PH202	PHYSICS FOR INFORMATION SCIENCE II	L	T	P	C
		3	0	0	3

Course Objectives	
1	To understand the electrical properties of materials including free electron theory, applications.
2	To enable the students to gain knowledge in semiconductor physics
3	To instill knowledge on magnetic properties of materials.
4	To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
5	To inculcate an idea of significance of nano structures, quantum confinement, ensuing nano device applications and quantum computing.

UNIT1 ELECTRICAL PROPERTIES OF MATERIALS	**9**

Conductors – Classical free electron theory of metals – Expression for Electrical and Thermal conductivity – Wiedemann – Franz law – Lorentz number – Success and failures of classical theory – Quantum theory – electron inperiodic potential -Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentrations in metals- Electron effective mass-concept of hole.

UNIT2 SEMICONDUCTOR PHYSICS	**9**

Properties of semiconductor -Direct and indirect band gap semiconductors - Intrinsic semi conductor – Carrier concentration in intrinsic semiconductors – Extrinsic semiconductors - Carrier concentration in N- type & P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Hall effect-determination of P&N type materials and Hall co efficient -Experiment.

UNIT3 MAGNETIC PROPERTIES OF MATERIALS	**9**

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses-– Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

UNIT4 OPTICAL PROPERTIES OF MATERIALS	**9**

Classification of optical materials – Absorption emission and scattering of light in metals, insulators and semiconductors (qualitative) – Carrier generation and recombination - photocurrent in a P-N diode – Principle and working of solar cell - LED – Organic LED – Laser diodes - Photo diode – Determination of V- I Characteristics -Photoconductors - Optical data storage techniques.

UNIT 5 PHYSICS OF NANOMATERIALS	**9**

Nano materials –Preparations, Properties, Applications, -Density of states in quantum well, quantum wire and quantum dot structures – Quantum confinement-Quantum well and Quantum dot lasers- CNOT gate-- Quantum Confined Stark effect.- Tunneling-resonant tunneling diode – Coulomb blockade-Single electron phenomena-single electron transistor.

TOTAL PERIODS	**: 45**

Course Outcomes

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

CO1	gain knowledge on classical and quantum electron theories, and energy band structures.
CO2	acquire knowledge on basics of semiconductor physics and its applications in various devices.
CO3	get knowledge on magnetic properties of materials and their applications in data storage.

CO4	have the necessary understanding on the functioning of optical materials for optoelectronics.
CO5	Understand quantum mechanics of nanostructures and their application to Nano electronics.

TEXT BOOKS

1.	Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007
2.	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.
3.	Progress in Nanoscale and Low-Dimensional Materials and Devices, Hilmi Unlu and Norman J M.Horing, Springer Link, 2022
4.	R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006

REFERENCES

1.	Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2.	Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3.	Yoshinobu Aoyagi and Kotaro Kajikawa, Optical Properties of Advanced Materials, Springer, 2013.
4.	Charles P. Poole Jr., Frank J. Owens, Introduction to nano technology, Wiley, 2003
5.	Principles of Electronic Materials and Devices, S.O.Kasap, McGraw Hill Education, 2017.
6.	Fundamentals of Nanoelectronics, G.W. Hanson, Pearson Education, 2009.
7.	Optoelectronics. Pearson Education, J. Wilson and J.F.B. Hawkes, 2018

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2					-	-	-	-	-	-	-	-
CO2	2	2	2				-	-	-	-	-	-	-	-
CO3	2	-		1	2	1	1	-	-	-	-	-	-	-
CO4	2	-	2	1	3		1	-	-	-	-	-	-	-
CO5	2	2	2	2	2	1	2	-	-	-	-	-	-	-
AVG	2	2	2	1.3	2.3	1	1.3	-	-	-	-	-	-	-

U24EC202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

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

UNIT I ELECTRICAL CIRCUITS 9

DC Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state). Introduction to AC Circuits: sinusoidal Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor –
Simple problems in series RLC circuits.
Introduction to three phase circuits:(star- delta conversion).

UNIT II ELECTRICAL MACHINES 9

DC generator- Construction and Working principle, types, EMF equation. DC Motor - Working Principle, types, Torque Equation. Applications. Single phase Transformer- construction, working principle and applications.
Three Phase and Single Phase Induction Motor- construction and working principle. Special Machines- Servo Motor and BLDC motor.

UNIT III ANALOG ELECTRONICS 9

Overview of Semiconductor Materials: Silicon &Germanium – PN Junction Diode -- Characteristics Applications – zener Diode -- Characteristics Applications –Bipolar Junction Transistor- JFET-- configurations -- I-V Characteristics and Applications, Rectifier and Inverters. appplications of Operational amplifiers, Ideal opamp characteristics, Inverting and Non-inverting amplifier.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, conversion of number systems,binary codes, error detection ancorrection codes,study of logic gates. Combinational logic Circuits - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, overview of Moving Coil and Moving Iron meters (Ammeters and voltmeters), DSO, Block diagram of Data acquisition systems. Electrical Safety – Fuses and Earthing.

TOTAL PERIODS : 45

Course Outcomes

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

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

TEXT BOOKS	
1.	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2.	S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3.	Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4.	James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015
REFERENCES	
1.	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill 2. Education, 2019.
2.	Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4.	Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	2	1	-	-	-	-	1	-	-	-	-	-	2
CO2	2	2	1	-	-	-	-	1	-	-	-	-	-	2
CO3	2	1	1	-	-	-	-	1	-	-	-	-	-	2
CO4	2	2	1	-	-	-	-	1	-	-	-	-	-	2
CO5	2	2	1	-	-	-	-	1	-	-	-	-	-	2
AVG	2	1.8	1	-	-	-	-	1	-	-	-	-	-	2

U24CY201	GREEN AND SUSTAINABLE CHEMISTRY	L	T	P	C
		2	0	0	2

Course Objectives

1	To give the basic knowledge on role of chemistry to mitigate environmental and global challenges.
2	To understand the global climatic change and the necessity for the preservation of ecosystem.
3	To become familiar with the safe design of synthesis and to minimze the generation of hazardous substances.
4	To understand the need of various energy resources for sustainable development.
5	To integrate the chemistry with environment, technology and public health.

UNIT1 ROLE OF CHEMISTRY - CURRENT CHALLENGES FOR SUSTAINABLE DEVELOPMENT	**6**

Role of chemistry in addressing the challenges for sustainable development and solving global issues. Nexus among biosphere environment, human and animal health. . Introduction to bio-diversity-threats and conservationof bio-diversity Millenium development goals (MDG) and sustainable development goals(SDG),clean development mechanism(CDM).

UNIT2 SUSTAINABLE ENVIRONMENTAL CHEMISTRY	**6**

Climate change – green house effect - gobal warming - sea level rise - intrusion and inundation, , ozone layer depletion, Elnino and LaNina – carbon credits, carbon trading ,carbon foot print, legal provision for environmental protection, coastal zone management-soft and hard measures, Ecosystem – estuaries - corals, mangroves, wetlands, sand dunes etc.

UNIT3 PRINCIPLES OF SUSTAINABLE GREEN CHEMISTRY	**6**

Sources, reactions and effect of chemicals in environments — Factory effluent and treatment, Handling of Hazards- Design of green pesticides for agriculture.- Introduction to Biocides: types and applications, Organic Insecticides – Carbamates, Chlorinated hydrocarbons, cypermithrin, Pyrethrin,silica gel,rotenone- synthesis properties and practical applications. -reduction of toxicity, improved recycling and improved product performance.

UNIT4 SUSTAINABLE ENERGY	**6**

Present energy challenges and the possible energy solutions - Solar energy- Solar panels- Solar water heater- solar heat collector and applications- Wind energy- Types – production - advantages and disadvantages- applications. Nuclear energy – production - advantages and disadvantages- applications. Geothermal energy – Production and applications – Bio fuels.

UNIT5 GOOD HEALTH AND WELL BEING -WATER-SOIL-AIR	**6**

Ground water contamination and contamination of water bodies. The role of chemistry in developing appropriate technological solutions for water treatment using Electrodialysis, Forward osmosis and advanced oxidation using photocatalysis and waste water treatment. Reclamation of soil. Current air pollution situation and trends. Factors responsible for air pollution. Air pollution assessment, monitoring and mitigation.

TOTAL PERIODS	**: 30**

Course Outcomes

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

CO1	Understand the ability to face the current challenges across globe with the aid of chemistry.
CO2	Identify the climatic challenges and to contribute for sustainable transformation.

CO3	Understand the safe design of products with the principles of green chemistry.
CO4	Understand to analyze the energy challenges for sustainable resource management.
CO5	Integrate chemistry with environmental science and public health.

TEXT BOOKS

1.	Anubha Kaushik and C.P.Kaushik "Perspectives in Environmental Studies",6thEdition,NewAge International Publishers, 2018.
2.	BennyJoseph,'Environmental Science and Engineering',TataMcGraw-Hill,NewDelhi,2016.
3.	Gilbert M. Masters, 'Introduction to Environmental Engineering and Science',2nd edition, Pearson Education, 2004.
4.	Allen,D.T.andShonnard,D.R.,SustainabilityEngineering:Concepts,DesignandCaseStudies, Prentice Hall.
5.	Bradley.A.S;Adebayo,A.O.,Maria,P.Engineering applications in sustainable design and development, Cengage learning.
6.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
7.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1.	M.Karpagam,Geetha Jaikumar,"Green Management Theory and Applications", ANE Publishers, First Edition, 2010
2.	Matlack,A.S. Introduction to green chemistry, Marcel Dekker: New York,2001.
3.	Anastas, P.T:Warner,J.C.Green chemistry:Theory and practice,Oxford univ press:oxford,1998.
4.	Fankte, Peter,et al. "Exposure and toxicity characterization of chemical emissions and chemical in products: Global recommendations and implementation in USEtox" The international journal of life cycle assessment,26.5(2021):899- 915.
5.	Rajagopalan. R, 'Environmental Studies-From Crisis to Cure',Oxford University Press, 2005.
6.	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Black swan Pvt. Ltd. 2013.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO 1
CO1	3	2	1	1	-	-	1	3	2	2	2	-	-	-	3
CO2	2	3	1	2	-	-	1	3	2	2	2	-	-	-	2
CO3	3	2	2	2	-	-	1	3	2	2	2	-	-	-	3
CO4	2	3	2	2	-	-	1	3	2	1	2	-	-	-	2
CO5	3	3	3	3	-	-	1	3	2	2	2	-	-	-	3
AVG	2.5	2.5	1.8	2	-	-	1	3	2	1.8	2	-	-	-	2.6

U24CS201	PYTHON PROGRAMMING	L	T	P	C
		3	0	3	4.5

Course Objectives

1	Develop and execute simple Python programs
2	Handle strings and functions in Python
3	Represent compound data using lists, tuples, dictionaries
4	Read and write data from/to files in Python programs
5	Perform basic operations using Python libraries.

UNIT 1 - INTRODUCTION TO PYTHON — **9+9**

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

Practicals:

1. Implement a python program to print an Electricity Bill. (for domestic usage.)
2. Implement a Python program to exchange the values of two variables. (using simple statements and expressions)

UNIT 2 CONTROL FLOW, FUNCTIONS, STRINGS — **9+9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif else);Iteration: state, while,for, break, continue, pass; Fruitful functions, return values, parameters, local and global scope, function composition,Lambda functions, recursion; Strings: string slices, immutability, string functions and methods, string module; Illustrative programs: square root, sum of individual digits of a number.

Practicals:

1. Implement a Python program to print a Number series & Number Patterns.(using Iterative loops).
2. Implement a Python program to find Factorial and largest number in a list(using Functions.)

Implement a Python program to perform operations on strings like string reverse,string concatenation & substring .(use match case).

UNIT 3 - LISTS, TUPLES, DICTIONARIES — **9+9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: linear search, binary search., Students marks statement.

Practicals:

1. Implement a Python program using Lists & Tuples. (operations of list & tuples - Book Catalogue)
2. Implement a Python program using Sets, Dictionaries. (operations of Sets - Product Categories , operations on Dictionaries - Product Categories)

UNIT 4 FILES, EXCEPTIONS AND MODULES — **9+9**

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Python Itertools & functools modules, Illustrative programs: Marks range validation.

Practicals:

1. Implement a Python program to perform file operations (copy from one file to another, word count, longest word).
2. Implement a Python program to handle Exceptions.(voter's age validity).

UNIT 5 LIBRARIES,PACKAGES — **9+9**

Python libraries - NumPy -Array manipulations, numeric ranges, Slicing, indexing, Searching, Sorting, and splitting, Pandas - Data Analysis, Data-frame, Data selection, group-by, Series, sorting, searching, and statistics, dask (pandas wrapper) ,Matplotlib- Data visualization , Line plot, Style properties, multi line plot, scatter plot.

Practicals:

1. Implement a Python program to create a weather data chart using Python Standard Libraries (pandas, numpy. Matplotlib, scipy)

TOTAL PERIODS	**: 90**

Course Outcomes

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

CO1	Develop and execute simple Python programs
CO2	Learn to handle strings and functions in python.
CO3	Represent compound data using Python lists, tuples, dictionaries
CO4	Read and write data from/to files in Python programs.
CO5	Perform basic operations using python Libraries

TEXT BOOKS

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

REFERENCES

1.	Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021
2.	G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling
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.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	-	-	2	-	-	-	-	-	1	-	-	2
CO 2	3	3	-	-	2	-	-	-	-	-	1	2	-	2
CO 3	2	3	2	-	3	-	-	1	-	-	1	2	1	2
CO 4	2	2	-	3	3	-	-	-	1	-	2	2	-	2
CO 5	1	2	-	2	3	-	-	1	1	-	3	2	1	2
AVG	**2.2**	**2.4**	**2**	**2.5**	**2.6**	**-**	**-**	**1**	**1**	**-**	**1.6**	**2**	**1**	**2**

U24BS101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on bending of beams,application of laser,. The course will also train the learner to observe good lab practices, record readings and analyse and interpret the results.
2	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on water treatment, electrochemistry, lubricants, composites and nanomaterials using simple chemical methods. The course will also train the learner to observe good lab practices, record readings and graphically represent the results, as well as analyse and interpret the influence of reaction conditions on the results.

LIST OF EXPERIMENTS:

PHYSICS LABORATORY

1.	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular objects
2.	Simple harmonic oscillations of cantilever.
3.	Uniform bending – Determination of Young's modulus
4.	Laser- Determination of the wave length of the laser using grating
5.	Ultrasonic Interferometer-Determination of compressibility of given liquid
6.	a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.
7.	Non-uniform bending - Determination of Young's modulus

CHEMISTRY LABORATORY

1.	Estimation of mixture of acids by conductometric titration
2.	Estimation of iron by potentiometric titration
3.	Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
4.	Determination of alkalinity in a water sample
5.	Estimation of hardness of water by EDTA method
6.	Estimation of hydrochloric acid by pHmetric method
7.	Determination of chloride content of water sample by Argentometric method
8.	Determination of viscosity of a polymer using ostwald's viscometer.
9.	Estimation of iron content using spectrophotometer.

TOTAL PERIODS	**:60**

COURSE OUTCOMES

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

CO1	Gain knowledge about torque and rigidity modulus of a material and understand the principles of simple harmonic motion and bending of beams
	Estimate the strength of given mixture of acids using conductance measurements under the principle of conductometric titration and Estimate the strength of given iron using EMF measurements with the help of potentiometer and have a knowledge on redox reaction.
	comprehend the principles of stress,strain & elasticity of the given materials & Gain knowledge about diffraction of laser light

CO2	Estimate the strength of given salt using conductance measurements under the principle of precipitation titration and Determine and estimate the amount of different types of alkalinities in water.
CO 3	Understand how sound waves are travelling in liquid medium&comprehend the light accepting power of given optical fibre and its transmission
	Employ complexometric titrations to estimate total hardness of a water sample and Determine the amount of chloride presemt in water using Argentometric method.

TEXT BOOKS

1.	Mechanics Part I&II, Narayanamoorthy, National publishing company,2001.
2.	Optics-Dr.Murugesan,TataMcgrew Hill,2004
3.	Gilbert M.Masters,'Introduction to Environmental Engineering and Science',2ndedition,Pearson Education, 2004.

REFERENCES

1.	Engineering Physics Manual, Visvesvaraya Technological university,2023
2.	Vogel's text book of quantitative chemicalAnalysis, 6th edition, Pearson Education,2009

CO-PO,PSOMapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs)andProgrammeSpecificOutcomesPSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	-	-	-	-	-	-	-	-	-	-	-

U24TP210	COMMUNICATION SKILLS LAB II	L	T	P	C
		0	0	2	1

Course Objectives	
1	Demonstrate understanding of spoken English in various contexts and participate in effective discussions in professional settings.
2	Demonstrate effective speaking and presentation skills.
3	Identify appropriate group discussion skills and apply them to participate in effective professional discussions.
4	Analyze issues and ideas to demonstrate critical thinking skills.
5	Apply communication strategies in real-life and workplace contexts through participation in mock interviews.

UNIT I	**6**
Listening: Listening to voicemail & messages, Audio texts, for writing short answers **Speaking:** Conversation between the interlocutor and each candidate	
UNIT II	**6**
Listening: Listening to podcasts, anecdotes and identifying topics, context etc.. **Speaking:** Presentation on any given topic (Non - Technical)	
UNIT III	**6**
Listening: One extended conversation or monologue - interview, discussion, lectures and educational videos **Speaking:** Group Discussion.	
UNIT IV	**6**
Listening: Listening to presentation and 5 min informal talk **Speaking:** Presentation on any given topic (Technical)	
UNIT V	**6**
Listening: Listening to interview skills **Speaking:** Mock interview	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand accurately and respond to a variety of spoken content to showcase their ability to capture both main ideas and supporting details.
CO2	Enhance the students to make effective presentations.
CO3	Speak effectively in group discussions held in a formal/semi-formal context.
CO4	Ability to interpret different genres of texts, infer implied meanings and evaluate it for ideas as well as for methods of presentation relevant in different situations
CO5	Motivate and prepare the students to attend job interviews and be successful in their pursuit.

List of experiments	
1.	Conversation
2.	Presentation on any given topic (Non - Technical)
3.	Group Discussion
4.	Presentation on any given topic (Technical)

5.	Mock interview
ASSESSMENT PATTERN	
End Semester Listening & Speaking activity will be conducted.	
1.	Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011
2.	Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
1.	E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
2.	Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
3.	English and Soft Skills, Dr. S.P. Dhanavel, Orient BlackSwan, 2013
4.	Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
5.	Interact English Lab Manual for Undergraduate Students,. Orient Balck Swan: Hyderabad, 2016
6.	E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
7.	Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
8.	S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	0	0	0	0	0	1	2	2	3	2	2	-	-	-
CO2	0	0	0	0	0	1	1	2	2	2	2	-	-	-
CO3	0	0	0	0	1	1	2	3	2	3	2	-	-	-
CO4	0	0	0	2	1	2	2	2	2	2	2	-	-	-
CO5	0	0	0	0	1	1	2	2	3	2	2	-	-	-
AVG	0	0	0	0.4	0.6	1.2	1.8	2.2	2.4	2.2	2	-	-	-

U24ED211	DESIGN THINKING – DECODING INNOVATION OPPORTUNITY	L	T	P	C
		0	0	1	0.5

Course Objectives

1	Understand and apply the five phases of the Stanford Design Thinking Framework (Empathize, Define, Ideate, Prototype, and Test) to identify user needs and create innovative solutions.
2	Gain knowledge of the five stages of the IDEO Design Thinking Framework (Discover, Interpret, Ideate, Experiment, and Evolve) and explore how to iteratively refine solutions through a human-centered approach.
3	Learn the application of Design Thinking tools such as visualization, journey mapping, value chain analysis, brainstorming, and rapid prototyping to generate and refine ideas that meet customer needs.
4	Apply Design Thinking methodologies to identify opportunities for innovation, scope projects, conduct research, generate ideas, and create business case studies and prototypes for real-world problem-solving.
5	Analyze and clarify innovation opportunities by understanding the problem, stakeholders, and solution context through frameworks like Doblin's Ten Types of Innovation and RACI, focusing on the 'Who', 'What', 'How', and 'Why' aspects of problem-solving.

UNIT – 1: STANFORD DESIGN THINKING FRAMEWORK — **3**

1. How To `Empathize'?
2. How To `Define'
3. How To `Ideate'?
4. How To `Prototype'?
5. How To `Test'?

UNIT – 2: IDEO DESIGN THINKING FRAMEWORK — **3**

- How To `Discover'?
- How To `Interpret'?
- How To `Ideate'?
- How To `Experiment'?
- How To `Evolve'?

UNIT – 3: DESIGN THINKING & DESIGN DOING — **2**

- `What Is'? - Overview About Visualization, Journey Mapping, Value Chain Analysis & Mind Mapping
- `What If'? - Overview About BrainStorming & Concept Development
- `What Wows'? - Overview About Assumption Testing & Rapid Prototyping
- `What Works'? - Overview About Customer Co-Creation & Learning Launch

UNIT – 4: DESIGN THINKING IN PRACTICE – Identify An Opportunity & Becoming Aware Of Next Steps For Innovation – Overview — **2**

- Before You Begin: Identify An Opportunity – Scope Your Project – Draft Your Design Brief – Make Your Plans
- `What Is' Focus: Do Your Research – Identify Insights – Establish Design Criteria
- What If' Focus: BrainStorm Ideas – Develop Concepts – Create Business Case Studies
- `What Wows' Focus: Surface Key Assumptions – Make Prototypes
- `What Works' Focus: Get Feedback From Stakeholders – Run Learning Launches – Design The On-Ramp

UNIT – 5: CLARIFYING PROBLEM STATEMENT & PRIORITIES BY IDENTIFYING & DECODING THE INNOVATION OPPORTUNITY	**5**

- Overview Of Doblin's Ten Types Of Innovation With Brief-Cases Towards Identifying Innovation Opportunity & Clarifying Problem Statement and Priorities
- Opportunity / Problem Clarity About `Who'? (Who're we solving the problem for?)
- Opportunity / Problem Clarity About `What'? (What is the Problem Or EGO – Expectation, Goal & Objective?)
- Opportunity / Problem Clarity About `HOW'? (How's the Overall Problem Solving Approach Help Highlighting RACI – Who's Responsible, Accountable, Consulted & Informed?)
- Opportunity / Problem Clarity About `WHY'? (Why's this Solution or Product or Service or Process beneficial to the stakeholders?)

TOTAL PERIODS	**15**

Course Outcomes

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

CO1	Apply Design Thinking frameworks, tools, and techniques to real-world problems, identifying opportunities for innovation and creating effective solutions.
CO2	Empathize with users, define problems, ideate solutions, prototype, and test, ensuring that solutions meet customer needs and are feasible, viable, and desirable.
CO3	Analyze problems, stakeholders, and solution contexts using frameworks like Doblin's Ten Types of Innovation and RACI, focusing on the 'Who', 'What', 'How', and 'Why' aspects of problem-solving.
CO4	Generate and refine ideas using Design Thinking tools like visualization, journey mapping, value chain analysis, brainstorming, and rapid prototyping, creating innovative solutions that meet customer needs.
CO5	Develop effective problem-solving skills, including the ability to scope projects, conduct research, generate ideas, and create business case studies and prototypes, preparing them to tackle complex real-world problems..

TEXT BOOKS

1	Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Publications, 2009
2	Don Norman, "The Design of Everyday Things", Basic Books, 2013
3	Tom Kelley, David Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", Currency, 2013

REFERENCES

1	Hasso Plattner, Christoph Meinel, Larry Leifer, "Design Thinking: Understand – Improve – Apply (Understanding Innovation)", Springer, 2011
2	Jakob Schneider, Marc Stickdorn, "This Is Service Design Thinking: Basics, Tools, Cases", John Wiley & Sons, 2011
3	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO2	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO3	-	2	3	2	2	2	-	3	3	2	2	1	1	1
CO4	-	2	3	2	2	2	-	3	3	2	2	1	1	1
CO5	-	2	3	2	2	2	-	3	3	2	2	1	1	1
AVG	1	2	3	2	2	2	1	3	3	2	2	1	1	1

SEMESTER III								
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA302	Discrete Mathematics	BSC	60	3	1	0	4
2	U24AD301	Fundamentals of Data Science and Analytics	PCC	45	3	0	0	3
3	U24MC313	Foreign Language (Japanese / French / German)	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
4	U24AD302	OOPS and Data Structures Design	ESC	75	3	0	2	4
5	U24AD303	Database Design and Management	PCC	75	3	0	2	4
6	U24EC310	Digital Principles and Computer Organization	PCC	75	3	0	2	4
PRACTICAL								
7	U24AD304	Data Science and Analytics Laboratory	PCC	45	0	0	3	1.5
9	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
10	U24ED311	Innovation Tool Kits	EDIC	15	0	0	1	0.5
11	U24RM312	Introduction To Problem Solving	RMC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**22.5**

#Mandatory Course is a Non-credit.

U24MA302	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

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

UNIT 1 LOGIC AND PROOFS	**9+3**
Propositional Logic – Propositional Equivalences – Normal Forms - Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.	
UNIT 2 COMBINATORICS	**9+3**
Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations -Generating Functions - Solving Linear Recurrence Relations Using Generating Functions– Inclusion – Exclusion – Principle and Its Applications.	
UNIT 3 GRAPHS	**9+3**
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.	
UNIT 4 ALGEBRAIC STRUCTURES	**9+3**
Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields**.**	
UNIT 5 LATTICES AND BOOLEAN ALGEBRA	**9+3**
Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems– Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.	
TOTAL PERIODS	**:60**

Course Outcomes

At the end of the course, the student will be able to	
CO1	Apply of propositions, predicates and flow of logical proofs
CO2	Understanding the knowledge of induction ,counting principles and to solve recurrence relation.
CO3	Understanding the knowledge of various types and characteristics of graphs.
CO4	Apply group,ring and field properties to solve algebraic problems.
CO5	Analyze lattice and Boolean algebra structures using algebraic laws.

TEXT BOOKS	
1.	Kenneth H. Rosen, ―Discrete Mathematics and its Applications‖, Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2012.

2.	Tremblay J.P. and Manohar R, ―Discrete Mathematical Structures with Applications to Computer Science‖, Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.
3.	Veerarajan.T,"Discrete Mathematics", 25th Edition,Tata Mcgraw Hill Education , private Limited ,2016.
4.	Won Y.Yang,Young K.Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho lm, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.
REFERENCES	
1.	Ralph. P. Grimaldi, ―Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education, Fifth Edition, New Delhi, 2014
2.	Seymour Lipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3.	Thomas Koshy," Discrete Mathematics with Applications ", Elsevier Publications, Boston, 2004.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	1	-	-	-	-	-	1	-	-	1	-	1
CO2	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	3	2	2	2	-	-	-	1	-	-	1	-	1
CO4	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO5	3	3	1	-	-	-	-	-	-	-	-	1	-	1
AVG	3	3	1.3	2	2	-	-	-	1	-	-	1	-	1

U24AD301	FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

Equip students with foundational skills in data collection, analysis, and interpretation to solve real-world problems using basic data science and analytical techniques.

1	Understand how data science is vital in modern digital ecosystems
2	Analyze the shape, center, and spread of distributions.
3	Explain how confidence levels affect the width of confidence intervals
4	Understand factorial experiments involving two independent variables.
5	Build regression models with multiple predictors..

UNIT 1 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 – Data Ethics & Privacy.

UNIT 2 DESCRIPTIVE ANALYTICS — **10**

Frequency distributions – Outliers –interpreting distributions-– graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data
- Normal distributions – z scores – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.

UNIT 3 INFERENTIAL STATISTICS — 9

Hypothesis testing – z-test –normal distribution- 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 4 ANALYSIS OF VARIANCE — **9**

T-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two factor experiments – three f-tests – two-factor ANOVA – Introduction to chi-square tests

UNIT 5 PREDICTIVE ANALYTICS — **9**

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. Introduction to survival analysis.

TOTAL PERIODS : 45

COURSE OUTCOMES

At the end of the course students will be able to

CO 1	Explain the data analytics pipeline
CO 2	Describe and visualize data
CO 3	Perform statistical inferences from data
CO 4	Analyze the variance in the data
CO 5	Build models for predictive analytics

TEXTBOOKS

1.	David 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.
3.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
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

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Product-based Projects (Team)	
1.	A Hands-on Approach to Data Science: Goal Setting, Processing, and Modeling
2.	Integrating & Transforming Data for Effective Analytics
3.	Building and Evaluating Regression Models: From Simple to Multiple Regression
4.	Analyzing Qualitative and Ranked Data Variability for Deeper Insights
5.	Exploring Relationships in Categorical Data: Chi-Square Test Applications"
6.	Hands-On Hypothesis Testing: P-Values, F-Tests, and Chi-Square Analysis
7.	Unpacking Variance: Conducting and Interpreting F-Tests and ANOVA Models
8.	Statistical Testing Workflow: From Sampling Distribution to Complex ANOVA
9.	Building Robust Linear and Logistic Regression Models with StatsModels
10.	Weighted Resampling and Regression Diagnostics: Improving Model Reliability

U24AD302	OOPS AND DATA STRUCTURES DESIGN	L	T	P	C
		3	0	2	4

Course Objectives: To apply data structures and OOP principles to solve real-world problems in AI and Data Science contexts.

1	To learn the fundamental concepts of Object-Oriented Programming (OOP) paradigms.
2	To familiarize oneself with the concept of Polymorphism and Inheritance.
3	To design and implement linear data structures.
4	To design and implement various tree structures.
5	Comprehend various graph representations and construct solutions for problems.

UNIT 1 INTRODUCTION TO OOP — **9+6**

Procedural vs. Object-Oriented Programming, Core OOP Concepts, Overview of C++, data types, operators, Objects and Classes**:** Definition, creating objects, instance variables, methods. Constructors and Destructors: Default, parameterized, copy constructors; destructor concepts. Static Members: Static variables and methods. this or self-Keyword, control flow statements (if-else, loops), Functions.

Practicals:

1. Implementation of Constructors & Destructors, Copy Constructor
2. Implementation of Friend Function & Friend Class.

UNIT 2 POLYMORPHISM AND INHERITANCE — **9+6**

Overloading: Function overloading and Operator Overloading, Types of Inheritance, Base Classes and Derived Classes — Protected Members, Access Specifiers, Constructors and Destructors in Inheritance, method overriding, Virtual Functions, This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding, Exception Handling: Try-catch blocks, throwing and handling exceptions.

Practicals:

3. Implement Polymorphism Concept- Function and Operator overloading.
4. Implement the concept of inheritance.

UNIT 3 LINEAR DATA STRUCTURE — **9+6**

Linked list implementation - Singly Linked List, Doubly Linked List, Circular Linked List. Queue ADT – Queue Implementation -Circular Queue — Priority Queue, Application of Queues. Stack ADT — Implementation of Stack using list- Applications: Evaluate expressions, Convert infix to postfix.

Practicals:

5. Implementation of Single Linked List (Insertion, Deletion and Display).
6. Implementation of Doubly Linked List (Insertion, Deletion and Display).
7. Implementation of Stack using Linked List.
8. Implementation of Queue using Linked List

UNIT 4 TREES — **9+6**

Tree ADT – Binary Tree ADT– Operations – Tree Traversals – Binary Search Tree-Red Black Trees – Operations – Expression tree-AVL Tree: Single and double rotations – Trie Data Structure, Properties and Basic Operations on Trie Data Structure, Applications of Trie data structure.

Practicals:

9. Implementation of a Binary Search Tree.
10. Implement the operations of Trie data structure

UNIT 5 GRAPHS — **9+6**

Representation of Graphs, Topological Sort, Depth First Search and Breadth-First Search, Minimum Spanning Tree – Prim's Algorithm, Shortest path algorithm – Dijikstra's Algorithm- Bellman-Ford-Graph connectivity – Applications of Graph

Practicals:

9. Implement Minimum Spanning Trees
10. Implement Shortest Path Algorithms

TOTAL PERIODS — **:45 + 30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Implement fundamental C++ programming constructs.
CO2	Apply core Object-Oriented Programming (OOP) principles.
CO3	Implement and analyze various linear data structures
CO4	Implement and traverse various Tree data structures.
CO5	Apply graph algorithms for connectivity and optimization

TEXT BOOKS	
1.	Data Structures and Algorithms in C++" by Michael T. Goodrich, Roberto Tamassia, David M. Mount,3rd Edition (2024)
2.	Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss,4th Edition (2014)

REFERENCES	
1.	"C++ Primer" by Stanley B. Lippman, Josée Lajoie, Barbara E. Moo,5th Edition (2012)
2.	"Programming -- Principles and Practice Using C++" by Bjarne Stroustrup, 2nd Edition (2014)

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	-	3	-	-	2	1	-	2	2	1	-
CO2	3	3	3	1	3	1	-	2	1	1	2	3	2	1
CO3	3	3	3	2	3	-	-	2	1	1	2	2	3	-
CO4	3	3	3	2	3	-	-	2	1	1	2	3	3	-
CO5	3	3	3	2	3	1	-	2	1	1	2	3	3	-
AVG	**3**	**2.8**	**2.8**	**1.8**	**3**	**1**	**0**	**2**	**1**	**1**	**2**	**2.6**	**2.4**	**1**

Product based Projects (in Team)

1	Smart Contact Management System with Trie Search
2	Route Optimization for Delivery Services (Dijkstra/BFS)
3	Basic Recommendation System using Graph Algorithms
4	Expression Evaluator & Converter (Infix-to-Postfix) with Stack Visualization
5	Online Quiz System with Dynamic Question Bank (Tree)
6	"Who Wants to Be a Millionaire" Game (Tree-based Question Flow)
7	Dynamic Memory Allocator Simulator (Linked List)
8	Patient Appointment Scheduling System (Priority Queue/Circular Queue)
9	Simple Version Control System (Linked List/Stack for commits)
10	File Compression/Decompression using Huffman Coding (Binary Tree/Priority Queue)
11	Text Editor with Undo/Redo Functionality (Stack-based)
12	Family Tree / Genealogy Explorer (Tree Structure)
13	Plagiarism Checker (Trie/Hashing for efficient text comparison)
14	Zombie Apocalypse Simulator (BFS/DFS on Grid Map)
15	Event Management System with Time-based Scheduling (Min-Heap/Priority Queue)
16	Phone Directory with Predictive Text (Trie Data Structure)
17	University Course Prerequisite System (Topological Sort)
18	Basic Image Processing Filters (Matrix/Array Operations)
19	Stock Price Tracker with Moving Average (Circular Queue/Dynamic Array)
20	Sudoku Solver using Backtracking (Stack/Array)

U24AD303	DATABASE DESIGN AND MANAGEMENT	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:
Design and implement a normalized database system enforcing integrity constraints, and Query optimization

1	Explore Database Architectures
2	Construct and Analyze SQL Queries
3	Understand the Motivation for Normalization
4	Analyze and Implement Schedules and Serializability
5	Design for Distributed Databases

UNIT1 INTRODUCTIONTODATABASESYSTEMS — **9+6**

Introduction–PurposeofDatabaseSystems-ViewofData–DatabaseArchitecture-databasesystem development lifecycle - Entity-Relationship model – Enhanced-ER model – UML class diagrams.

Practicals:

Database Development Lifecycle:

1. Problem definition and Requirement analysis scope and Constraints
2. Database design using Conceptual modelling(ER-EER)–top-down approach Mapping conceptual to relational database and validate using Normalization

UNIT2 RELATIONALMODELANDSQL — **9+6**

DatabaseSchema–Keys–Codd'sRule–RDBMS-SQL:DataDefinition–Domaintypes–Structureof SQL Queries - Modifications of the database–Set Operations –AggregateFunctions –NullValues-SQLNested Subqueries– Complex Queries –Views – Joined relations– Complex Queries-Introduction to NoSQL and MongoDB

Practicals:

3. Introduction to SQL: DDL, DML, DCL, TCL. SQL clause
4. SELECT FROM WHERE GROUP BY, HAVING, ORDER BY Using SQ Lite / My SQL / Oracle

UNIT 3 NORMAL FORMS AND INDEXING — **9+6**

MotivationforNormalForms–Functionaldependencies–Armstrong'sAxiomsforFunctionalDependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF-File Organization-Indexing B+ tree ,B-Tree

Practicals:

5. WriteaPL/SQLblocktospecifyconstraintsbyacceptinginputfromtheuser.
6. Implementation of PL/SQL Procedure(IN,OUT,IN OUT) with Exception Handling
7. Implementation of PL / SQL Function.

UNIT 4 TRANSACTION PROCESSING AND ERROR RECOVERY — **9+6**

Transaction concepts - ACID Properties –Schedules –Serializability-Implementation of Isolation Levels – Concurrency Control: Lock based protocols-Deadlock handling-Timestamp based protocols(CBS)-Error Recovery: Failure classification, deferred update, immediate update, Shadow paging

Practicals:

8. Implementation of PL/ SQ command.
9. Implementation of PL /SQL Cursor.
10. Implementation of Top-Down approach.
11. Implementation of Bottom-up approach

UNIT 5 OBJECTRELATION AND DATABASE DESIGN — **9+6**

Mapping EER to ODB schema –Object identifier — reference types –row types — Introduction to ER model-Mapping from ER to relational model-Functional Dependencies-Normalization (BCNF, Optionally 3NF,Nosql and distributed database

Practicals:

12. Object features of SQL Convert ER design to tables
13. Implementation of hospital management system
14. Implementation of Normalization Approach

TOTAL PERIODS — **:45+30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Understand the database development life cycle and apply conceptual modeling
CO2	Apply the basics of SQL and construct queries using SQL
CO3	Apply the conceptual-to-relational mapping and normalization to design relational database
CO4	Determine the serializability of any non-serial schedule using concurrency techniques
CO5	Relate the data model and querying in Object-relational and No-sql database
TEXTBOOKS	
1.	Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2.	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2017.
3.	Introduction to Database Systems, C.J.Date, Pearson Education 2021
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.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO3**
CO1	2	2		3	-	-	-	3	1	2	1	2	3	3
CO2	2	3	1	3	1	-	-	1	2	2	1	3	3	3
CO3	2	2	2	1	1	-	-	2	3	1	2	1	1	2
CO4	2	2	3	1	-	-	-	1	2	1	2	2	2	2
CO5	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

Product based Projects (in Team)	
1.	Electronic Health Record (EHR) System:
2.	Online Course Platform with Progress Tracking:
3.	Order Fulfillment & Tracking System:
4.	Personal Finance Management (PFM) Application:
5.	Personalized Product Recommendation Engine:
6.	Online Course Registration System

7.	Crime Record Management System
8.	Vehicle Service Management System
9.	Student Academic Performance Tracking System
10.	Online Food Delivery System

U24EC310	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	2	4

Course Objectives

1	To analyze and design combinational circuits.
2	To analyze and design sequential circuits
3	To understand the basic structure and operation of a digital computer.
4	To study the design of data path and control unit for the processor and to familiarize with the hazards.
5	To understand the concept of various memories and I/O interfacing.

UNIT 1 COMBINATIONAL LOGIC CIRCUITS — **9+12**

Combinational Circuits – Karnaugh Map - Minimization Techniques: Minimization of Boolean expressions using Boolean laws, Karnaugh map Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers – De multiplexers

Practicals:

1. Design and implementation of combinational circuits using gates for arbitrary functions. Implementation of binary adder/subtractor circuits.
2. Implementation of encoder and decoder circuits.
3. Implementation of functions using Multiplexers and Demultiplexers.

UNIT 2 SYNCHRONOUS SEQUENTIAL LOGIC — **9+9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

Practicals:

4. Design and Implementation of counters
5. Design and Implementation of Registers

UNIT 3 COMPUTER FUNDAMENTALS — **9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

Practicals:

6. Simulator based study of Computer Architecture

UNIT 4 INSTRUCTION EXECUTION AND PROCESSOR — **9 + 9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control - Introduction to processors (8085) and basics of programming – Pipelining – Data Hazard – Control Hazards.

Practicals:

7. Arithmetic operations using 8085
8. ALU operations using 8085
9. Interfacing operations using 8085

UNIT 5 MEMORY AND I/O SYSTEMS — **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 – Interconnection Standards: USB, SATA

TOTAL PERIODS — **45 + 30**

COURSE OUTCOMES

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

CO1	Analyze and Design various combinational digital circuits using logic gates and simplify Boolean expressions using minimization techniques
CO2	Analyze and Design sequential circuits using the Flipflops

CO3	Understand the fundamentals of computer systems and analyze the execution of an instruction
CO4	Understand the control design process and Analyze the various processors and perform basic operations
CO5	Identify the characteristics of various memory systems and I/O communication

TEXT BOOKS

1.	M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2.	David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

REFERENCES

1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2.	William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
3.	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
4.	Charles H.Roth."Fundamental sofLogic Design", 6th Edition,Thomson Learning, 2013.
5.	Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", 2nd Edition, Pearson Education,2005.
6.	John P Hayes, "Computer Architecture and Organization",3rd edition, McGraw Hill, 2002.

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

U24AD304	DATA SCIENCE AND ANALYTICS LABORATORY	L	T	P	C
		0	0	3	1.5

Course Objectives	
1	To develop data analytic code in Python
2	To be able to use Python libraries for handling data
3	To develop analytical applications using python
4	To perform data visualization using plots

LIST OF EXPERIMENTS	
1.	Working with Pandas data frame
2.	Basic plots using Matplotlib
3.	Frequency distributions, Averages, Variability
4.	Normal curves, Correlation and scatter plots, Correlation coefficient
5.	Regression
6.	Z-test
7.	T-test
8.	ANOVA
9.	Building and validating linear models
10.	Building and validating logistic models
11.	Time series analysis

Tools: Using Jupyter Notebook.,Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

TOTAL PERIODS	**: 45**

COURSE OUTCOMES

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

CO1	Write python programs to handle data using Numpy and Pandas
CO2	Perform descriptive analytics
CO3	Perform data exploration using Matplotlib
CO4	Perform inferential data analytics
CO5	Build models of predictive analytics

TEXT BOOKS

1.	David 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.
3.	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES

1.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014
2.	Data Analysis and Visualization Using Python, Analyze Data to Create Visualizations for BI Systems — Dr. Ossama Embarak

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

U24TP310	GENERAL APTITUDE & LOGICAL REASONING	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES	
1	Master fundamental and advanced quantitative aptitude skills essential for competitive exam
2	Develop speed and accuracy in solving arithmetic, algebraic, and data interpretation problems.
3	Apply mathematical concepts to solve real-life and recruitment-related problems.
4	Strengthen logical reasoning skills, including number series and coding-decoding.
5	Prepare confidently for placement and competitive exam aptitude sections.

Topics	
1.	Number System
2.	LCM & HCF
3.	Divisibility
4.	Number and Decimal Fractions
5.	Percentages
6.	Ratio & Proportion
7.	Profit, Loss and Discount
8.	Average & Mixtures
9.	Simple Interest and Compound Interest
10.	Time and Work
11.	Time and Distance
12.	Pipes and Cistern
13.	Problems on Race
14.	Problems on Trains
15.	Problems on Ages
16.	Permutations & Combinations
17.	Probability
18.	Data Interpretation (Multiple charts & caselets)
19.	Logarithms
20.	Surds & Indices
21.	Boats and Stream
22.	Measurement
23.	Algebra
24.	Calendar
25.	Data Sufficiency & Logical Data Analysis
26.	Work Efficiency & Manpower Problems
27.	Complex Number Series (Arithmetic & Geometric)
28.	Advanced Approximation & Simplification Techniques
TOTAL PERIODS	**: 30**

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO1	Solve arithmetic & algebra problems with accuracy
CO2	Interpret complex data & charts
CO3	Apply logical reasoning techniques
CO4	Solve time & work/distance problems
CO5	Excel in recruitment aptitude tests
TEXTBOOKS	
1.	R.S. Aggarwal, Quantitative Aptitude, S. Chand
2.	Ananta Ashisha, Data Interpretation & Data Sufficiency, Arihant
REFERENCES	
1.	S.P. Bakshi, General Aptitude, Arihant
2.	Rakesh Yadav, Competitive Aptitude, Arihant

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1											1			
CO2											1			
CO3											1			
CO4											1			
CO5											1			

U24ED311	IGNITE - ENTREPRENEURSHIP AND NEW VENTURE CREATION	L	T	P	C
		1	0	2	2

COURSE OBJECTIVES

1	Develop entrepreneurial mind-set and attributes; entrepreneurial skill sets for venture creation and entrepreneurial leadership
2	Apply process of problem-opportunity identification and feasibility assessment through developing a macro perspective of the real market, industries, domains and customers while using design thinking principles to refine and pivot their venture idea
3	Analyse Customer and Market segmentation, estimate Market size, develop and validate Customer Persona
4	Initiate Solution design, Prototype for Proof of Concept. Understand MVP development and validation techniques to determine Product-Market fit
5	Craft initial Business and Revenue models, financial planning and pricing strategy for profitability and financial feasibility of a venture. Understand relevance and viability of informal and formal funding with respect to different business models..
6	Understand and develop Go-to-Market strategies with a focus on digital marketing channels.
7	Understand and apply story telling skills in presenting a persuasive and defensible Venture Pitch.

UNIT 1 ENTREPRENEURSHIP FUNDAMENTALS & CONTEXT	**2**

Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillsets, attributes and networks while on campus.
Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

UNIT 2 PROBLEM & CUSTOMER IDENTIFICATION	**3**

Understanding and analysing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problems using Design thinking principles. Analysing problems and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity.
Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the building' and Venture Activity

UNIT 3 SOLUTION DESIGN, PROTOTYPING & OPPORTUNITY ASSESSMENT AND SIZING	**2**

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.
Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

UNIT 4 BUSINESS & FINANCIAL MODEL, GO-TO-MARKET PLAN	**2**

Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.
Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT 5 SCALE OUTLOOK AND VENTURE PITCH READINESS	**6**

Understand and identify potential and aspiration for scale vis a vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.
Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

TOTAL PERIODS	**:40**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Develop an entrepreneurial mindset and appreciate the concepts of entrepreneurship, cultivate essential attributes to become an entrepreneur or Entrepreneur and demonstrate skills such as problem solving, team building, creativity and leadership
CO2	Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution
CO3	Analyse and refine business models to ensure sustainability and profitability
CO4	Build Prototype for Proof of Concept and validate MVP of their practice venture idea
CO5	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
CO 6	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders
TEXT BOOKS	
1.	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGraw Hill, 11th Edition
REFERENCES	
1.	Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
2.	Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons
3.	Simon Sinek (2011) Start with Why, Penguin Books limited
4.	Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business
5.	Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
6.	Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd
WEB RESOURCES	
1.	Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

CO/PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 2	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 3	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 4	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 5	1	2	3	2	2	2	1	3	3	2	2	1	1	1
AVG	**1**	**1.8**	**2.8**	**1.8**	**1.8**	**2**	**1**	**3**	**3**	**2.2**	**2.2**	**1**	**1**	**1**

U24RM312	INTRODUCTION TO PROBLEM SOLVING	L	T	P	C
		0	0	1	0.5

COURSE OBJECTIVES	
1	Develop an understanding of the types and characteristics of problems in research and real-life scenarios
2	Enable students to explore creative and critical thinking strategies for solving complex problems
3	Introduce engineering-oriented and methodical problem-solving techniques using logical and algorithmic thinking.
4	Equip students to analyze, model, and evaluate real-world problems in diverse domains.
5	Foster the ability to apply scientific inquiry and strategic design to derive optimized solutions

UNIT1 Problem Solving	**2**
Problem – types and characteristics, Problem vs research question, Curiosity and observation in research, Introduction to critical and analytical thinking, Literature Survey, Redefined Problem Statement	
UNIT2 The Art and Craft of Creative Problem Solving	**3**
Understanding the nature of problems, Techniques for defining and analysing problems, Strategies for investigating problems, Tactics for solving problems, Creative thinking methods for generating solutions, Evaluating and implementing solutions effectively, The toolbox, Algebra, Combinatronics, Number Theory, Geometry, Calculus.	
UNIT3 Problem Solving for New Engineers	**2**
Formulation, Myths of Discovery, Experimenting with Storytelling, Variation, Strategic Design, Randomness.	
UNIT4 Methodical Approach in Problem Solving	**2**
Scientific methods and its applications in research, Algorithmic thinking, Step-wise problem decomposition, Heuristics and Optimization strategies, Comparative analysis of problem solving techniques	
UNIT5 Real-life Examples in Problem Solving techniques	**6**
Problem solving examples in Healthcare, Education, Urban and Infrastructure, Business and Workplace related problems, Technology and Software, Agriculture and Environment, Engineering and Design, Society and Community problems	
TOTAL PERIODS	**:15**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Demonstrate critical, analytical, and observational skills to redefine a research problem
CO2	Apply creative thinking and problem analysis techniques to generate and evaluate solutions.
CO3	Use mathematical tools like algebra, number theory, and geometry to solve structured problems
CO4	Adopt algorithmic, heuristic, and optimization strategies in scientific problem solving.
CO5	Analyze and apply appropriate problem-solving approaches to real-life sector-specific problems.

TEXT BOOKS	
1.	G. Polya, How to Solve It: A New Aspect of Mathematical Method, 2nd ed. Princeton, NJ, USA: Princeton University Press, 2014.
2.	M. Buie, Problem Solving for New Engineers: What Every Engineering Manager Wants You to Know. Boca Raton, FL, USA: CRC Press, 2018.
3.	A. Barker, How to Solve Almost Any Problem: The Creative Approach to Any Problem Solving. New York,

	NY, USA: Wiley, 2001.
4.	P. Zeitz, The Art and Craft of Problem Solving, 3rd ed. Hoboken, NJ, USA: Wiley, 2016.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	-	2	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	2	2	-	-	-	-	-	2	1	1	1
CO3	3	3	3	-	2	-	-	-	-	-	-	1	1	1
CO4	3	3	3	3	2	-	-	-	-	-	-	1	1	1
CO5	3	3	3	3	3	2	2	-	2	2	2	1	1	1
AVG	3	2	2.75	2.5	2.25	2	2	-	2	2	2	1	1	1

SEMESTER IV								
S. NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA402	Linear Algebra and Numerical Methods	PCC	60	3	1	0	4
2	U24AD401	Artificial Intelligence	PCC	45	3	0	0	3
3	U24AD402	Machine Learning	PCC	45	3	0	0	3
4	U24MC413	Indological Studies	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5	U24AD403	Introduction to Operating Systems	PCC	75	3	0	2	4
6	U24AD404	Data Exploration and Visualization	PCC	75	3	0	2	4
PRACTICAL								
7	U24AD405	Artificial Intelligence Laboratory	PCC	45	0	0	3	1.5
8	U24AD406	Machine Learning Laboratory	PCC	45	0	0	3	1.5
9	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
10	U24ED411	Idea and Simulation Lab	EDIC	15	0	0	1	0.5
11	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				**480**	**17**	**1**	**14**	**23**

#Mandatory Course is a Non-credit

U24MA402	LINEAR ALGEBRA AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1	To introduce the basic notions of vector spaces which will then be used to solve related problems.
2	To understand the concepts of vector space, linear transformations , inner product spaces and orthogonalization.
3	To introduce the basic concepts of solving algebraic and transcendental equations.
4	To introduce the Interpolation operators and numerical techniques of interpolation in various intervals, numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT 1 VECTOR SPACES **9+3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT 2 LINEAR TRANSFORMATION AND INNER PRODUCT SPACES **9+3**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT 3 SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **9+3**

Solution of algebraic and transcendental equations - Fixed point iteration method -Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method.

UNIT 4 INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **9+3**

Interpolation operators (Forward, Backward, shifting operators and its Properties) – Newton's forward and backward difference interpolation for equal intervals – Lagrange's and Newton's divided difference interpolations for unequal intervals - Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT 5 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9+3**

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 PERIODS : 60

Course Outcomes

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

CO1	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2	Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the ordinary differential equations with initial conditions by using certain techniques with engineering applications.

TEXT BOOKS

1.	Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi, 4 th Edition, 2004.
2.	Grewal. B.S. and Grewal. J.S., “Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
3.	Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
4.	Won Y.Yang,Young K.Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho lm, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.

REFERENCES

1.	Kolman. B. Hill. D.R., “Introductory Linear Algebra”, Pearson Education, New Delhi, First Reprint, 2009.
2.	Kumaresan. S., “Linear Algebra – A Geometric Approach”, Prentice – Hall of India, New Delhi, Reprint, 2010.
3.	Burden, R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.
4.	.Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.
5.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis” Pearson Education, Asia, New Delhi, 2006.
6.	Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
7.	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.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

U24AD401	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: Develop intelligent systems or applications by integrating AI techniques such as search algorithms, knowledge representation and natural language processing to solve real world problems.

1	Understanding the fundamental concepts of Intelligent Agents
2	Apply Problem Solving Techniques and Understand Search Strategies
3	Apply Game Playing and CSP
4	Analyse and Apply Logical Reasoning
5	Understand Probabilistic Reasoning and Natural Language Processing

UNIT 1 INTELLIGENT AGENTS	**8**

Introduction to AI -Agents and Environments -concept of Rationality-Rational Agent-PEAS Description-Nature of Environments-Structure of Agents-Applications of Artificial Intelligence- Problem solving agents

UNIT 2 PROBLEM SOLVING	**10**

Search algorithms-uninformed search Strategies-Breadth First Search-Depth First Search Depth Limited Search-Iterative Deepening Depth-First Search (IDDFS)-Uniform-Cost Search (UCS)-Heuristic search strategies-A* Search-AO* Search-Memory Bounded A* Algorithm - Greedy Best First Search-Hill Climbing Algorithm-Genetic Algorithm

UNIT 3 GAME PLAYING AND CSP	**9**

Game Theory-optimal decisions in Games-Min-Max Algorithm for Game Playing-Alpha-beta Pruning-Constraint satisfaction problems-constraint propagation -backtracking search for CSP-Overview of Reinforcement Learning-Components of Reinforcement Learning -Markov decision process.

UNIT 4 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 - resolution.

UNIT 5 PROBABILISTIC REASONING AND NLP	**9**

Probabilistic Reasoning - Bayesian networks - exact inference in BN - Natural language processing Morphological Analysis - Syntax analysis - Semantic Analysis - NLP Applications - Language Models - Information Retrieval - Information Extraction

TOTAL PERIODS	**:45**

COURSE OUTCOMES

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

CO1	Understand the Fundamental Concepts of Intelligent Agents
CO2	Apply Problem Solving Techniques and Search Strategies
CO3	Apply Game Playing and Constraint Satisfaction Problems
CO4	Explain Logical Reasoning systems
CO5	Understand Naive Bayes Model and Natural Language Processing

TEXTBOOKS

1.	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2.	Artificial intelligence a guide to intelligent systems - Fourth edition,2024

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/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 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	2	1	2	1	1	-	-	1	1	2	2	2	2	1
AVG	2.2	1.2	2	1.6	1	-	-	1.8	1.6	2.2	1.8	1.8	2	1.6

Product based Projects (in Team)

1.	AI-Powered Language Translation App - Create an application that translates spoken or written language in real-time.
2.	AI-Based Financial Advisor -Create A virtual assistant that provides financial advice based on user spending habits and financial goals.
3.	Smart Traffic Management System - Create an AI-driven system that optimizes traffic flow and reduces congestion.
4.	AI-Based Health Monitoring System - Create A system that monitors vital health parameters and predicts potential health issues.
5.	AI-Powered Personalized Learning Assistant - Create an adaptive learning platform that personalizes educational content based on individual student performance and learning styles.
6.	AI based Trip Advisor and Trip planning app.
7.	AI powered Resume Analyzer that checks grammar, job relevant information and gives improvement suggestions
8.	AI Powered Autonomous Game-Playing Agent
9.	AI-Based Smart Farming System - Predict crop yield or disease using environmental data.
10.	Face Recognition Attendance System-Automate attendance using facial recognition.
11.	AI-Based Resume Screening Tool-Automatically rank resumes based on job descriptions using NLP.
12.	Sentiment Analysis for Social Media-Analyze opinions from Twitter, Reddit, or product reviews.
13.	Automatic Text Summarization Tool-Generate concise summaries from long documents.
14.	Fake News Detection System-Classify news articles as real or fake using NLP techniques.
15.	Emotion Recognition System-Detect emotions from text, voice, or facial expressions.

U24AD402	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: Design and develop a machine learning model by analyzing datasets, synthesizing appropriate algorithms, and evaluating the model's performance to solve a real-world problem

1	Understanding the fundamental concepts of Machine Learning and types
2	Apply clustering to group data and reduce its complexity
3	Evaluate classification methods like decision trees and SVMs to create predictive models.
4	Apply Bayesian learning and graphical models to perform intelligent inference
5	Apply neural networks and reinforcement learning techniques to build adaptive intelligent systems.

UNIT 1 MACHINE LEARNING BASICS — **9**

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of Machine learning methods– Early trends in Machine learning – Data understanding, representation and visualization– Hypothesis- Modelling in Machine learning - Classification: Probability theory and Bayes rule – Generative vs. discriminative training – Self-supervised Learning and Transfer learning.

UNIT 2 ENSEMBLE, CLUSTERING AND DIMENSIONALITY REDUCTION — **9**

Ensemble Learning: Using committees of multiple hypotheses, Bagging - Random Forest- Adaptive Boosting, Stacking and DECORATE- Active learning with ensembles – Clustering– K- means Clustering– Hierarchical Clustering - Expectation Maximization algorithm– Gaussian Mixture Model– Dimensionality Reduction – Principal Component Analysis (PCA) – Linear Discriminant Analysis (LDA) - Latent Variable Models (LVM) – Latent Dirichlet Allocation – Independent Component Analysis (ICA)

UNIT 3 CLASSIFICATION TECHNIQUES — **9**

Regularization techniques- Decision Tree based Learning algorithms– Induction algorithms– Regression trees- Instance based Learning - Support Vector Machines: Hard and soft margin – Functional and Geometric margin - Maximum margin linear separators – Kernels for learning non- linear functions

UNIT 4 PROBABILISTIC LEARNING MODEL — **9**

Bayesian Learning - Naive Bayes Algorithm- Introduction to Graphs – Bayesian Belief Networks - Inference in Graphical Models- Markov Chain – Markov Model- Hidden Markov Models – Inference– Learning - Generalization– Undirected Graphical Models

UNIT 5 ANN & REINFORCEMENT LEARNING — **9**

Artificial Neural Networks– Structure and Activation functions– Perceptron– MultiLayer Perceptron- Backpropagation– Gradient descent training - Radial Basis function Neural Network- Overview of Reinforcement Learning- Components of Reinforcement Learning - Markov decision process- Model Based Learning - Model Free Learning - Q Learning.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

CO1	Understand the basics of machine learning
CO2	Solve analytical problems with relevant mathematics background knowledge.
CO3	Explain testing and evaluation machine learning algorithms.
CO4	Understanding ANN models apply knowledge in data analytics.
CO5	Explore the knowledge of unsupervised learning in data analysis.

TEXTBOOKS

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	Ameet V Joshi, "Machine Learning and Artificial Intelligence", Springer Publications, 2020.
2	Sridhar S. and Vijayalakshmi M., "Machine Learning", Oxford University Press, 2021.
3	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
4	John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, "Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies", MIT press, 2015
5	Tom Mitchell, "Machine Learning", McGraw-Hill, 1997
6	Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
7	Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021
8	Jerome Friedman, Robert Tibshirani, Trevor Hastie, "The Elements of Statistical Learning", Springer, 2017.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO3	2	2	2	2	2	1	1	2	2	1	2	1	1	1
CO4	2	2	2	2	3	1	1	2	2	1	2	2	3	1
CO5	2	2	2	2	3	1	1	2	2	1	2	2	3	1
AVG	2	2	2	2	3	1	1	2	2	1	2	2	2	1

Product based Projects (in Team)

1	Develop an ML-powered risk assessment tool to predict hazardous zones based on environmental and worker movement data.
2	Build a quality control system using computer vision and ML models to identify defective products automatically.
3	Create an ML model that predicts disease risks based on patient symptoms and medical history.
4	Apply reinforcement learning to optimize traffic signal timings and reduce congestion in smart cities.
5	Use ML to predict energy demand patterns and suggest efficient electricity distribution strategies.
6	Develop a fraud detection system using anomaly detection methods to prevent fraudulent transactions.
7	Design an intelligent chatbot that provides legal guidance based on natural language processing (NLP).
8	Utilize ML algorithms to detect crop diseases early and suggest appropriate treatments to farmers.
9	Implement a recruitment tool that automatically screens resumes based on job descriptions using NLP.
10	Create an ML-based inventory tracking system that forecasts product demand and optimizes stock levels.

U24AD403	INTRODUCTION TO OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

Course Objective :Develop an operational multi-threaded application or prototype system by analyzing, synthesizing, and evaluating core operating system concepts

1	Analyse the fundamental concepts of operating system operations, structures, and inter-process communication mechanisms.
2	Evaluate various synchronization mechanisms and CPU scheduling algorithms to optimize multicore program execution and enhance system efficiency.
3	Analyse deadlock handling strategies and file system management techniques to design robust and efficient operating system solutions.
4	Evaluate various memory management techniques, including paging and allocation strategies, to optimize memory utilization and system performance.
5	Analyse diverse mass-storage structures, I/O systems, and operating system design principles (Linux vs. Windows, Android) to evaluate their impact on overall system efficiency and responsiveness.

UNIT 1 INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES — 9+6

Introduction to OS – Operating System Operations – Operating System Services – User and Operating System - System Interface – System Calls – Operating System Structures – Process Concept – Process Scheduling – Context Switch – Operations on Processes – Inter-process Communication – IPC in Shared Memory Systems – IPC in Message Passing Systems

Practicals:

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
2. Shell script.
3. Process control system calls - demonstration of fork, exec and wait

UNIT 2 PROCESS SYNCHRONIZATION AND SCHEDULING — 9+6

Multicore Programming – Multithreading Models – Thread Libraries – Threading Issues – The Critical Section Problem – Mutex Locks – Semaphore – Basic Concepts of CPU Scheduling– Scheduling Criteria – Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue – Thread Scheduling

Practicals:

4. Use of ps, ps lx, ps tree, ps –aux , top commands
5. Use fork, exec, wait, exit system calls
6. Thread management and Thread synchronization.
7. Program to simulate preemptive and non-preemptive process scheduling algorithms.

UNIT 3 DEADLOCKS AND FILE SYSTEM — 9+6

Deadlocks – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention –Deadlock Avoidance – Deadlock detection – Recovery from deadlock. File Concept – Access Methods – Directory Structure – Protection – Memory-Mapped Files – File-System Structure – File-System Operations – Directory Implementation – Allocation Methods – Free-Space Management – Recovery – File-System Mounting – File Sharing

Practicals:

8. Deadlock prevention
9. Program to simulate file allocation strategies.

UNIT 4 MEMORY MANAGEMENT — 9+6

Contiguous Memory Allocation – Paging – Structure of the Page Table – Swapping – Demand Paging – Copy-on-Write – Page Replacement – Allocation of Frames – Thrashing – Memory Compression – Allocating Kernel Memory.

Practicals:

10. Interprocess communication using pipes.
11. Interprocess communication using FIFOs.

UNIT 5 STORAGE MANAGEMENT AND CASE STUDIES	9+6
Mass-Storage Structure: Disk Structure - Disk Scheduling Algorithms – NVM Scheduling – Storage Device Management - Swap Space Management. I/O Systems: I/O Hardware – Application I/O Interface – Kernel I/O Subsystem – Transforming I/O Requests to Hardware Operations –Design principles – Process management – Scheduling – Memory management – File systems and Introduction to Mobile Operating System: Android. **Practicals:** 12. Implementation of CPU scheduling policy in Linux/Windows 13. Implementation of memory management policy in Linux/Windows	
TOTAL PERIODS	**45+30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Understanding the main concepts, key ideas, strengths and limitations of operating systems
CO2	Understanding process synchronization and Design of various process scheduling Algorithms.
CO3	Understanding deadlock handling and various file management systems
CO4	Design and implement memory management schemes
CO5	Acquire a detailed understanding of various aspects of I/O, storage management and services with the recent OS.
TEXT BOOKS	
1	Silberschatz Abraham, Greg Gagne, Peter B. Galvin. “Operating System Concepts”, Tenth Edition, Wiley, 2018.
2	Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education, 2016
3	NPTEL course on “Operating System fundamental “https://archive.nptel.ac.in/courses/106/105/106105214
REFERENCES	
1	D. M. Dhamdhere, “Operating Systems: A Concept–based Approach”, Third Edition. Tata McGraw–Hill, 2017.
2	William Stallings, “Operating Systems: Internals and Design Principles”, Ninth Edition, Pearson, 2019.
3	Harvey M Deitel, Paul J Deitel, David R Choffnes, "Operating Systems", 3rd Edition, Pearson Education, New Delhi, 2013.
4	https://pdos.csail.mit.edu/6.828/2014/xv6/book–rev8.pdf
5	The xv6 source code: git clone git://pdos.csail.mit.edu/xv6/xv6.git

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	2	2	2	3	3	3	3
CO2	3	3	3	3	2	-	-	2	2	2	3	3	3	3
CO3	3	3	3	3	2	-	-	2	2	2	3	3	3	3
CO4	3	3	3	3	2	-	-	2	2	2	3	3	3	3
CO5	3	3	3	3	2	-	-	2	2	2	3	3	3	3
AVG	3	3	3	3	2	-	-	2	2	2	3	3	3	3

Product based Projects (in Team)	
1	Real-Time Patient Monitoring System: Continuously monitors vitals (heart rate, BP, oxygen) and alerts to anomalies.

2	Smart Traffic Light Control System: Real-time control based on vehicle density and emergency vehicle detection - Real-time sensor polling (IR, RFID).
3	Robotics: Communication between motion control, sensor processing, and AI modules.
4	Web-Based CPU Scheduling Simulator & Analyzer: A full-stack web app where users input processes and get Gantt charts, average waiting time, etc.
5	Mobile App: Disk Scheduling Game for OS Concepts: A gamified app where users "control the disk arm" and optimize access times using different strategies.

U24AD404	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	2	4

Course Objectives: Develop the skills to clean, analyze, and visually represent data effectively to uncover patterns and support data-driven decision-making.

1	Grasp the fundamentals of summarizing and organizing data into usable formats.
2	Uncover hidden insights, understand data quality, and prepare information for meaningful discoveries.
3	Explore, understand, and present data-driven insights, from quality assessment to advanced modeling.
4	Gain the skills to design and implement various data visualizations, from basic charts to complex 3D and geographic representations.
5	Gain expertise in turning raw text into clear visual narratives

UNIT 1 THE FUNDAMENTALS OF EXPLORATORY DATA ANALYSIS — **9+2**

Overview of EDA – Identifying Data quality -Missing values – Irregular Cardinality- Outliers - handling data Quality - Describing Data, Preparing Data Tables- Understanding Relationships – Identifying and Understanding Groups- Building Models from Data. (1)

practical:

1. Generate the data quality report in terms of identifying missing values, irregular cardinality and outliers for an insurance company.

UNIT 2 EDA TOOLS AND DESCRIPTIVE STATISTICS — **9+6**

Significance of EDA - Comparing EDA with classical and Bayesian analysis - Software tools for EDA Visual Aids for EDA-EDA with Personal Email-Data Transformation - Descriptive Statistics- Grouping Datasets Correlation-Time Series Analysis

Practical:

2. Descriptive feature identification for predicting a target feature by visualizing relationships.
3. Data preparation for Exploration using normalization, binning and sampling methods.

UNIT 3 UNIVARIATE, BIVARIATE, MULTIVARIATE DATA ANALYSIS — **9+2**

Univariate Data Analysis -Bivariate Association Regression Analysis- Cluster Analysis - Visualization Design Principles – Tables - Univariate Data Visualization- Bivariate Data Visualization - Multivariate Data Visualization - Visualizing Groups Dynamic Technique

Practical:

4.Design and create data visualizations.

UNIT 4 DATA VISUALIZATION (2D / 3D) — **9+10**

Simple Line Plots- Simple Scatter Plots- Visualizing Errors-Density and Contour Plots -Histograms- Binnings and Density - Customizing Plot Legends -Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Stylesheets- Three Dimensional Plots- Geographic Data with Basemap - Visualization with Seaborn.

Practical:

5. Conduct exploratory data analysis using visualization.
6. Craft visual presentations of data for effective communication.
7. Use knowledge of perception and cognition to evaluate visualization design alternatives.
8. Design and evaluate color palettes for visualization based on principles of perception.
9. Apply data transformations such as aggregation and filtering for visualization.

UNIT 5 INTERACTIVE DATA VISUALIZATION — **9+10**

Text and Document Visualization -Levels of Text Representations-Single Document Visualizations - Document Collection Visualizations-Interaction Concepts and Techniques -Designing Effective Visualizations - Comparing and Evaluating Visualization Techniques -Visualization Systems -Systems based on Data Type - Systems based on Analysis Type-Text Analysis and Visualization -Modern Integrated Visualization Systems

Practical:

10.Develop data exploration and visualization for an application - Mini Project

TOTAL PERIODS — **45+30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Understand the fundamentals of exploratory data analysis and its commonly used Techniques.
CO2	Apply statistical concepts to analyze data and explore the tools used for EDA.
CO3	Perform multivariate data visualization and analysis.
CO4	Interpret results of exploratory data analysis using stylesheets
CO5	Implement visualization techniques in web for applications
TEXTBOOKS	
1.	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2.	Thomas Cleff , "Exploratory Data Analysis in Business and Economics", Springer International, 2013.
3.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 1st Edition, December 2016.
4.	Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015
5.	Glenn J. Myatt, Wayne P. Johnson," Making Sense Of Data I", John Wiley & Sons, 2nd Edition, 2014.
REFERENCES	
1.	Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
2.	Andy Kirk," Data Visualisation: A Handbook for Data Driven Design", Second Edition, Sage Publications Ltd, 2020.
3.	Mike Kahn, "Data Exploration and Preparation with BigQuery: A practical guide to cleaning, transforming, and analyzing data for business insights", Kindle Edition, Packt Publishing; 1st edition, 2023
4.	Dursun Delen, "Predictive Analytics: Data Mining, Machine Learning and Data Science for Practitioners", Pearson Business Analytics Series, 2021.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	3	2	1	1	-	1	3	2	3	2
CO2	3	3	3	3	3	2	1	1	-	1	3	2	2	3
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CO4	2	2	2	2	3	2	1	1	-	1	3	3	3	2
CO5	2	2	2	2	3	2	1	1	1	1	3	3	3	2
AVG	2	2	2	2	3	2	1	1	1	1	3	3	3	3

PRODUCT BASED PROJECTS(TEAM)	
1.	Live Urban Mobility Dashboard: Tracking Public Transit in Real-Time
2.	Pulse of the Internet: Real-time Social Media Sentiment Analysis
3.	Smart Environment Monitor: Live IoT Sensor Data Visualization
4.	Market Momentum: Dynamic Stock & Crypto Price Tracker
5.	Cyberflow Insights: Real-time Network Traffic & Security Visualizer

U24AD405	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES	
1	To Understanding the fundamental concepts of Problem Solving Agents
2	To Apply Various Search Strategies
3	To Apply Game Playing and CSP
4	To Analyse Logical Reasoning
5	To develop systems with probabilistic reasoning

LIST OF EXPERIMENTS	
1	Implementation of - 8-Puzzle
2	Implementation of - 8-Queen Problem
3	Implementation of - Tic-Tac -Toe Problem
4	Implementation of Cryptarithmetic Problem
5	Implementation of Travelling Salesman Problem
6	Implementation of Depth First Search
7	Implementation of A* Algorithm
8	Implementation of Greedy Best First Search Algorithm
9	Implementation of Min - Max Algorithm
10	Implementation of Alpha Beta Pruning Algorithm
11	Implementation of Graph Coloring Algorithm
12	Implementation of Map Coloring Algorithm
13	Implementation of Backtracking Using CSP
14	Implementation of Propositional Model Checking Algorithm
15	Implementation of Bayesian Networks
TOTAL PERIODS	**: 45**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Implement Problem Solving Agents
CO2	Apply various Search Strategies
CO3	Implement Game Playing and Constraint Satisfaction Problems
CO4	Apply Logical Reasoning systems
CO5	Understand Bayesian Networks

TEXT BOOKS	
1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2	Artificial intelligence a guide to intelligent systems - Fourth edition,2024

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
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CO4	2	2	2	2	3	1	1	2	2	1	2	2	3	1
CO5	2	2	2	2	3	1	1	2	2	1	2	2	3	1
AVG	**2**	**2**	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**1**

U24AD406	MACHINE LEARNING LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES	
1	Apply machine learning algorithms to analyze, classify, and visualize data.
2	Evaluate and implement supervised and unsupervised models
3	Develop and optimize neural networks for real-world applications.
4	Utilize ensemble techniques to enhance classification and decision-making.
5	Implement ML models for fraud detection and sentiment analysis.

LIST OF EXPERIMENTS	
1	Use a dataset (e.g., Iris or MNIST) to perform data understanding and visualization.
2	Explore data distributions, identify missing values, and create visualizations to represent data characteristics.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4	Write a program to handle overfitting.
5	Implement SVM algorithm for a given data set.
6	Implement Bagging, boosting, and DECORATE algorithms with performance evaluation mechanisms.
7	Write a program to implement k-Nearest Neighbour algorithm.
8	Implement a k-means partitional clustering
9	Implement Naive Bayes learning algorithm for a sample training data set.
10	Implement a linear regression method
11	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
12	Implement facial recognition application with artificial neural network
13	Choose best machine learning algorithm to implement online fraud detection
14	Implement sentiment analysis using random forest optimization algorithm.
TOTAL PERIODS	**: 45**

Course Outcomes:	
At the end of the course, the student will be able to	
CO1	Understand the basics of machine learning
CO2	Solve analytical problems with relevant mathematics background knowledge.
CO3	Explain testing and evaluation machine learning algorithms.
CO4	Understand ANN model apply knowledge in data analytics.
CO5	Explore the knowledge of unsupervised learning in data analysis.

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.	Ameet V Joshi, “Machine Learning and Artificial Intelligence”, Springer Publications, 2020.
2 .	Sridhar S. and Vijayalakshmi M., “Machine Learning”, Oxford University Press, 2021.
3 .	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
4 .	John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, “Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies”, MIT press, 2015
5 .	Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997
6 .	Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
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8 .	Jerome Friedman, Robert Tibshirani, Trevor Hastie, “The Elements of Statistical Learning”, Springer, 2017.

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CO5	2	2	2	2	3	1	1	2	2	1	2	2	3	1
CO6	3	3	3	2	3	2	1	2	2	1	2	3	2	2
AVG	**2**	**2**	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**2**	**1**

U24TP410	CRITICAL AND CREATIVE THINKING SKILLS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES	
1	Develop logical, analytical, and creative reasoning abilities for problem-solving.
2	Analyze and decode complex patterns, sequences, and reasoning puzzles.
3	Enhance skills in judgment, decision-making, and inference through real-world scenarios.
4	prepare students for challenging critical reasoning questions in recruitment exams.
5	Cultivate ability to tackle abstract and visual reasoning problems confidently.
Topics	
1.	Coding-Decoding
2.	Seating Arrangement (Linear, Circular, Square)
3.	Data Arrangements (Ranking, Scheduling, Grouping)
4.	Analogy (Verbal and Non-Verbal)
5.	Syllogisms – Statement & Conclusions
6.	Blood Relations
7.	Clocks and Calendars
8.	Image-Based Problems (Water, Mirror, Embedded)
9.	Image Grouping
10.	Number Series
11.	Letter Series
12.	Logical Puzzles
13.	Clock Puzzles
14.	Input-Output Pattern Recognition
15.	Complex Multi-level Direction Sense Problems
16.	Statement & Assumption Analysis
17.	Theme Detection and Contextual Inference
18.	Decision Making and Problem Solving under Uncertainty
19.	Making Judgments, Statement and Conclusion
20.	Cause and Effect
21.	Decision Making
22.	Course of Action, Analogy
23.	Fact-Inference-Judgment
24.	Resume building
TOTAL PERIODS	**:30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Solve seating, coding-decoding problems
CO2	Analyze syllogisms & blood relations
CO3	Recognize patterns and analogies

CO4	Apply critical reasoning to draw conclusions
CO5	Demonstrate creative thinking skills
TEXTBOOKS:	
1.	R. S. Aggarwal. A Modern Approach to Verbal & Non-verbal Reasoning (Revised Edition 2025). S. Chand Publishing, New Delhi: 2025.
2.	Arun Sharma. Logical Reasoning for CAT (Latest Edition). McGraw Hill Education, New Delhi: 2025
REFERENCES	
1.	A.K. Gupta. Logical and Analytical Reasoning (Latest Edition). S. Chand Publishing, New Delhi: 2023
2.	Edgar Thorpe. Test of Reasoning. Pearson Education, New Delhi: 2022

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1											1			
CO2											1			
CO3											1			
CO4											1			
CO5											1			
AVG											1			

U24RM412	HYPOTHESIS	L	T	P	C
		0	0	1	0.5

1	To understand the fundamental principles and types of hypothesis and their role in scientific research
2	To enable students to formulate clear and testable hypothesis from research problems using variable analysis
3	To equip students with knowledge of research methodology and statistical tools for hypothesis testing
4	To apply hypothesis in real-world, interdisciplinary research while addressing ethical considerations
5	To explore advanced hypothesis techniques in modern fields such as AI, business analytics, and design thinking

UNIT 1 Foundations of Hypothesis in Research	**3**
Definition and Role of Hypothesis in Research, Characteristics of good hypothesis – testable, specific, falsifiable – Difference between assumptions, theories and hypotheses, Types – Null, alternative, directional, non-directional, Hypothesis vs Research questions.	
UNIT 2 Hypothesis Formulation and Design	**3**
Steps in developing a hypothesis from a problem statement, Operationalization of variables, Independent, dependent, and controlled variables, Conceptual vs. empirical hypothesis, Case studies on hypothesis framing in various disciplines.	
UNIT 3 Research Methodology and Hypothesis Testing	**3**
The scientific method and its relationship to hypotheses, Experimental vs. non-experimental designs, Statistical tools for hypothesis testing (t-test, chi-square, ANOVA, etc.), Type I and Type II errors, p-values, confidence intervals, Sampling techniques and hypothesis testing limitations.	
UNIT 4Applications of Hypothesis in Real-World Research	**3**
Hypothesis-driven research in natural sciences, social sciences, and engineering, Hypothesis in qualitative vs. quantitative research, Hypothesis in interdisciplinary and applied research, Ethics in hypothesis formulation and testing, Case studies and analysis of published research papers.	
UNIT 5 Advanced Topics and Contemporary Approaches	**3**
Hypotheses in data science, AI, and machine learning (e.g., model hypothesis space), Hypothesis in action research and participatory methods, Iterative hypothesis development in design thinking, A/B testing and hypothesis validation in business research, Writing research proposals with strong hypothesis foundations.	
	TOTAL: 15

COURSE OUTCOMES

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

CO1	Explain the characteristics, types, and significance of hypothesis in research
CO2	Develop and operationalize hypothesis using variables and domain specific frameworks
CO3	Apply statistical methods and research methodology to test and validate hypothesis
CO4	Analyze the application and ethics of hypothesis usage in various domains using case studies
CO5	Evaluate and construct advanced, iterative hypotheses in modern research contexts.

TEXTBOOKS

1	C. R. Kothari and G. Garg, Research Methodology: Methods and Techniques, 4th ed. New Delhi, India: New Age International Publishers, 2019.
2	P. D. Leedy and J. E. Ormrod, Practical Research: Planning and Design, 12th ed. Boston, MA, USA: Pearson, 2019.
3	W. Goddard and S. Melville, Research Methodology: An Introduction, 4th ed. Chichester, UK: Wiley-Blackwell, 2004.

REFERENCES

1	J. W. Creswell and J. D. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th ed. Thousand Oaks, CA, USA: SAGE Publications, 2017.
2	M. J. Schervish, Theory of Statistics, 2nd ed. New York, NY, USA: Springer, 1995. (for statistical hypothesis theory)

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	2	-	1	1	1	1
CO2	3	3	2	-	-	-	-	-	2	-	2	1	1	1
CO3	3	3	3	3	2	-	-	-	2	-	2	1	1	1
CO4	3	3	2	3	2	2	3	2	2	1	3	1	1	1
CO5	3	3	3	3	3	2	2	2	3	2	3	1	1	1
AVG	3	2.8	2.5	3	2.3	2	2.5	2	2.2	1.5	2.2	1	1	1

U24ED411	IDEA AND SIMULATION LAB	L	T	P	C
		0	0	1	0.5

COURSE OBJECTIVES:

1	To understand the purpose and process of ideation and how to transition effectively from empathy and definition phases.
2	To apply structured idea generation techniques such as Brainwriting and Brainstorming to foster creative solutions.
3	To analyze and facilitate idea selection by evaluating desirability, feasibility, and viability of solutions.
4	To evaluate and refine solutions using the SCAMPER framework and other ideation techniques to address real-world needs.
5	To create actionable solution models by defining concepts, mapping processes, and outlining requirements for market-ready offerings.

UNIT 1 IDEATE MODE — **1**

- Transitioning from Empathize and Define Modes
- What is the IDEATE Mode?
- Why Ideate?
- How to Ideate?
- How to transition and move from “Ideate” to “Prototype” Modes

UNIT 2 IDEA GENERATION — **2**

- How to generate ideas?
- How to Brainwrite? (6-3-5 and 3-3-5 techniques)
- How to prepare for Brainstorming?
- Prepare a checklist for Brainstorming
- Prepare Brainstorming rules

UNIT 3 BRAINSTORMING FACILITATION — **4**

- Prepare warmup questions to facilitate effective brainstorming
- Prepare focus areas and topics for brainstorming
- Discuss desirability, feasibility and viability perspectives plus point-of-views
- Document desirability, feasibility and viability ratings and rankings
- Select promising ideas that has potential to become solutions

UNIT 4 SKETCH TO THINK BEYOND — **4**

- Introduction to “SCAMPER” Framework to improve solutions to promising products and services
- Refine ideas to become potential solutions with stakeholder acceptable results
- Do a reality check by assessing value, needs, challenges, and barriers
- Improve and form new concepts leading to products and services
- Write a one-sentence concept description (Why? Why is this solution the best in class?)

UNIT 5 TRANSLATE SOLUTIONS TO PRODUCTS AND SERVICES — **4**

- Describe your idea with concept name
- Draw a sketch or mind map reflecting at least Business, People, Process, Technology and

Stakeholders / Customers

- Describe how the product will work and produce the intended Output, Outcomes and Results
- Evaluate resources and infrastructure requirements to build the products and services
- Detail a plan to arrive at Market-Ready Product / Service

TOTAL PERIODS	**:15**

COURSE OUTCOMES

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

CO1	Describe the IDEATE mode, explain its role in design thinking, and illustrate the transition from ideate to prototype.
CO2	Demonstrate the use of Brainwriting (6-3-5, 3-3-5) and construct effective brainstorming rules and checklists.
CO3	Analyze ideas based on desirability, feasibility, and viability, and select high-potential ideas for further development.
CO4	Evaluate ideas using SCAMPER, refine them by assessing value and barriers, and formulate concise concept descriptions.
CO5	Design a product/service concept with clear stakeholder mapping, develop a detailed action plan, and justify its readiness for market.

TEXTBOOKS

1.	An Introduction to Design Thinking PROCESS GUIDE, Hasso Plattner, d. School
2.	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Publications, 2009
3.	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Publications, 2009
4.	Tom Kelley, David Kelley, “Creative Confidence: Unleashing the Creative Potential Within Us All”, Currency, 2013

REFERENCES

1.	Hasso Plattner, Christoph Meinel, Larry Leifer, “Design Thinking: Understand – Improve – Apply (Understanding Innovation)”, Springer, 2011
2.	Jakob Schneider, Marc Stickdorn, “This Is Service Design Thinking: Basics, Tools, Cases”, John Wiley & Sons, 2011
3.	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001

CO/PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO 1	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 2	1	2	3	2	2	2	1	3	3	2	2	1	1	1
CO 3	-	2	3	2	2	2	-	3	3	2	2	1	1	1
CO 4	-	2	3	2	2	2	-	3	3	2	2	1	1	1
CO 5	-	2	3	2	2	2	-	3	3	2	2	1	1	1
AVG	1	2	3	2	2	2	1	3	3	2	2	1	1	1

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER V								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATE GORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	T	P	
		VAC		30				
THEORY								
1	U24AD501	Deep Learning	PCC	45	3	0	0	3
2		Open Elective I	OEC	45	3	0	0	3
THEORY COME PRACTICAL								
3	U24AD502	Big Data Analytics	PCC	75	3	0	2	4
4	U24AD503	Introduction to Java Programming	PCC	75	3	0	2	4
5		Professional Elective I	PEC	60	2	0	2	3
6		Professional Elective II	PEC	60	2	0	2	3
PRACTICAL								
7	U24AD504	Deep Learning Lab	PCC	60		0	4	2
8	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
9	U24AD505	Summer Internship*	EEC					1
10	U24RM514	Domain Specific Experiments/ Methodology/ Algorithms	RMC	30	0	0	2	1
11	U24ED511	Prototype & Market Valuation	EDIC	15	0	0	1	0.5
12	U24MC513	Fitness for Life-Yoga, Food Nutrition	MC#	30	0	0	2	0
TOTAL				**510**	**16**	**0**	**19**	**25.5**

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

#Mandatory Course is a Non-credit.

U24AD501	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

Design and implement end-to-end deep learning projects, including neural network architecture development, model training, and optimization, to solve complex real-world problems in areas such as computer vision, natural language processing, and speech recognition.

1	Design and implement neural network models
2	Build and train multilayer perceptrons using gradient descent
3	Design and implement convolutional neural networks (CNNs) for image classification
4	Develop and apply sequence modeling techniques using Recurrent Neural Networks (RNNs)
5	Design and implement generative models

UNIT 1 BASICS OF NEURAL NETWORK	**9**
Artificial Neuron - McCulloch Pitts units and Thresholding logic - Perceptron learning algorithm and Convergence - Linear separability - Feedforward Networks - Activation and Loss Functions- Hyper parameters and validation sets- Overfitting and underfitting.	
UNIT II INTRODUCTION OF DEEP NEURAL NETWORKS	**9**
Multilayer perceptron - Gradient Descent(GD) – Backpropagation - Vanishing and Exploding GD problem – Optimization Methods: Stochastic GD: Momentum based GD & Nesterov Accelerated GD, AdaGrad, RMSProp, Adam – Bias Variance tradeoff - Regularization – Dropout.	
UNIT III CONVOLUTIONAL NEURAL NETWORKS	**9**
Motivation – Architectural Overview –Pooling – Parameter sharing - Regularization –Advanced Convolution Techniques- Strided -- Tiled -- Transposed and dilated convolutions; Popular CNN Architectures: ResNet, AlexNet, VGGNet - Transfer learning –Image classification using Transfer learning.	
UNIT IV RECURRENT NEURAL NETWORKS	**9**
Sequence Modelling –Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - Deep Recurrent Networks, Recursive Neural Networks Long Short-Term Memory Networks – Other Gated RNNs	
UNIT – V AUTOENCODERS AND GENERATIVE MODELS	**9**
Autoencoders – Regularized Autoencoders – stochastic Encoders and Decoders – Contractive Encoders - Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine – Directed Generative Nets - Generative Adversarial Networks- Introduction to GenAI.	
TOTAL PERIODS	**45**

COURSE OUTCOMES

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

CO1	Understand fundamental neural network concepts, including activation functions and loss functions.
CO2	Familiarize with different optimizers in machine learning and choose the appropriate one.
CO3	Design and implement deep learning architectures, such as CNNs, RNNs, autoencoders and Generative models.
CO4	Implement deep learning models using libraries like TensorFlow or PyTorch
CO5	Apply deep learning techniques to real-world problems, with awareness of ethical considerations.

TEXT BOOKS	
1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2.	Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
3.	Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
4.	Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
REFERENCES	
1.	Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
2.	Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
3.	Francois Chollet, "Deep Learning with Python", Manning Publications, 2018Publications Ltd, 2020.
4.	Mike Kahn, "Data Exploration and Preparation with BigQuery: A practical guide to cleaning, transforming, and analyzing data for business insights", Kindle Edition, Packt Publishing; 1st edition, 2023

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	1	-	-	-	-	1	2	3	3	3
CO2	3	3	3	3	1	-	-	-	-	1	2	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	2	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	2	3	3	3
AVG	3	3	3	3	3	3	2	2	3	3	2	3	3	3

Product based Projects (in Team)

1	Image Classification with Convolutional Neural Networks (CNNs) — Build a model to recognize objects in photos.
2	Sentiment Analysis on Social Media Posts — Use deep learning to find positive or negative feelings in tweets.
3	Speech Recognition Experiment — Convert spoken words into text using deep learning models.
4	Face Mask Detection — Detect whether people are wearing masks using camera images.
5	Chatbot Development — Create a simple chatbot that understands and replies to questions.
6	Image Style Transfer — Apply artistic styles from one image to another using neural networks.
7	Object Detection in Video Streams — Detect and track objects in real-time video.
8	Medical Image Analysis — Classify medical images, like X-rays, to help in diagnosis.
9	Automatic Image Captioning — Generate captions describing images using CNN and RNN models.
10	Recommender Systems — Use deep learning to suggest movies, products, or songs based on user data

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U24AD502	BIG DATA ANALYTICS	L	T	P	C
		3	0	2	4

Course Objectives:

Develop and present a scalable big data solution that processes, analyzes, and visualizes large dataset

1	To develop scalable and efficient data processing solutions using Hadoop.
2	To design and optimize distributed data processing applications using MapReduce and Spark.
3	To design and implement an end-to-end big data pipeline leveraging Big Data Ecosystem Tools.
4	To create real-time data analytics solutions using stream processing techniques.
5	To Analyze recommender systems and social network mining techniques.

UNIT 1 UNDERSTANDING BIG DATA — **9+6**

Introduction to Big Data - Need for processing Big Data – Need for analytics- Characteristics of big data, Domain-specific examples of big data, Big Data Stack – Introduction to Hadoop - Setting up of Hadoop.

Practicals:

1. Study : Installation and Setting up Hadoop

UNIT 2 MAPREDUCE AND NEW SOFTWARE STACK — **9+6**

Distributed File System – MapReduce, algorithms using MapReduce - Extensions to MapReduce – Communication-cost model – Complexity Theory for MapReduce - Overview of Spark.

Practicals:

2.Write a map reduce program to compute and measure the runtime and study its scaling behaviour for the following:
i).Compute descriptive statistics such as mean, median, mode, standard deviation from a large dataset.
ii).Compute box-plots and histograms of all the numerical variables in a large multi-variate dataset.
iii)Perform clustering of a large multi-variate dataset.

UNIT 3 BIG-DATA TECHNOLOGY OVERVIEW — **9+6**

Big Data Collection Systems – Apache Flume – Big data Storage – HDFS Systems – Pig and Hadoop – Grunt – Data Model – pig Latin – Hive Overview – Hive QL – Overview of HBase - Overview of Workflow – Workflow and Scheduling using Apache Oozie - Introduction to NoSQL Databases – Basics of MongoDB.

Practicals:

3. Write a spark program to compute and measure the runtime and study its scaling behaviour for the following:
i) Box-plots and histograms of all the numerical variables in a large dataset.
ii) Perform classification in a large dataset.

UNIT 4 STREAMING ANALYTICS AND LINK ANALYSIS — **9+6**

Introduction to Stream analytics – Stream data model – Sampling Data – filtering streams – Count distinct elements in a stream, Counting ones, Estimating moments – Decaying windows – Link Analysis – PageRank Computation – Market Basket model – Limited pass algorithms for Frequent Item sets.

Practicals:

4. Write, run and debug Map reduce programs
i)To analyse and build models from streaming data efficiently using systems like Apache Spark.
ii)To analyse and build models from non-streaming data efficiently using systems like Apache Spark.

UNIT 5 RECOMMENDER SYSTEMS AND SOCIAL NETWORK MINING — **9+6**

Advertising on the Web – Online Algorithms – Matching problem – Adwords problem and Implementation – recommendation systems – Collaborative filtering – Dimensionality reduction – Mining Social Network graphs – Clustering of social network graphs – Partitioning of graphs – Counting Triangles – Neighborhoods properties of Graphs.

Practicals:

5.Use graph dataset and perform the following:

i)Perform basic analysis such as calculating node degree centrality, identifying important nodes using between-ness centrality.	
TOTAL PERIODS	**45+30**

COURSE OUTCOMES

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

CO1	Understand the basics of Big Data..
CO2	Know about Hadoop and MapReduce.
CO3	Know about Big Data Technology, Tools, and Algorithms.
CO4	Analyze the stream data and Link analysis.
CO5	Know about the role of big data in Recommender systems and social network analysis..

REFERENCES

1.	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Third Edition, Cambridge University Press, New Delhi
2.	Arshdeep Bagha and Vijay Madisetti, “Big Data Science & Analytics - A Hands-on Approach”, New Delhi, 2016.
3.	Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, 2013.
4.	Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2014.
5.	Ultimate Big Data Analytics with Apache Hadoop by Simhadri Govindappa (2024)

CO-PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	1	2	1	2	2	3	3	3
CO2	3	3	3	3	3	1	1	2	1	2	2	3	3	3
CO3	3	3	3	3	3	1	1	2	1	2	2	3	3	3
CO4	3	3	3	3	3	1	1	2	1	2	2	3	3	3
CO5	3	3	3	3	3	1	1	2	1	2	2	3	3	3
AVG	3	3	3	3	3	1	1	2	1	2	2	3	3	3

Product based Projects (in Team)

1	Real-time Social Media Analytics Platform
2	E-commerce Recommendation Engine
3	Big Data Pipeline for Clickstream Analytics
4	Graph-based Fraud Detection System
5	Streaming Analytics Dashboard for IoT Sensors
6	Big Data Workflow Orchestration and Monitoring System
7	Graph-Based Social Network Analysis Platform
8	Personalized Online Advertising Platform

U24AD503	INTRODUCTION TO JAVA PROGRAMMING	L	T	P	C
		3	0	2	4

Course Objectives:

Develop and present a scalable big data solution that processes, analyses, and visualizes large dataset

1	Understand and apply core Java programming constructs including data types, control structures, arrays, classes, and objects for problem-solving.
2	Design object-oriented solutions using principles of encapsulation, inheritance, polymorphism, and abstraction
3	Develop robust Java applications using exception handling and multithreading concepts.
4	Implement data persistence and processing using file I/O, collections, generics, and database connectivity (JDBC).
5	Build interactive and event-driven applications using Java GUI frameworks and web components.

UNIT 1 INTRODUCTION TO JAVA — **9+6**

Introduction to Java – JVM – Data Types, Variables, Operators, Expressions – Control flow Statements – Methods – Arrays – Classes and Objects – Constructors – Access Specifiers – Static Members – this keyword – constants – String Class – Working with Date and Time API.

Practical:

1. Develop programs using Java basic constructs and arrays using any standard IDE like NETBEANS / ECLIPSE
2. Develop programs to illustrate concept of class and static classes and methods

UNIT 2 POLYMORPHISM AND INHERITANCE — **9+6**

Overloading Methods – Static, Nested and Inner Classes. Inheritance – Superclasses and Subclasses – Method Overriding – Downcasting – instance of Operator – Abstract and Final Classes – Packages – Interfaces.

Practical:

3. Develop programs using abstract classes, method overloading and overriding
4. Develop programs using Interfaces

UNIT 3 EXCEPTION HANDLING AND MULTITHREADING — **9+6**

Exception Handling – Java's Built-in Exceptions – User defined Exception – Assertions. Multithreading – Priorities – Synchronization – Avoiding Deadlocks – Wrappers – Autoboxing and Unboxing.

Practical:

5. Develop programs using Exception handling
6. Develop programs using Multithreading and synchronization

UNIT 4 FILE STREAMS AND DATABASE — **9+6**

Java I/O– Reading and Writing Files – Regular Expressions – Streams API – Object Serialization – Generic collections – Generic Classes – Generic Methods – List, Set, Map – Lambda expressions – Databases with JDBC.

Practical:

7. Develop programs using Generics classes and methods
8. Develop applications with Database Connectivity

UNIT 5 WEB DEVELOPMENT AND FRAMEWORKS — **9+6**

Event handling: Events, Listeners and Adapter Classes-Anonymous Inner Classes-Overview of Abstract

Windowing Toolkit (AWT)- Core Concepts of spring Boot-Starter Dependencies-Embedded Servers-Spring Boot Annotations-Dependency Injection (DI)- Spring Boot Actuator-Spring Boot Architecture

Practical:

9. Develop Event-driven programs for GUI applications
10. Develop servlet based applications

TOTAL PERIODS	**45+30**

Course Outcomes

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

CO1	Construct programs using Object Oriented Design principles like encapsulation, abstraction, polymorphism, inheritance and types.
CO2	Develop applications with handlers for user– defined exceptions, according to the given requirements.
CO3	Construct efficient multithreaded programs with synchronization constructs
CO4	Develop interactive GUI applications with event handling that provide rich user experience.
CO5	Construct programs using the suitable Collection classes and interfaces for efficient modelling of the objects

TEXT BOOK

1.	Y. Daniel Liang, "Introduction to Java Programming and Data Structures, Comprehensive Version", 12th Edition, Pearson Education, 2021.
2.	Paul Dietel and Harvey Deitel, "Java – How to Program Early Objects", 11th Edition, Pearson Education, 2018.
3.	Sachin Malhotra, Sourabh Choudhary, "Programming in Java", Revised 2nd Edition, Oxford University Press, 2018.

REFERENCES

1.	Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw– Hill Education, 2018.
2.	Craig Walls, "Spring in Action", 3rd edition, Manning Publications, 2011.

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(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
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	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	3	2	2	2	2	-	-	-	2	2	3	2
CO 2	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 3	3	3	2	2	2	2	2	-	-	2	2	2	2	2
CO 4	2	2	3	2	2	2	2	-	2	2	2	2	2	3
CO 5	3	2	3	2	2	2	2	-	2	2	2	2	3	2
AVG	**2.6**	**2.4**	**2.6**	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**2.4**	**2.2**

Product Based Projects(In Teams)

1. Student Information Management System
2. Library Management System
3. Online Banking Transaction System
4. Employee Payroll Management System
5. File-Based Log Analyzer Tool
6. Multi-Threaded File Downloader
7. GUI-Based Quiz Application
8. Online Voting System (Simulation)
9. Chat Application Using Multithreading
10. JDBC-Based Inventory Management System

Meenakshi Sundararajan Engineering College

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

Department: Artificial Intelligence and Data Science, R2024, CBCS

U24AD504	DEEP LEARNING LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

1	Design and implement neural network models
2	Build and train multilayer perceptrons using gradient descent
3	Design and implement convolutional neural networks (CNNs) for image classification
4	Develop and apply sequence modeling techniques using Recurrent Neural Networks (RNNs)
5	Design and implement generative models

LIST OF EXPERIMENTS

1	Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias and threshold. a. AND logic function b. OR logic function c. NOT logic function d. NOR logic function e. XOR logic function
2	Write a program to build a logistic regression classifier with a Neural Network mindset. Consider following guidelines. a. Consider any convenient dataset (Cats dataset etc.) and pre-process the dataset. b. Define the appropriate model structure. c. Evaluate the model performance d. Analyse the obtained results
3	Design a neural network (NN) model with one hidden layer for classification problems. Use Planar data set or any other suitable data set a. Implement a 2-class classification neural network with a single hidden layer. b. Use units with a non-linear activation function, such as tanh. c. Compute the cross-entropy loss. d. Implement forward and backward propagation. e. Evaluate the model performance. f. Analyse the results
4	Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable dataset. Perform Exploratory Data Analysis a. Prepare dataset b. Build MLP model c. Evaluate Model performance d. Predict for test data
5	Implement the Face recognition using CNN
6	Implement a transfer learning concept for image classification
7	Implement an auto encoder for image denoising
8	Implement a dialogue generation using LSTM with attention mechanism
9	Implement an opinion mining in RNN

10	Machine Translation using Encoder-Decoder model.
11	Image augmentation using GANs
	TOTAL PERIODS **60**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO 1	Understand fundamental neural network concepts, including activation functions and loss functions.
CO 2	Familiarize with different optimizers in machine learning and choose the appropriate one.
CO 3	Design and implement deep learning architectures, such as CNNs, RNNs, autoencoders and Generative models.
CO 4	Implement deep learning models using libraries like TensorFlow or PyTorch
CO 5	Apply deep learning techniques to real-world problems, with awareness of ethical considerations.
TEXTBOOKS	
1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2.	Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
3.	Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
4.	Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
REFERENCES	
1.	Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
2.	Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
3.	Francois Chollet, "Deep Learning with Python", Manning Publications, 2018Publications Ltd, 2020.
4.	Mike Kahn, "Data Exploration and Preparation with BigQuery: A practical guide to cleaning, transforming, and analyzing data for business insights", Kindle Edition, Packt Publishing; 1st edition, 2023

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	1	1	2	3	3	3
CO2	3	3	3	3	1	-	-	-	1	1	2	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	2	3	3	3
AVG	3	3	3	3	3	3	2	3	3	3	2	3	3	3

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24RM512	DOMAIN SPECIFIC EXPERIMENTS / METHODOLOGY / ALGORITHMS	L	T	P	C
		0	0	2	1

Course Objectives:

1	Analyze different research paradigms and experimental design types to select appropriate methodologies for domain-specific research.
2	Apply experimental methodologies and instrumentation techniques in laboratory and simulation contexts for engineering research.
3	Analyze and implement domain-specific algorithms and optimization techniques using computational tools.
4	Analyze qualitative research methodologies and tools for social science data collection and analysis.
5	Evaluate interdisciplinary research approaches and emerging technologies to enhance research quality and reproducibility.

UNIT 1 Introduction to Research Methodologies and Experimental Design	**6**
Overview of research paradigms (qualitative, quantitative, mixed methods), Types of experimental designs (true, quasi, and non-experimental), Domain-specific needs: controlled vs. field experiments, Key concepts: validity, reliability, reproducibility, Ethical considerations in experimentation	
UNIT 2 Experimental Methodologies in Science and Engineering	**6**
Laboratory vs. simulation-based experiments, Design of Experiments (DoE) in engineering, Measurement systems and calibration, Data acquisition and instrumentation techniques, Case studies: electrical circuits, mechanical systems, fluid dynamics, etc.	
UNIT 3 Algorithms in Computational and Data-Driven Domains	**6**
Algorithmic problem-solving in domain-specific contexts (e.g., shortest path in transportation, clustering in biology), Numerical methods and optimization algorithms, AI/ML algorithms and model evaluation strategies, Domain-specific programming and simulation tools (e.g.,MATLAB, Python, R, NS-3, Ansys, etc.), Case studies: image processing, robotics, bioinformatics, cybersecurity, etc.	
UNIT 4 Methodologies in Social Sciences and Humanities	**6**
Survey research, interviews, and ethnographic methods, Sampling techniques and field data collection, Case study and content analysis, Tools: SPSS, NVivo, ATLAS.ti, Case studies: behavioral research, education studies, cultural research	
UNIT 5 Interdisciplinary Approaches and Emerging Trends	**6**
Cross-domain methodologies: combining qualitative and quantitative, IoT-based experiments (e.g., smart agriculture, smart health), Simulation-based research and digital twins, Research using big data and cloud platforms, Ethics, reproducibility, and open science trends	
TOTAL PERIODS	**:30**

Course Outcomes

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

CO1	Differentiate research paradigms and experimental designs, evaluating their applicability and ethical considerations in various fields.
CO2	Design and conduct experiments using DoE principles, data acquisition systems, and measurement calibration in engineering applications.
CO3	Solve algorithmic problems using numerical methods and AI/ML models, applying appropriate programming and simulation tools.
CO4	Design and conduct surveys, interviews, and case studies using qualitative tools like SPSS, NVivo, and ATLAS.ti.
CO5	Integrate cross-domain methods, employ IoT and big data tools, and uphold ethical standards in modern

	research contexts.
TEXT BOOKS	
1	R. Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 4th ed. London, UK: SAGE Publications, 2019.
2	D. C. Montgomery, Design and Analysis of Experiments, 9th ed. Hoboken, NJ, USA: Wiley, 2017.
3	S. J. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Upper Saddle River, NJ, USA: Pearson, 2020.
REFERENCES	
1	B. Stroustrup, Programming: Principles and Practice Using C++, 2nd ed. Boston, MA, USA: Addison-Wesley Professional, 2014. (for algorithm implementations)
2	S. S. Rao, Engineering Optimization: Theory and Practice, 5th ed. Hoboken, NJ, USA: Wiley, 2020.

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	1	1	2	2	1	2	1	1	1
CO2	3	2	3	2	3	1	1	2	3	2	3	1	1	1
CO3	3	3	3	2	3	1	1	3	3	2	3	1	1	1
CO4	2	2	2	3	2	1	1	2	3	3	3	1	1	1
CO5	3	3	3	3	3	2	2	3	3	3	3	1	1	1
AVG	2.8	2.6	2.6	2.6	2.6	1.2	1.2	2.4	2.8	2.2	2.8	1	1	1

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24ED511	PROTOTYPE AND MARKET VALUATION	L	T	P	C
		0	0	1	0.5

COURSE OBJECTIVES:

1	To understand the purpose, process, and transition from ideation to prototyping in the design thinking framework.
2	To develop the ability to plan and perform testing processes for validating prototypes and iterating for improvement.
3	To analyze and create various forms of rapid and resource-efficient experimentation methods including risk and failure analysis
4	To evaluate and incorporate feedback through structured methods for refining the prototype based on stakeholder insights.
5	To create a strategic roadmap for evolving prototypes into validated market-ready solutions through metrics and stakeholder planning.

UNIT 1 PROTOTYPE — **1**

- Transitioning from Ideate Mode
- What is the Prototype mode?
- Why Prototype?
- How to Prototype?
- How to seamlessly transition from Prototype to Test?

UNIT 2 TEST — **2**

- What is the Test Mode?
- How to Test?
- How to iterate for continuous improvements?
- Deciding how to move forward (Persevere or Pivot)
- How to make the process to repetitively lead to product / service improvements

UNIT 3 EXPERIMENTATION — **4**

- Make prototypes (Fast & Cheap / Simulate & Stimulate)
- Create and Try, Experience Prototypes by shrinking big things down
- Rapid Concept Development
- Assumptions, Constraints, Limitations, Potential point of failures and Risk Analysis
- Test prototypes by Customer Co-Creation

UNIT 4 FEEDBACK — **4**

- Identify potential sources of feedback
- Obtain feedback from select participants (Client / Customer / Consumer / Stakeholder)
- Build a questionnaire guide by starting specific to moving broad
- Probe deep, facilitate feedback prompts, capture input and integrate overall feedback
- Identify costs, resources, infrastructure, features and functionalities to iterate based on what is available vs. needed at the institution to decide buying needs

UNIT 5 EVOLUTION — **4**

- Track learnings and establish Learning Launches
- Define success with Impact Guidance
- Identify methods of tracking (Measures / Metrics – Lag or Lead)
- Document progress and asset needs iteratively by effective stakeholder engagement to plan next steps

• Define RASCI / RACI Chart to prepare and pitch product or service concept for Market Valuation by Storytelling	
TOTAL PERIODS	**15**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Explain the importance of prototyping and describe how to create and transition from ideate to prototype and then to test mode.
CO2	Apply appropriate testing techniques to evaluate prototypes and determine whether to persevere or pivot based on test results.
CO3	Analyze assumptions, constraints, and risks in experimental prototypes and develop effective rapid concept models.
CO4	Evaluate feedback using probing tools like questionnaires and integrate the insights to modify their solution.
CO5	Design a market-pitch-ready concept using tools like RASCI/RACI, impact tracking, and storytelling.

TEXTBOOKS	
1.	An Introduction to Design Thinking PROCESS GUIDE, Hasso Plattner, d. School
2.	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Publications, 2009
3.	Don Norman, “The Design of Everyday Things”, Basic Books, 2013
4.	Tom Kelley, David Kelley, “Creative Confidence: Unleashing the Creative Potential Within Us All”, Currency, 2013

REFERENCES	
1.	Hasso Plattner, Christoph Meinel, Larry Leifer, “Design Thinking: Understand – Improve – Apply (Understanding Innovation)”, Springer, 2011
2.	Jakob Schneider, Marc Stickdorn, “This Is Service Design Thinking: Basics, Tools, Cases”, John Wiley & Sons, 2011
3.	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	2	2	2	1	3	3	2	2	0	0	1
CO2	1	2	3	2	2	2	1	3	3	2	2	0	0	1
CO3	-	2	3	2	2	2	-	3	3	2	2	0	0	1
CO4	-	2	3	2	2	2	-	3	3	2	2	0	0	1
CO5	-	2	3	2	2	2	-	3	3	2	2	0	0	1
AVG	1	2	3	2	2	2	1	3	3	2	2	0	0	1

SEMESTER VI								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24CS503	Theory of Computation	PCC	45	3	1	0	4
2		Open Elective II	OEC	45	3	0	0	3
3	U24MC613	Integrated Disaster management	# MC	30	2	0	0	0
THEORY CUM PRACTICAL								
4	U24IT602	Embedded Systems and IOT	PCC	75	3	0	2	4
5	U24AD601	Network Essentials	PCC	75	3	0	2	4
6		Professional Elective III	PEC	60	2	0	2	3
7		Professional Elective IV	PEC	60	2	0	2	3
PRACTICAL								
8	U24RM614	Technical Writing and Research Ethics	RMC	15	0	0	1	0.5
9	U24TP610	Employability Skills & Problem-Solving Techniques	EEC	30	0	0	2	1
10	U24ED611	Building a Business Model, GTM & Startup Journey	EDIC	15	0	0	1	0.5
TOTAL				**465**	**19**	**0**	**12**	**23**

#Mandatory Course is a Non-credit.

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24CS503	THEORY OF COMPUTATION	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1	Understand the classification of languages according to the Chomsky hierarchy.
2	Learn about finite automata and prove its equivalence with other forms.
3	Learn about push down automata and prove its equivalence with context– free grammar
4	Learn about Turing Machine and prove the equivalence of different extensions of Turing Machine
5	Understand the undecidability of Recursively Enumerable Languages

UNIT 1 REGULAR LANGUAGES — **9**

Introduction to Formal Languages and Automata – Finite Automata – Deterministic Finite Automata – Non–deterministic Finite Automata – Finite Automata with Epsilon Transitions – Regular Expression – Finite Automata and Regular Expressions – Proving Languages not to be Regular – Closure Properties of Regular Languages – Decision Properties of Regular Languages – Equivalence and Minimization of Finite Automata.

UNIT 2 CONTEXT FREE LANGUAGES — **9**

Free Grammar – Parse Trees – Ambiguity in Grammars and Languages – Normal Forms of Context Free Grammars – The Pumping Lemma for Context Free Languages – Closure Properties of Context Free Languages – Decision Properties of Context Free Languages.

UNIT 3 PUSH DOWN AUTOMATA — **9**

Push Down Automata – Language of Push Down Automata – Equivalence of Pushdown Automata and Context Free Languages – Deterministic Push Down Automata

UNIT 4 TURING MACHINES — **9**

Turing Machines – Language of a Turing Machine – Programming Techniques for Turing Machine – Extensions to Turing Machines – Restricted Turing Machine Two– way Infinite Tape, Equivalence of One Way Infinite Tape and Two– way Infinite Tape Turing Machines – Multi Tape Turing Machines, Non– deterministic Turing Machine.

UNIT 5 UNDECIDABILITY — **9**

A Language that is not Recursively Enumerable – An Undecidable Problem that is Recursively Enumerable – Undecidable Problems about Turing Machine – Post's Correspondence Problem – Other Undecidable Problems.

TOTAL PERIODS :45

COURSE OUTCOMES

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

CO1	Classify languages according to Chomsky hierarchy.
CO2	Design finite automata and prove its equivalence with other forms.
CO3	Design push down automata and prove its equivalence with context– free grammar
CO4	Design Turing Machine and prove the equivalence of different extensions of Turing Machine
CO5	Prove the undecidability of Recursively Enumerable Languages

TEXTBOOKS

1	John E Hopcroft, Rajeev Motwani, and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition, 2009.
2	John E Hopcroft and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations", Narosa Publishing House, 2002.

REFERENCES

1	H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
2	J. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill, 2003.
3	Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation)
3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2	1	-	-	-	-	1	3	3	1
CO 2	3	3	3	3	3	2	-	-	-	-	1	3	3	1
CO 3	3	3	3	3	3	2	-	-	-	-	1	3	3	1
CO 4	3	3	3	3	3	2	-	-	-	-	1	3	3	1
CO 5	3	3	3	3	3	2	-	-	-	-	1	3	3	3
AVG	**3**	**2.8**	**2.8**	**2.8**	**2.8**	**1.8**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**1.4**

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24IT602	EMBEDDED SYSTEMS AND IOT	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

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

UNIT 1 8-BIT EMBEDDED PROCESSOR — **9 +6**

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

Practicals:

1. Write 8051 Assembly Language experiments using a simulator.
2. Test data transfer between registers and memory.

UNIT 2 EMBEDDED C PROGRAMMING — **9 +6**

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

Practicals:

4. Write Basic and arithmetic Programs Using Embedded C.
5. Introduction to Arduino platform and programming

UNIT 3 IOT AND ARDUINO PROGRAMMING — **9 +6**

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

Practicals:

6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)

UNIT 4 IOT COMMUNICATION AND OPEN PLATFORMS — **9 +6**

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

Practicals:

7. Introduction to Raspberry PI platform
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Setup a cloud platform to log the data
11. Log Data using Raspberry PI and upload to the cloud platform

UNIT 5 APPLICATION DEVELOPMENT — **9 +6**

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

Practicals:

12. Design an IoT-based system

TOTAL PERIODS — **45+30**

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Explain the architecture of embedded processors.
CO2	Write embedded C programs
CO3	Design simple embedded applications.
CO4	Compare the communication models in IOT
CO5	Design IoT applications using Arduino/Raspberry Pi /open platform.
TEXTBOOKS	
1	Muhammed Ali Mazidi, Janice Gillispie Mazidi,Rolin D.McKinlay—The8051 Microcontroller and Embedded Systems‖, Pearson Education, Second Edition, 2014
2	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, —IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things‖, CISCO Press, 2017.
3	Dieter Uckelmann; Mark Harrison; Florian Michahelles, "Architecting the Internet of Things", Springer 2011.
REFERENCES	
1	MichaelJ. Pont, —Embedded C‖, Pearson Education, 2007.
2	Wayne Wolf, —Computers as Components: Principles of Embedded Computer SystemDesign‖, Elsevier, 2006.
3	Andrew N Sloss, D. Symes, C. Wright, —Arm System Developer's Guide‖, MorganKauffman/ Elsevier, 2006.
4	Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, UniversitiesPress, 2015

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	-	1	2	3	3	2	1	3
CO2	2	1	3	2	2	-	-	1	2	3	3	3	1	3
CO3	3	1	3	3	1	-	-	1	2	1	1	1	3	3
CO4	3	2	3	2	1	-	-	1	2	1	1	2	2	1
CO5	2	3	3	2	2	-	-	1	3	2	2	3	1	3
AVG	**2.6**	**2**	**3**	**2.4**	**1.5**	**-**	**-**	**1**	**2.2**	**2.2**	**2.4**	**2.2**	**1.6**	**2.6**

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24AD601	NETWORK ESSENTIALS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

Design and implement a functional small-scale network that meets specified performance and security requirements.

COURSE OBJECTIVES

1	To understand the division of network functionality into layers
2	To familiarize the functions and protocols of each layer in the TCP/IP protocol suite
3	To visualize end– to– end flow of information
4	To understand the components required to build different types of networks
5	To learn concepts related to the network addressing and routing

UNIT 1 LINK LAYER **9+6**

Introduction – Layered Architecture, ISO/OSI Model, Internet Architecture (TCP/IP) – Link Layer Framing, Addressing – Error Detection/ Correction Techniques – Switched Local Area Networks (ARP, Ethernet, VLAN) – Wireless LAN (802.11)

Practical:

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
2. Capture ping and trace route PDUs using a network protocol analyzer and examine.
3. Write a HTTP web client program to download a web page using TCP sockets.

UNIT 2 NETWORK LAYER **9+6**

Inside a Router – Internet Protocols – IPV4, IPV6, IP Addressing and NAT – Subnetting – Variable Length Subnet Mask (VLSM) – Classless Inter– Domain Routing (CIDR)

Practical:

3. Applications using TCP sockets like: a) Echo client and echo server b) Chat
4. Simulation of DNS using UDP sockets.

UNIT 3 ROUTING PROTOCOLS **9+6**

Distance Vector Routing – Link State Routing – RIP – OSPF – BGP – ICMP – DHCP – Introduction to Quality of Services (QoS)

Practicals:

5. Study of TCP/UDP performance using Simulation tool
6. Use a tool like Wireshark to capture packets and examine the packets

UNIT 4 TRANSPORT LAYER **9+6**

Introduction – Connectionless Transport: User Datagram Protocol – Principles of Reliable Data Transfer (GBN, SR) – Connection– Oriented Transport – TCP – Connection establishment and teardown – Triggering transmission – Flow Control – Congestion Control

Practicals:

7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
8. Write a code simulating ARP /RARP protocols.

UNIT 5 INTRODUCTION/ APPLICATION LAYER **9+6**

Building a network, Network edge and core – Networking Devices: Hubs, Bridges, Switches, Routers, and Gateways – Performance Metrics – Application Layer protocols – HTTP – FTP – Email – DNS

Practicals:

9. Simulation of Distance Vector/ Link State Routing algorithm.
10. Simulation of an error correction code (like CRC)

TOTAL PERIODS **: 45+30**

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO1	Highlight the significance of the functions of each layer in the network
CO2	Identify the devices and protocols to design a network and implement it
CO3	Build network applications using the right set of protocols and estimate their performance
CO4	Apply addressing principles such as subnetting and VLSM for efficient routing
CO5	Explain media access techniques

TEXTBOOKS

1	James F. Kurose, Keith W. Ross, "Computer Networking: A Top– Down Approach", Eighth Edition, Pearson Education, 2022.
2	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Sixth Edition, Morgan Kaufmann Publishers Inc., 2022.

REFERENCES

1	William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2017.
2	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill, 2012.
3	Andrew S Tanenbaum, Nick Feamster and David J Wetherall, "Computer Networks", Sixth Edition, Pearson Education, 2022.

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	1	1	1	-	-	1	3	1	1
CO2	3	3	2	3	1	1	1	-	-	-	2	3	3	1
CO3	3	3	3	2	2	1	1	3	-	-	2	3	3	3
CO4	3	3	3	2	2	1	1	3	-	-	2	3	3	3
CO5	3	3	3	2	1	1	1	-	-	-	-	3	2	2
AVG	**3**	**3**	**3**	**2.1**	**1.4**	**1**	**1**	**2.3**	**-**	**-**	**1.75**	**3**	**2.4**	**1.8**

Product based Projects (in Team)

1	Simulate a gateway that converts data between two different protocols or network types.
2	Multiplexing/Demultiplexing Demo: Build a simple program where multiple clients send messages to one server port, and the server routes responses correctly back based on port numbers.
3	Packet Switching Simulator: Simulate a simple packet-switching network where packets are forwarded node-to-node with queueing delays.
4	IPv4 Subnet Calculator: Build a tool where users input an IP address and subnet mask or prefix length, and it calculates network ID, broadcast address, number of hosts, valid IP range, etc.
5	CSMA/CD Network Simulation: Simulate multiple nodes sending data on a shared channel and detect collisions with retransmission.

Meenakshi Sundararajan Engineering College

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

Department: Artificial Intelligence and Data Science, R2024, CBCS

U24RM612	DATA COLLECTION, ANALYSIS AND INTERPRETATION	L	T	P	C
		0	0	1	0.5

COURSE OBJECTIVES

1	Analyze different types of data, sources, and sampling methods in research contexts to ensure appropriate data collection.
2	Apply appropriate digital and manual tools for designing and administering data collection instruments across disciplines.
3	Analyze and preprocess raw data using statistical and visualization techniques to prepare it for analysis.
4	Evaluate statistical methods and domain-specific analysis techniques for their suitability in different research scenarios.
5	Evaluate the significance of data analysis results and effectively communicate findings through structured research outputs.

UNIT 1 INTRODUCTION TO RESEARCH DATA AND COLLECTION TECHNIQUES — **3**

Types of data: qualitative vs. quantitative; primary vs. secondary, Sources of data: surveys, experiments, sensors, interviews, observations, literature, Tools and techniques for data collection: questionnaires, focus groups, digital sensors, APIs, Sampling methods: probability and non-probability sampling, Data quality: validity, reliability, accuracy, and bias

UNIT 2 TOOLS AND METHODS FOR DATA COLLECTION — **3**

Designing data collection instruments: scales, forms, and logs, Using online tools: Google Forms, Survey Monkey, KoboToolbox, IoT and sensor-based data acquisition in engineering and science, Ethical considerations in data collection: consent, privacy, anonymization, Case studies from various domains

UNIT 3 DATA PREPARATION AND ANALYSIS TECHNIQUES — **3**

Data cleaning and preprocessing: handling missing, duplicate, and outlier data, Organizing data: tabulation, coding, categorization, Descriptive statistics: mean, median, mode, standard deviation, variance, Data visualization: charts, graphs, dashboards using Excel, Python, R, Introduction to data analysis tools: SPSS, Excel, Python (Pandas), R

UNIT 4 STATISTICAL AND ANALYTICAL METHODS — **3**

Inferential statistics: hypothesis testing, confidence intervals, Correlation and regression analysis, ANOVA, chi-square, and non-parametric tests, Multivariate analysis (introductory), Domain-specific analysis techniques (e.g., sentiment analysis in social sciences, FFT in engineering)

UNIT 5 DATA INTERPRETATION AND RESEARCH REPORTING — **3**

Interpreting statistical results in context, Drawing meaningful conclusions and identifying patterns, Reporting and visualizing findings (charts, tables, narrative explanation), Using data to support or refute hypothesis, Writing data-driven research papers, reports, and presentations

TOTAL PERIODS : 15

COURSE OUTCOMES

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

CO1	Distinguish and evaluate data types, sources, and sampling methods to design valid and reliable research strategies.
CO2	Design effective data collection tools using platforms like Google Forms, SurveyMonkey, and IoT-based systems, while addressing ethical considerations.
CO3	Clean, organize, and summarize datasets using descriptive statistics and visualize results using tools like Excel, Python, or R.

CO4	Select and apply appropriate statistical and analytical techniques such as regression, ANOVA, and chi-square to interpret research data.
CO5	Interpret analytical outcomes and prepare data-driven research reports and presentations that effectively communicate insights.

TEXTBOOKS

1	A. Field, Discovering Statistics Using SPSS / R / Python, 5th ed. London, UK: SAGE Publications, 2018.
2	J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, Multivariate Data Analysis, 8th ed. Andover, UK: Cengage Learning EMEA, 2018.
3	C. R. Kothari and G. Garg, Research Methodology: Methods and Techniques, 4th ed. New Delhi, India: New Age International Publishers, 2019.

REFERENCES

1	G. James, D. Witten, T. Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, 1st ed. New York, NY, USA: Springer, 2013.
2	E. R. Tufte, The Visual Display of Quantitative Information, 2nd ed. Cheshire, CT, USA: Graphics Press, 2001.

CO-PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	2	2	2	2	1	1	2	1	2	1	2	1	1	1
CO 2	2	2	3	2	3	1	3	2	3	2	3	1	1	1
CO 3	2	3	2	2	3	1	2	2	3	2	3	1	1	1
CO 4	3	3	3	3	3	1	2	2	3	3	3	1	1	1
CO 5	2	2	3	2	2	1	3	2	3	3	3	1	1	1
AVG	**2.2**	**2.4**	**2.6**	**2.2**	**2.4**	**1**	**2.4**	**1.8**	**2.8**	**2.2**	**2.8**	**1**	**1**	**1**

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SEMESTER VII								
SL.NO	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		**30**				
THEORY								
1	U24AD701	Information Security	PCC	45	3	0	0	3
2	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
3		Open Elective – III	OEC	45	3	0	0	3
4		Constitution of India	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5		Professional Elective V	PEC	60	2	0	2	3
6		Professional Elective VI	PEC	60	2	0	2	3
PRACTICAL								
7	U24AD702	Summer Internship*	EEC					1
8	U24RM714	Data Collection, Analysis, and Interpretation	RMC	15	0	0	1	0.5
TOTAL				**285**	**16**	**0**	**3**	**16.5**

***Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester**

 # Mandatory Course is a Non-credit

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24AD701	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

This course introduces the fundamentals of Information Security, covering core principles, threats, and protection methods.It also explores legal, ethical, and professional issues, along with digital signatures, email, and web security technologies.

1	To understand the basics of Information Security
2	To know the legal, ethical and professional issues in Information Security
3	To equip knowledge on digital signature
4	To understand the E-mail Security and Architecture
5	To understand the concept of Web Security

UNIT 1 INTRODUCTION — **9**

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

UNIT 2 SECURITY INVESTIGATION — **9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues – An Overview of Computer Security – Access Control Matrix, Policy – Security policies, Confidentiality policies, Integrity policies and Hybrid policies-symmetric key algorithms:Substitution and Transposition Techniques-Asymmetric key algorithms:RSA(Rivest–Shamir–Adleman),Elliptic Curve Cryptography (ECC),Diffie-Hellman,DSS (Digital Signature Standard)

UNIT 3 Digital Signature And Authentication — **9**

Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants – Digital Signature Standards-Authentication: Overview- Requirements Protocols Applications – Kerberos – X.509 Directory Services

UNIT 4 E-Mail And IP Security — **9**

E-mail and IP Security: Electronic mail security: Email Architecture – PGP – Operational Descriptions – Key management – Trust Model – S/MIME.IP Security: Overview – Architecture – ESP, AH Protocols IPSec Modes – Security association – Key management.

UNIT 5 Web Security — **9**

Web Security: Requirements- Secure Sockets Layer – Objectives – Layers – SSL secure communication – Protocols – Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

CO1	Understand the basics of data and information security

CO2	Understand the legal, ethical and professional issues in information security
CO3	Understand the various authentication schemes to simulate different applications
CO4	Understand various security practices and system security standards
CO5	Understand the Web security protocols for E-Commerce applications
TEXT BOOKS	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017.
2	Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.
REFERENCES	
1	Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016.
2	Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012.
3	Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.
4	Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	3	`1	-	-	2	3	1	2	3	3	3
CO2	2	2	2	3	3	-	-	1	2	2	3	1	1	3
CO3	3	3	3	3	3	-	-	2	1	1	2	2	1	3
CO4	3	3	1	1	1	-	-	1	3	1	3	2	1	1
CO5	3	2	2	2	3	-	-	2	3	2	2	2	3	3
AVG	**2.8**	**2.4**	**2**	**2.4**	**2.2**	**-**	**-**	**1.6**	**2.4**	**1.4**	**2.4**	**2**	**1.8**	**2.6**

Product based Projects (in Team)

1.	Detecting and Mitigating Phishing Attacks in Real-Time
2.	Enhancing Data Privacy in Cloud Storage through Encryption and Access

3.	Developing an Intrusion Detection System Using Machine Learning for IoT Networks
4.	Securing Mobile Applications Against Reverse Engineering and Tampering
5.	Blockchain-Based Secure Voting System to Ensure Transparency and Anonymity
6.	Evaluating and Mitigating Insider Threat Risks in Enterprise Networks
7.	Automated Vulnerability Assessment of Web Applications Using Static and Dynamic Analysis
8.	Securing Mobile Applications Against Man-in-the-Middle (MitM) Attacks

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U24RM712	TECHNICAL WRITING AND RESEARCH ETHICS	L	T	P	C
		0	0	1	0.5

COURSE OBJECTIVES

1	Apply the principles of clarity, conciseness, coherence, and correctness in technical writing tasks.
2	Analyze the structure and components of various research and technical documents using the IMRaD format.
3	Apply principles of formal, objective, and precise language in crafting professional technical documents.
4	Evaluate the effectiveness of visual elements (tables, charts, graphs) in technical documentation and revise them for clarity and precision.
5	Analyze ethical issues related to research publication, data integrity, authorship, and collaborative writing.

UNIT 1 FUNDAMENTAL OF TECHNICAL WRITING	**3**

Nature and scope of technical writing vs. academic writing, Characteristics of effective technical writing: clarity, conciseness, coherence, correctness, Audience analysis and purpose identification, Writing process: planning, drafting, revising, editing, Common technical documents: manuals, reports, proposals, research papers

UNIT 2 WRITING RESEARCH AND TECHNICAL DOCUMENTS	**3**

Structure and format of research papers (IMRaD structure), Writing abstracts, introductions, literature reviews, methodologies, results, and conclusions, Writing technical reports, project documentation, lab reports, Research proposals and funding applications, Case studies of well-written technical documents

UNIT 3 LANGUAGE AND STYLE IN TECHNICAL WRITING	**3**

Use of formal, objective, and precise language, Active vs. passive voice; tone and style, Grammar, punctuation, and sentence construction, Avoiding jargon, redundancy, and ambiguity, Consistency in units, terminology, and symbols

UNIT 4 DATA PRESENTATION AND VISUAL COMMUNICATION	**3**

Integrating tables, charts, graphs, and diagrams effectively, Captioning, labelling, and referencing visuals, Tools for creating visuals (Excel, Python, R, LaTeX), Guidelines for formatting figures and tables (APA, IEEE, etc.), Visual abstracts and infographics in technical communication

UNIT 5 ETHICS, REVIEW, AND PUBLISHING	**3**

Plagiarism, citation styles (APA, MLA, IEEE), and referencing tools (Zotero, Mendeley), Ethics in authorship, collaborative writing, and data reporting, Ethical issues in Research planning and design, Ethics in data collection, analysis and interpretation, Publication ethics and professional conduct, Contemporary and Emerging ethical challenges.

TOTAL PERIODS	**:15**

COURSE OUTCOMES

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

CO1	Draft effective technical documents that demonstrate clarity, coherence, and appropriateness for a specified audience and purpose.

CO2	Deconstruct well-written technical documents and identify effective strategies in structuring abstracts, literature reviews, and methodologies.
CO3	Produce grammatically accurate and stylistically appropriate texts while minimizing ambiguity and redundancy.
CO4	Design and integrate well-labeled, correctly formatted visuals to support technical arguments in reports and presentations.
CO5	Critically assess research practices for ethical compliance, and apply appropriate citation and referencing standards using tools like Zotero or Mendeley.

TEXT BOOKS

1	M. Alley, The Craft of Scientific Writing, 3rd ed. New York, NY, USA: Springer, 1996.
2	A. Eisenberg, Guide to Technical Writing, New York, NY, USA: Macmillan, 1978.
3	W. Strunk Jr. and E. B. White, The Elements of Style, 4th ed. Boston, MA, USA: Pearson, 2022.
4	D. B. Resnik, The Ethics of Science: An Introduction, 2nd ed. New York, NY, USA: Routledge, 2018.
5	A. E. Shamoo and D. B. Resnik, Responsible Conduct of Research, 4th ed. New York, NY, USA: Oxford Univ. Press, 2022.

REFERENCES

1	J.-L. Lebrun, Scientific Writing: A Reader and Writer's Guide, Singapore: World Scientific, 2007.
2	S. Bailey, Academic Writing: A Handbook for International Students, 5th ed. New York, NY, USA: Routledge, 2018.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	1	1	1	2	3	1	2	1	1	1
CO2	2	3	2	3	2	1	2	2	3	2	3	1	1	1
CO3	2	2	2	1	1	1	2	2	3	2	3	1	1	1
CO4	2	2	3	2	3	1	1	2	3	3	3	1	1	1
CO5	2	2	1	2	2	2	3	2	3	2	3	1	1	1
AVG	2	2	2	1.8	1.8	1.2	1.8	2	3	2	2.8	**1**	**1**	**1**

PROFESSIONAL ELECTIVES					
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					
Intelligent Computing	**AI in Industry**	**Data Technologies**	**Agile Software Technologies**	**Cyber Security & Forensics**	**Multimodal Processing**
Computational Intelligence	Reinforcement Learning	Business Analytics	Web Engineering	Ethical Hacking	Quantum Computing
Computer Vision	AI for Industrial Applications	Predictive Analytics	Cloud Computing	Digital & Mobile Forensics	Augmented Reality
Cognitive Models for computing	AI in IOT	Text & Speech Analysis	UI & UX Design	Social Network Security	Virtual Reality
MLops	AI for Robotics	Health Care Analytics	Software Engineering	Modern Cryptography	Game Development
Generative AI	Autonomous Vehicles	Optimization Techniques	DevOps	AI for Cyber Security	Large Language Models
Explainable AI	Responsible AI	Social Network Analytics	AI Based Mobile Application Development	Cryptocurrency & Block chain Technologies	Agentic AI

PROFESSIONAL ELECTIVES					
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					
Intelligent Computing	**AI in Industry**	**Data Technologies**	**Agile Software Technologies**	**Cyber Security & Forensics**	**Multimodal Processing**
Computational Intelligence	Reinforcement Learning	Business Analytics	Web Engineering	Ethical Hacking	Quantum Computing
Computer Vision	AI for Industrial Applications	Predictive Analytics	Cloud Computing	Digital & Mobile Forensics	Augmented Reality
Cognitive Models for computing	AI in IOT	Text & Speech Analysis	UI & UX Design	Social Network Security	Virtual Reality
MLops	AI for Robotics	Health Care Analytics	Software Engineering	Modern Cryptography	Game Development
Generative AI	Autonomous Vehicles	Optimization Techniques	DevOps	AI for Cyber Security	Large Language Models
Explainable AI	Responsible AI	Social Network Analytics	AI Based Mobile Application Development	Cryptocurrency & Block chain Technologies	Agentic AI

VERTICAL 1: INTELLIGENT COMPUTING								
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP11	COMPUTATIONAL INTELLIGENCE	PEC	45	3	0	0	3
2	U24ECP25	COMPUTER VISION	PEC	60	2	0	2	3
3	U24ADP12	COGNITIVE MODELS FOR COMPUTING	PEC	60	2	0	2	3
4	U24ADP13	MLOPS	PEC	60	2	0	2	3
5	U24ITP65	GENERATIVE AI	PEC	45	3	0	0	3
6	U24ADP14	EXPLAINABLE AI	PEC	45	3	0	0	3

VERTICAL 2: AI IN INDUSTRY								
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP21	REINFORCEMENT LEARNING	PEC	60	2	0	2	3
2	U24ADP22	AI FOR INDUSTRIAL APPLICATIONS	PEC	45	3	0	0	3
3	U24ADP23	AI IN IOT	PEC	60	2	0	2	3
4	U24ADP24	AI FOR ROBOTICS	PEC	45	3	0	0	3
5	U24ADP25	AUTONOMOUS VEHICLES	PEC	45	3	0	0	3
6	U24ADP26	RESPONSIBLE AI	PEC	60	2	0	2	3

VERTICAL 3: DATA TECHNOLOGIES								
S.No	COURSE CODE	COURSE TITLE	CATEGORY	TOTAL CONTACT PERIODS	L	T	P	C
1	U24ADP31	BUSINESS ANALYTICS	PEC	60	2	0	2	3
2	U24ADP32	PREDICTIVE ANALYTICS	PEC	60	2	0	2	3
3	U24CSP14	TEXT & SPEECH ANALYSIS	PEC	60	2	0	2	3
4	U24ITP26	HEALTH CARE ANALYTICS	PEC	45	3	0	0	3
5	U24ADP33	OPTIMIZATION TECHNIQUES	PEC	45	3	0	0	3
6	U24ADP34	SOCIAL NETWORK ANALYTICS	PEC	45	3	0	0	3

VERTICAL 4: AGILE SOFTWARE TECHNOLOGIES								
S. No	COURSE CODE	COURSE TITLE	CATEGORY	TOTAL CONTACT PERIODS	L	T	P	C
1	U24ADP41	WEB ENGINEERING	PEC	60	2	0	2	3
2	U24CSP31	CLOUD COMPUTING	PEC	60	2	0	2	3
3	U24CSP24	UI & UX DESIGN	PEC	60	2	0	2	3
4	U24ADP42	SOFTWARE ENGINEERING	PEC	45	3	0	0	3
5	U24CSP23	DEVOPS	PEC	45	3	0	0	3
6	U24ADP43	AI BASED MOBILE APPLICATION DEVELOPMENT	PEC	45	3	0	0	3

VERTICAL 5:CYBER SECURITY AND FORENSICS								
S.No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24CSP41	ETHICAL HACKING	PEC	60	2	0	2	3
2	U24CSP42	DIGITAL AND MOBILE FORENSICS	PEC	60	2	0	2	3
3	U24ADP41	SOCIAL NETWORK SECURITY	PEC	60	2	0	2	3
4	U24CSP44	MODERN CRYPTOGRAPHY	PEC	45	3	0	0	3
5	U24CSP45	AI FOR CYBER SECURITY	PEC	45	3	0	0	3
6	U24CSP46	CRYPTOCURRENCY AND BLOCK CHAIN TECHNOLOGIES	PEC	45	3	0	0	3

VERTICAL 6: MULTIMODEL PROCESSING								
S. No	**COURSE CODE**	**COURSETITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP61	QUANTUM COMPUTING	PEC	45	3	0	0	3
2	U24ITP55	AUGMENTED REALITY	PEC	60	2	0	2	3
3	U24ITP56	VIRTUAL REALITY	PEC	60	2	0	2	3
4	U24ADP62	GAME DEVELOPMENT	PEC	60	2	0	2	3
5	U24ADP63	LARGE LANGUAGE MODEL	PEC	45	3	0	0	3
6	U24ADP64	AGENTIC AI	PEC	60	2	0	2	3

VERTICAL 1: INTELLIGENT COMPUTING								
S.No	COURSE CODE	COURSE TITLE	CATEGORY	TOTAL CONTACT PERIODS	L	T	P	C
1	U24ADP11	Computational Intelligence	PEC	45	3	0	0	3
2	U24ECP25	Computer Vision	PEC	60	2	0	2	3
3	U24ADP12	Cognitive Models for computing	PEC	60	2	0	2	3
4	U24ADP13	MLops	PEC	60	2	0	2	3
5	U24ITP65	Generative AI	PEC	45	3	0	0	3
6	U24ADP14	Explainable AI	PEC	45	3	0	0	3

U24ADP11	COMPUTATIONAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Apply historical and theoretical concepts of evolutionary computation and fuzzy logic to examine their role in solving computational problems.
2	Analyze neural network structures, terminology, and functional components to determine their comparative advantages for various applications.
3	Apply genetic algorithms, evolutionary programming, and particle swarm optimization techniques to design and implement intelligent problem-solving models. .
4	Analyze particle swarm optimization and ant colony optimization approaches to evaluate their effectiveness in real-world optimization tasks.
5	Apply fuzzy logic principles to develop and test fuzzy controllers and inferencing systems for practical scenarios.

UNIT – 1 INTRODUCTION **9**

Overview of Computation- Background and history of evolutionary computation - Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption - Self organization and Evolution - Historical Views of Computational Intelligence - Adaption and Self organization for Computational Intelligence - Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing

Content Beyond the Syllabus: Evolutionary computation in bioinformatics, adaptive systems in robotics.

Industrial Application: Smart manufacturing systems, adaptive traffic signal optimization.

Experiential Learning: Analyze real-world CI applications and adaptive system behaviors..

UNIT – 2 NEURAL NETWORK CONCEPTS AND PARADIGMS **9**

Neural Network History - What Neural Networks are and Why they are useful - Neural Networks Components and Terminology - Neural Networks Topology - Neural Network Adaption - Comparing Neural Networks and Other information Processing Methods - Preprocessing and Post Processing

Content Beyond the Syllabus: Deep learning architectures, convolutional and recurrent neural networks.

Industrial Application: Image recognition, speech processing, predictive maintenance in industries. Experiential Learning: Build and test neural network models using Python frameworks..

UNIT – 3 EVOLUTIONARY COMPUTATION THEORY AND CONCEPTS **9**

History of Evolutionary Computation, Evolution Computation Overview, Genetic algorithms, Evolutionary programming, Evolution strategies, genetic programming, and particle swarm optimization.

Content Beyond the Syllabus: Hybrid evolutionary algorithms, multi-objective optimization, real-world optimization strategies

Industrial Application Production scheduling, supply chain optimization, automated design optimization.

Experiential Learning: Implement genetic algorithms to optimize real-world industrial problems.

UNIT – 4 SWARM INTELLIGENCE **9**

Particle Swarm Optimization: Particle Swarm Optimization Algorithm - PSO System Parameters - Modifications to PSO - Cooperative PSO - Particle Swarm Optimization versus Evolutionary Computing and Cultural Evolution – Applications. Ant Colony Optimization.

Content Beyond the Syllabus: Hybrid swarm algorithms, bio-inspired optimization beyond classical methods.

Industrial Application: Network routing, robotic swarm coordination, logistics optimization

Experiential Learning: Simulate particle swarm and ant colony algorithms for optimization.

UNIT – 5 FUZZY SYSTEMS	**9**

Fuzzy systems: Fuzzy Sets - Membership Functions - Fuzzy Operators - Fuzzy Set Characteristics - Linguistics Variables and Hedges - Fuzziness and Probability - Fuzzy Inferencing systems: Fuzzification: Inferencing – Defuzzification - Fuzzy Controllers: Components of Fuzzy Controllers - Fuzzy Controller Types

Content Beyond the Syllabus: Adaptive fuzzy controllers, fuzzy-neural hybrid systems, advanced inferencing..

Industrial Application Air conditioning control, washing machines, autonomous vehicle decision systems.

Experiential Learning: Design fuzzy controllers to manage real-world processes efficiently.

TOTAL PERIODS	**45**

COURSE OUTCOMES:

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

CO 1	Provide a basic exposition to the goals and methods of Computational Intelligence.
CO 2	Implement basic neural networks for solving problems.
CO 3	Design of Evolutionary Computation Theory and Apply genetic algorithms to optimization problems
CO 4	Develop problem solving skills using the acquired knowledge in the areas of swarm intelligence
CO 5	Apply fuzzy logic and build fuzzy systems to handle uncertainty and solve engineering problems

TEXTBOOKS

1.	Sajja,PS. “Illustrated Computational Intelligence: Examples and Applications”, Springer, 2021..
2.	Modestus O. Okwu, Lagouge K. Tartibu,” Metaheuristic Optimization: Nature-Inspired Algorithms Swarm and Computational Intelligence, Theory and Applications ,1st ed, Kindle Edition, Springer, 2021
3.	Engelbrecht, A.P. Computational Intelligence: An Introduction, Second Edition, John Wiley and Sons, 2007
4.	Eberhart, E. and Y. Shi., “Computational Intelligence: Concepts and Implementations”, Morgan Kauffmann, San Diego, 2007.

REFERENCES

1.	Stuart Russell, Peter Norvig, ―Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education / Prentice Hall of India, 2010
2.	Elaine Rich and Kevin Knight, ―Artificial Intelligence, Third Edition, Tata McGraw- Hill, 2010.
3.	MitchellMelanie, An Introduction to Genetic Algorithms, The MIT Press, 1998.
4.	Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
5.	Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PS O 1**	**PS O 2**	**PS O 3**
CO 1	2	1	1	-	-	-	-	-	-	-	2	1	1	1
CO 2	3	2	2	1	3	-	-	1	-	-	2	3	2	1
CO 3	3	3	2	2	2	-	-	-	-	1	2	3	2	1
CO 4	2	3	2	3	2	-	-	2	1	-	2	3	1	1
CO 5	3	2	2	2	2	1	1	-	-	-	2	3	1	2
AVG	2.6	2.2	1.8	2	2.3	1	1	1.5	1	1	2	2.6	1.4	1.2

Product-based Projects (Team)

1	Traffic Signal Optimization Using Particle Swarm Optimization
2	Smart HVAC Energy Management Using Fuzzy Logic
3	Cloud Job Scheduling Using Genetic Algorithms
4	Energy Consumption Forecasting Using Neural Networks

5	Delivery Route Optimization Using Ant Colony Optimization
6	Student Performance Prediction Using ANN and Fuzzy Logic
7	Adaptive Spam Email Detection Using Evolutionary Programming
8	Disease Outbreak Prediction Using Neural Networks
9	PSO-Based Feature Selection for Machine Learning Models
10	Fuzzy Logic–Based Water Level Control for Smart Agriculture

U24ECP25	COMPUTER VISION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	To understand the fundamental concepts related to Image formation and processing
2	To understand and apply techniques for detecting features, matching key points, and performing segmentation in images.
3	To gain proficiency in feature-based alignment methods and techniques for estimating motion.
4	To enhance the skills on 3D reconstruction
5	To understand image recognition techniques.

UNIT 1 INTRODUCTION TO IMAGE FORMATION AND PROCESSING — **6+6**

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

Content Beyond Syllabus: Bilateral Filtering: A non-linear, edge-preserving smoothing filter commonly used in photo editing apps

Industrial Application: Critical in autonomous vehicle navigation and robotic vision systems.

Experiential Learning (Activity Based Learning): Build an OpenCV-based tool that allows students to apply and visualize geometric transformations (translation, rotation, scaling)

Lab Components:

1.OpenCV Installation and working with Python

2.Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection

UNIT 2 FEATURE DETECTION, MATCHING AND SEGMENTATION — **6+6**

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

Content Beyond Syllabus : Superpixel Segmentation

Industrial Application : Object Recognition in Robotics:

Experiential Learning (Activity Based Learning): Implement and compare basic segmentation methods such as thresholding, k-means clustering, and watershed on natural images.

Lab Components

1.Image Annotation – Drawing lines, text circle, rectangle, ellipse on images

2. Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection

3.Image segmentation using Graphcut / Grabcut

UNIT 3 FEATURE-BASED ALIGNMENT & MOTION ESTIMATION — **6+6**

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

Content Beyond Syllabus : Optical Flow in Autonomous Vehicles:Real-time application combining pose estimation, feature mapping, and motion tracking — widely used in robotics and AR.

Industrial Application : Structure from Motion in 3D Mapping:

Experiential Learning (Activity Based Learning): Implement dense and sparse optical flow (e.g., Farneback, Lucas-Kanade) on video sequences and visualize motion vectors.

Lab Components

1.Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB
2.Image features, Feature matching, cloning, Feature matching based image alignment
3.Pose Estimation

UNIT4 3D RECONSTRUCTION	**6+6**

Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.
Content Beyond Syllabus : Multiview 3D Reconstruction Pipelines (e.g., COLMAP, OpenMVG)
Industrial Application :3D Face and Body Scanning:
Experiential Learning (Activity Based Learning): Shape-from-Shading or Stereo Demo:
Lab Components
1.3D Reconstruction – Creating Depth map from stereo image

UNIT5 IMAGE-BASED RECOGNITION	**6+6**

Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test set
Experiential Learning (Activity Based Learning): Real-Time Object Detection:
Industrial Application : Security & Surveillance:,Retail & Smart Shopping
Content Beyond Syllabus :Scene Classification Challenge
Lab Components
1.Object Detection and Tracking using Kalman Filter, Camshift

TOTAL PERIODS	**: 30+30**

COURSE OUTCOMES

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

CO1	Demonstrate an understanding of fundamental concepts, theories, and techniques used in image processing and computer vision.
CO2	Implement fundamental and selected advanced image processing techniques using OpenCV.
CO3	Apply 2D feature-based image alignment, segmentation, and motion estimation methods.
CO4	Utilize techniques for 3D image reconstruction.
CO5	Design and develop creative applications in image processing and computer vision.

TEXT BOOKS

1	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3	Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson India, 3rdEdition, 2013

REFERENCES

1	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision,Second Edition, Cambridge University Press, March 2004.
2	E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
3	Forsyth and Ponce, ‘Computer Vision: A Modern Approach’ Pearson India, 2015.

4	Amin Ahmadi Tazehkandi, 'Hands-On Algorithms For Computer Vision : Learn How To UseThe Best And Most Practical Computer Vision Algorithms' Packt Publishing Limited, 2018.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	-	-	1	2	3	3
CO2	3	3	3	3	2	2	-	-	-	-	1	2	2	2
CO3	3	3	2	2	2	2	-	-	-	-	1	2	1	2
CO4	3	3	2	2	3	1	-	-	-	-	1	3	2	2
CO5	3	2	2	2	3	2	-	-	-	-	1	1	2	2
AVG	3	3	2	2	2	2	-	-	-	-	1	2	2	2

Product based Projects (in Team)

1	Automated Vehicle Number Plate Image Enhancement for Low-Light CCTV Footage
2	Defect Detection in Industrial Products Using Frequency-Domain Filtering
3	Medical Image Tumor Boundary Detection Using Active Contours
4	Driver Drowsiness Detection Using Optical Flow of Eye Movements
5	Human Activity Tracking in CCTV Using Dense Optical Flow
6	3D Room Reconstruction Using Phone Stereo Images for Interior Design
7	Crowd Counting Using Image-Based Density Estimation
8	Face Recognition Attendance System for Colleges/Offices
9	Helmet Detection System for Traffic Monitoring
10	Crop Disease Detection & Segmentation

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U24ADP12	COGNITIVE MODELS FOR COMPUTING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

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

UNIT - 1 PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE — **6+6**

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

PRACTICAL

1. To investigate the "Mental-physical Relation" by measuring how automatic linguistic processing interferes with sensory perception, and to determine if a "Materialist" mathematical model (a Neural Network) can accurately predict human error and delay.

Experiential Learning (Activity Based Learning): Explore Panpsychism (the idea that consciousness is a fundamental feature of all matter) and Integrated Information Theory (IIT).

Industrial Application : Explore Multisensory Integration through the "McGurk Effect" Illusion.

Content Beyond Syllabus: Brain-Computer Interfaces (BCI)

UNIT – 2 COMPUTATIONAL INTELLIGENCE — **6+6**

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

PRACTICAL

1.Implementation of reasoning algorithms.

Experiential Learning (Activity Based Learning): Build a "Mini-Agent Society" using frameworks like LangGraph

Industrial Application : Digital Twins in Smart Factories

Content Beyond Syllabus: Explore Multi-Agent Orchestration (MAO) and Sovereign AI.

UNIT – 3 PROBABILISTIC PROGRAMMING LANGUAGE — **6+6**

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

PRACTICAL

1.Demonstration of Mathematical functions using WebPPL.

Experiential Learning (Activity Based Learning): Investigate Variational Inference (VI) as an alternative to Enumeration.

Industrial Application : Recursive Feedback Loops in LLMs

Content Beyond Syllabus: Study Non-Local Control Flow and Delimited Continuations.

UNIT – 4 INFERENCE MODELS OF COGNITION — **6+6**

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

PRACTICAL

1. Developing an Application system using generative model. Experiential Learning (Activity Based Learning): Use DoWhy (an open-source library) to test a credit-scoring model Industrial Application : Autonomous Vehicle Navigation Content Beyond Syllabus: Generative Molecular Design	
UNIT – 5 LEARNING MODELS OF COGNITION	**6+6**
Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models. **PRACTICAL** **1.** Developing an Application using conditional inference learning model. **2.** Application development using hierarchical model. Experiential Learning (Activity Based Learning): Try the ARC-AGI (Abstraction and Reasoning Corpus) challenge Industrial Application : Automated Code Refactoring & Security Content Beyond Syllabus: Explore Program Synthesis as Inference	
TOTAL PERIODS	**: 30+30**

COURSE OUTCOMES:

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

CO 1	Understand the underlying theory behind cognition.
CO 2	Connect to the cognition elements computationally.
CO 3	Implement mathematical functions through WebPPL
CO 4	Develop applications using cognitive inference model.
CO 5	Develop applications using cognitive learning model

TEXTBOOKS

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

REFERENCES

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

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

CO 4	2	1	1	2	3	-	-	-	1	2	3	3	1	2
CO 5	1	2	3	2	2	-	-	-	1	2	2	2	2	1
AVG	1.8	1.8	1.8	2	2.4	-	-	-	1.4	2	2.2	2.2	2.2	1.6

	Product based Projects (in Team)
1.	Developing a Rule-Based Expert System for Heuristic Reasoning
2.	Simulating Neural Plasticity
3.	Computational Linguistics and the Semantic Gap
4.	Architecting a Knowledge-Based Expert System
5.	Implementing Message-Passing Algorithms for Real-Time Risk Assessment
6.	Bayesian Weather Station & Decision Engine
7.	Cognitive Vision & External Data Bridge
8.	Anomaly Detective using Generative Model
9.	Context-Aware Predictor using Bayesian Networks
10.	Developing a Gaussian Mixture Model (GMM) for Unsupervised Discovery

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U24ADP13	MLOPS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	To Understand development environments, version control systems, and data preprocessing techniques essential for efficient and collaborative machine learning model development
2	To Build and Evaluate machine learning models
3	To Understand and implement Continuous Integration and Continuous Deployment (CI/CD) in machine learning
4	To Understand Dockers and its Application for machine learning workloads
5	Deploy, and manage machine learning applications using Kubernetes

UNIT - 1 INTRODUCTION TO MLOPS AND DATA PROCESSING — **6+6**

Introduction to Version Control Systems – Concepts of repositories, branching, merging, commits, rollback;Collaborative Programming with GitHub (or equivalent platforms) – Pull requests, code reviews, issue tracking, teamwork workflows;Overview of MLOps – Principles, lifecycle stages, CI/CD for ML, reproducibility and automation;Significance of MLOps in Machine

Practical:

1.Implement Git version control and collaborative development using branches, commits, and pull requests.

2.Create and reproduce a Python virtual environment using requirements files for MLOps workflows.

Content Beyond Syllabus: Dataset versioning using DVC for reproducible data pipelines.

Industrial Application:Automated data preprocessing and feature engineering pipelines used in real-time ML production systems.

Experiential Learning:Conduct peer-reviewed ML workflow development using GitHub pull requests and code reviews.

UNIT – 2 MACHINE LEARNING PIPELINE — **6+6**

Training ML Models – Regression & Classification basics;Core Algorithms – Decision Trees & Support Vector Machines;Model Evaluation – Metrics & Cross-Validation;Model Optimization – Hyperparameter Tuning & Testing;Model Packaging

Practical:

1.Train Regression, Decision Tree, and SVM models on a real dataset; compute accuracy, RMSE, precision–recall, and perform k-fold cross-validation.

2.Apply Grid Search or Random Search for hyperparameter tuning; finalize the best model; package it using joblib/pickle for deployment.

3.Build a Flask or Streamlit application that loads the packaged model and serves predictions through a REST API endpoint.

Content Beyond Syllabus:Exploring automated MLOps pipelines for continuous model training and deployment.

Industrial Application:Optimized ML models for real-time prediction in sectors like finance, healthcare, and e-commerce.

Experiential Learning:Build and deploy a complete ML model as a REST API using Flask or Streamlit.

UNIT – 3 CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT (CI/CD) FOR ML MODELS — **6+6**

CI/CD concepts for machine learning - Setting up CI/CD pipelines - Tools for CI/CD in MLOps (e.g., Jenkins, GitHub Actions) - Implementation of CI/CD for ML project - Monitoring - Importance of monitoring ML models - Tools for monitoring.

Practicals:

1.Configuring a CI/CD pipeline using GitHub Actions to automate ML model training and testing.

2.Implementing continuous deployment for an ML project using Jenkins with automated model packaging and release.

3.Setting up logging and monitoring dashboards for deployed ML models using tools like Prometheus and Grafana.

Content Beyond Syllabus: Automated data drift detection Industrial Application : End-to-End MLOps automation platforms (AWS Cloud Pipeline). Experiential Learning: Configure GitHub Actions for a sample ML repo.	
UNIT – 4 DOCKER FOR MLOPS	**6+6**
Basics of Docker and containerization concepts; Installing and setting up Docker & Docker Desktop; Working with DockerHub and pulling images;Creating and using Dockerfiles for simple and ML applications Building, running containers & managing multi-container setups with Docker Compose;Docker networking, storage, and image optimization for ML workloads. Practicals: 1.Build and run a simple Docker container using a basic Dockerfile for a “Hello World” web application. 2.Pull an existing image from DockerHub and customize it by adding dependencies, then rebuild the updated image. 3.Create a two-container setup using Docker Compose (web app + database) and verify networking between the containers. Content Beyond Syllabus : Docker vs Virtual Machines vs Kubernetes Industrial Application:Built Central repository for ML and software images (TensorFlow, PyTorch, Scikit-learn) Experiential Learning : Installation of Docker Desktop and Docker Engine	
UNIT – 5 KUBERNETES FOR MLOPS	**6+6**
Overview of Kubernetes and container orchestration - Setting up a local Kubernetes cluster (e.g., Minikube) - Kubernetes architecture and key components using pods - Deploying ML applications on Kubernetes - Scaling ML applications with Kubernetes - Configuration Management Practical: 1.Set up a local Kubernetes cluster using Minikube and deploy a simple “Hello Pod” application. 2.Create a Deployment and Service to run a basic ML inference container and expose it within the cluster. 3.Scale the Deployment (e.g., from 1 to 3 replicas) and observe pod scheduling, status, and logs using kubectl commands. Content Beyond Syllabus: Networking and Service Meshes for ML micro services. Industrial Application: Automatic horizontal scaling of ML inference. Experiential Learning: Visualize the Kubernetes architecture: Pods → Nodes → Cluster → Control Plane	
TOTAL PERIODS	**:60**

COURSE OUTCOMES:

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

CO 1	Apply version control and data preprocessing techniques to build reproducible machine learning workflows.
CO 2	Operationalize machine learning models using various algorithms and frameworks, including REST API serving.
CO 3	Implement CI/CD pipelines for machine learning projects, ensuring continuous integration, deployment, and monitoring of ML models using industry-standard tools
CO 4	Operationalize Docker containers for machine learning applications.
CO 5	Orchestrate machine learning applications on Kubernetes clusters.

TEXTBOOKS

1.	Emmanuel Raj, Engineering MLOps Rapidly build, test and manage production-ready machine learning life cycles at scale, Packt Publications, 2021.
2.	Jeff Nickoloff and Stephen Kuenzli, Docker in Action, Third Edition, Manning, 2019.
3.	Kelsey Hightower, Brendan Burns, and Joe Beda, Kubernetes Up & Running: Dive into the Future of Infrastructure", OReilly 2017.

REFERENCES

1.	Artificial Intelligence in Industrial Applications, Stevan Lawrence Fernandes Tarun K.Sharma,Springer, 2022.
2.	Mihelj, Matjaž, Domen Novak, and Samo Beguš. "Virtual reality technology and applications" Springer Publication, 2014
3.	Haller M, Billinghurst M, Thomas B, editors. "Emerging technologies of augmented reality: Interfaces and design", IGI Global; 2006

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	2	3	1	1	1	1	1	3	3	3	2
CO 2	3	3	3	2	3	1	1	1	2	2	3	3	3	2
CO 3	3	3	3	3	3	1	1	2	2	3	3	3	2	2
CO 4	3	2	3	2	3	1	1	1	1	2	3	3	2	1
CO 5	3	3	3	3	3	1	1	2	2	3	3	3	2	1
AVG	3	2.6	2.8	2.4	3	1	1	1.4	1.6	2.2	3	3	2.4	1.6

Product based Projects (Team)

1	Live Traffic Congestion Prediction Using Sensor Data
2	IoT-Based Temperature Monitoring with ML Forecasting
3	Social Media Sentiment Tracking Dashboard
4	End-to-End ML Pipeline for Fraud Detection
5	Customer Churn Prediction with Live Dashboard Integration
6	Live Vehicle Number Plate Recognition System (ANPR)
7	Containerized Weather Forecast ML Application
8	Docker-Based Microservices for Real-Time Recommendation Engine
9	Weather Forecast API with Docker + Kubernetes Deployment
10	Model Drift Detection and Automatic Retraining System

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U24ITP65	GENERATIVE AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Understand the basics of Generative AI.
2	Know the basics of Text Generation.
3	Understand the process of generating videos.
4	Know about GAN and its variants.
5	Understand and Apply Gen AI tools.

UNIT – 1 INTRODUCTION TO GEN AI — **9**

Historical Overview of Generative modeling - Difference between Gen AI and Discriminative Modeling – Importance of generative models in AI and Machine Learning – Types of Generative models – GANs, VAEs, autoregressive models and Vector quantized Diffusion models - Understanding if probabilistic modeling and generative process - Challenges of Generative Modeling – Future of Gen AI – Ethical Aspects of AI – Responsible AI – Use Cases.

Experiential Learning (Activity Based Learning): Create a simple text or image generator using a pre-trained GAN or VAE.

Industrial Application : Study how ChatGPT or DALL·E generates content for chatbots and creative tools.

Content Beyond Syllabus : Advanced Probabilistic & Ethical GenAI

UNIT – 2 GENERATIVE MODELS FOR TEXT — **9**

Language Models Basics – Building blocks of Language models - Transformer Architecture – Encoder and Decoder – Attention mechanisms - Generation of Text – Models like BERT and GPT models – Generation of Text - Autoencoding – Regression Models – Exploring ChatGPT – Prompt Engineering – Designing Prompts– Revising Prompts using Reinforcement Learning from Human Feedback (RLHF) - Retrieval Augmented Generation – Multimodal LLM – Issues of LLM like hallucination.

Experiential Learning (Activity Based Learning): Experiment with ChatGPT by designing and refining prompts to generate relevant responses.

Industrial Application : Study how GPT models are used in customer support, content creation, and virtual assistants.

Content Beyond Syllabus : Multimodal & RLHF-Enhanced LLMs

UNIT – 3 GENERATION OF IMAGES — **9**

Introduction to Generative Adversarial Networks – Adversarial Training Process – Nash Equilibrium – Variational Autoencoders – Encoder-Decoder Architectures - Stable Diffusion Models – Introduction to Transformer-based Image Generation – CLIP – Visual Transformers ViT- Dall-E2 and Dall-E3, GPT4V – Issues of Image Generation models like Mode Collapse and Stability.

Experiential Learning (Activity Based Learning): Train a simple GAN or VAE on a small image dataset to observe generated outputs.

Industrial Application : Explore how DALL·E or Stable Diffusion generates images for creative and commercial applications

Content Beyond Syllabus :Transformer & Diffusion-Based Image Generation

UNIT – 4 GENERATION OF PAINTING, MUSIC, AND PLAY — **9**

Variants of GAN – Types of GAN - Cyclic GAN – Using Cyclic GAN to Generate Paintings – Neural Style Transfer – Style Transfer - Music Generating RNN – MuseGAN – Autonomous agents – Deep Q Algorithm – Actor-critic Network.

Experiential Learning (Activity Based Learning): Apply CycleGAN or Neural Style Transfer to generate artistic images.
Industrial Application : Study MuseGAN for AI-generated music and creative content tools.
Content Beyond Syllabus : Creative GANs & Autonomous Agent Models

UNIT – 5 OPEN SOURCE MODELS AND PROGRAMMING FRAMEWORKS	**9**

Training and Fine tuning of Generative models – GPT4All - Transfer learning and Pretrained models - Training vision models – Microsoft Copilot - Programming LLM – LangChain – Open Source Models – Llama - Programming for TimeSformer – Deployment – Hugging Face.
Experiential Learning (Activity Based Learning): Fine-tune a pre-trained GPT or vision model on a small custom dataset using Hugging Face.
Industrial Application : Explore how Google Copilot or LangChain enhances coding and productivity with LLMs.
Content Beyond Syllabus :Overview of CLAUDE AI.

TOTAL PERIODS	**:45**

COURSE OUTCOMES

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

CO 1	Understand the concepts of Generative Modeling.
CO 2	Apply Gen AI to Generating Texts.
CO 3	Understand and Apply Gen AI for generating video.
CO 4	Understand and Apply Gen AI for generating video.
CO 5	Apply Open Source Tools for solving problems using Gen AI.

TEXTBOOKS

1.	Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition , Packt Books, 2024

REFERENCES

1.	David Foster, ”Generative Deep Learning”, O’Reily Books, 2024.
2.	Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO 4	3	3	3	1	2	2	-	1	2	-	-	3	3	3
CO 5	3	3	3	1	2	2	-	1	2	-	-	3	3	3
AVG	3	3	3	1	2	2	-	1	2	-	-	3	3	3

Product based Projects (Team)

1.	Intelligent Content Generation System Using GPT and Prompt Engineering
2.	Multimodal AI Assistant for Text and Image Generation
3.	Fake Content Detection and Ethical Analysis of Generative AI
4.	AI-Based Image Generation Platform Using GANs and Diffusion Models
5.	Artistic Painting Generator Using CycleGAN and Neural Style Transfer
6.	Music Composition System Using Generative Neural Networks
7.	Autonomous Game-Playing Agent Using Deep Reinforcement Learning
8.	Retrieval-Augmented Chatbot for Academic and Industrial Knowledge
9.	Code Generation and Debugging Assistant Using Programming LLMs
10.	End-to-End Generative AI Deployment Using Open-Source Models

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24ADP14	EXPLAINABLE AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Apply foundational concepts of Explainable AI (XAI) to promote model transparency.
2	Analyze the decision-making patterns of various machine learning models.
3	Apply model-agnostic XAI techniques to generate explanations across diverse models.
4	Analyze deep learning models using suitable XAI methods.
5	Evaluate XAI methods to address ethical and responsible AI considerations.

UNIT – 1 INTRODUCTION TO XAI — **9**

Introduction to Explainable AI: Motivation, Importance - Challenges and limitations of black box models - Types of Explainability – taxonomy of explanations - Interpretability – Importance of Interpretability - Taxonomy of Interpretability Methods - Scope of Interpretability - Evaluation of Interpretability - Properties of Explanations - Human-friendly Explanations

Industrial Application: Explainability in AI-driven Loan Approval and Credit Scoring Systems

Experiential Learning: Build an Explainable Classifier and Interpret Its Decisions

Content Beyond the Syllabus: Causal Inference and Counterfactual Explanations in XAI

UNIT – 2 INTERPRETABLE MACHINE LEARNING MODELS — **9**

Overview of Interpretable Machine Learning – Decision Trees, Random Forests – principles, interpretation techniques, Rule based Models – Rule induction, Decision list, rule-based classifiers, Linear models – Interpreting Coefficients, regularization techniques, feature selection

Content Beyond the Syllabus: Generalized Additive Models (GAMs) and Explainable Boosting Machines (EBMs)

Industrial Application: Interpretable Models in Healthcare Diagnosis Systems

Experiential Learning: Build and Interpret a Rule-Based and Linear Model on a Real Dataset

UNIT – 3 MODEL AGNOSTIC XAI TECHNIQUES — **9**

Overview of model Agnostic systems – LIME – local feature importance explanations – SHAP – individual predictions and feature importance – Partial Dependence Plot – Individual Conditional Expectation Plot - Counterfactual explanations.

Content Beyond the Syllabus: Causal Explanations and Contrastive Reasoning in XAI

Industrial Application: Explainability in Loan and Credit Scoring Systems

Experiential Learning: Black-Box Models on Real-World Data

UNIT – 4 XAI FOR DEEP LEARNING — **9**

XAI for deep learning models - Gradient-based methods: Grad-CAM, Integrated gradients, Saliency Maps – Layer wise relevance propagation (LRP)– feature visualization- Deep Dream – Activation Maximization

Content Beyond the Syllabus: XAI in Transformer-based Deep Learning Models

Industrial Application: Explainable AI in Medical Imaging and Diagnostics

Experiential Learning: Visualizing CNN Decision-Making Using Grad-CAM and Saliency Maps

UNIT – 5 EVALUATION AND ETHICAL CONSIDERATIONS — **9**

Evaluating XAI Methods - Metrics and criteria for evaluating explanation - Human-in-the-loop evaluation - User studies and feedback - Ethical Considerations in XAI - Bias, fairness, and transparency - Privacy and security concerns - Social and legal aspects of XAI – Applications

Content Beyond the Syllabus: Auditable AI and Regulatory Frameworks for Explainability

Industrial Application: Auditing AI Systems in Hiring and Recruitment Platforms

Experiential Learning: Designing and Evaluating XAI in a Human-Centered Loop

TOTAL PERIODS : 45

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO 1	Explain interpretable machine learning principles of decision tree, rule based and linear models.
CO 2	Apply Model Agnostic XAI techniques, interpret and explain predictions of machine learning models
CO 3	Develop XAI techniques for deep learning models.
CO 4	Evaluate XAI methods and Propose innovative solutions to address ethical considerations
CO 5	Apply XAI techniques in practical scenarios, for real-world datasets and problems.

TEXTBOOKS

1.	Christoph Molnar, "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable", 2022. (This is a comprehensive book available as a free online resource: https://christophm.github.io/interpretable-ml-book/)", Springer, 2019.
2.	Uday Kamath, John Liu, "Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning", 2021.
3.	Leonida Gianfagna, Antonio Di Cecco, Explainable AI with Python, Springer, 2021.

REFERENCES

1.	Denis Rothman, "Hands-On Explainable AI (XAI) with Python: Interpret, Visualize, Explain, and Integrate Reliable AI for Fair, Secure, and Trustworthy AI Apps", Packt Publishing Ltd, 2020.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	1	1	2	1	2		1		2	2	2	2
CO 2	3	3	2	2	3	1	2	1	2	1	2	3	3	2
CO 3	3	3	3	2	3	1	2	1	1	1	3	3	2	2
CO 4	2	3	2	3	2	2	3	1	2	1	3	2	2	3
CO 5	3	3	3	2	3	2	2	2	2	2	3	3	3	3
AVG	**2.8**	**2.8**	**2.2**	**2**	**2.6**	**1.4**	**2.2**	**1.2**	**1.6**	**1.2**	**2.6**	**2.6**	**2.4**	**2.4**

Product based Projects (Team)

1.	Interpreting Black-Box Models Using LIME for Real-World Datasets
2.	SHAP-Based Feature Importance Analysis for Healthcare or Finance Data
3.	Comparing Explainability Techniques: LIME vs. SHAP vs. PDP
4.	Building an Interpretable Spam Detection System Using Rule-Based Models
5.	Explainable Decision Trees and Random Forests for Student Performance Prediction
6.	Developing Counterfactual Explanations for Loan Approval Decisions

7.	Interpreting Deep Learning Models Using Grad-CAM for Image Classification
8.	Human-Friendly Explanations for ML Models Using Natural Language Summaries
9.	Evaluating the Quality of Explanations: A Human-in-the-Loop XAI Study
10	Bias and Fairness Analysis with Explainable AI Techniques

VERTICAL 2: AI IN INDUSTRY								
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP21	Reinforcement Learning	PEC	60	2	0	2	3
2	U24ADP22	AI For Industrial Applications	PEC	45	3	0	0	3
3	U24ADP23	AI In IoT	PEC	60	2	0	2	3
4	U24ADP24	AI For Robotics	PEC	45	3	0	0	3
5	U24ADP25	Autonomous Vehicles	PEC	45	3	0	0	3
6	U24ADP26	Responsible AI	PEC	60	2	0	2	3

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U24ADP21	REINFORCEMENT LEARNING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	Introduce a range of topics related to Reinforcement Learning and probability concepts
2	Gain knowledge on the Markov Decision Process
3	Understand the Q-Learning and SARSA methods
4	To know about the Deep Learning in Reinforcement Learning
5	Gain knowledge on Policy Gradient Methods.

UNIT – 1 FUNDAMENTALS OF REINFORCEMENT LEARNING **6+6**

Introduction to Reinforcement Learning and motivation - Elements of RL: Agent, Environment, State, Action, Reward - Agent–Environment interaction loop - Exploration vs Exploitation - Challenges and limitations of RL - Introduction to Multi-Armed Bandit problem

Practical:

1. Installation of Code Standards and Libraries used in RL (Python/Keras/Tensorflow).
2. Implement Tic-tac-toe and Armed Bandit Problem.

Content Beyond the Syllabus: Introduction to real-world reinforcement learning environments such as OpenAI Gym and simulation-based learning systems.

Industrial Application: Game playing agents, recommendation systems, and adaptive control systems.

Experiential Learning: Students design a simple RL environment and observe agent behaviour using reward feedback

UNIT – 2 MARKOV DECISION PROCESSES **6+6**

Markov Process and Markov Chain - Markov Decision Process (MDP) formulation - Policies and value functions - Bellman expectation equations - Optimal value function and optimal policy - Introduction to Dynamic Programming in RL

Practical:

3. Modeling a Problem using Markov Decision Process
4. Bellman Equation and Optimal Policy Computation

Content Beyond the Syllabus: Discussion on partially observable MDPs (POMDPs) and real-world decision-making under uncertainty.

Industrial Application: Robot navigation, inventory management, and automated decision-making systems

Experiential Learning: Students model a real-life problem (traffic signal or navigation task) as an MDP.

UNIT – 3 DYNAMIC PROGRAMMING AND TEMPORAL DIFFERENCE LEARNING **6+6**

Policy Evaluation using Dynamic Programming - Policy Improvement and Policy Iteration - Value Iteration - Temporal Difference learning concepts - SARSA (On-policy TD learning) - Q-Learning (Off-policy TD learning)

Practical:

5. Policy Iteration and Value Iteration
6. SARSA and Q-Learning Algorithms

Content Beyond the Syllabus: Comparison of model-based and model-free reinforcement learning approaches.

Industrial Application: Optimal resource allocation, scheduling problems, and adaptive pricing strategies.
Experiential Learning: Hands-on implementation and comparison of SARSA and Q-learning algorithms

UNIT – 4 VALUE FUNCTION APPROXIMATION AND DEEP Q-LEARNING	**6+6**

Curse of dimensionality and need for approximation - Linear value function approximation - Gradient descent in RL - Neural networks for value approximation - Deep Q-Network (DQN) architecture - Experience Replay and Target Networks.

Practical:

7. Linear Value Function Approximation
8. Deep Q-Network Implementation

Content Beyond the Syllabus: Introduction to deep reinforcement learning frameworks and scalable learning architectures.
Industrial Application: Autonomous driving systems, robotics, and real-time decision engines.
Experiential Learning: Students implement a simple Deep Q-Network and analyse learning performance.

UNIT – 5 POLICY-BASED AND ADVANCED REINFORCEMENT LEARNING	**6+6**

Policy-based vs value-based methods - Policy Gradient methods - REINFORCE algorithm - Baseline and variance reduction - Actor–Critic methods - Overview of PPO and AlphaZero

Practical:

9. Policy Gradient using REINFORCE Algorithm
10. Actor–Critic Method and Case Study

Content Beyond the Syllabus: Overview of recent advancements such as multi-agent reinforcement learning and real-world RL challenges.
Industrial Application: Industrial robotics, automated trading systems, and intelligent game agents.
Experiential Learning: Mini-project applying a policy-based reinforcement learning method to a practical problem.

TOTAL PERIODS	**: 60**

COURSE OUTCOMES:

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

CO 1	Implement basic reinforcement learning environments.
CO 2	Model problems using Markov Decision Processes.
CO 3	Apply Dynamic Programming and Temporal Difference learning.
CO 4	Implement function approximation and deep reinforcement learning.
CO 5	Analyze advanced policy-based reinforcement learning techniques.

TEXTBOOKS

1.	Richard S.Sutton and Andrew G.Barto, Reinforcement learning: An introduction, Second Edition, MIT Press, 2019.
2.	Michael Hu, The Art of Reinforcement Learning – Fundamentals, Mathematics and Implementations with Python, Apress, 2024**.**

REFERENCES

1.	Sudharsan Ravichandiran, Deep Reinforcement Learning with Python, Second Edition, Packet Publishing, Birmingham, 2020.
2.	Csaba Szepesvari, Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence & Machine Learning), Morgan & Claypool Publishers, 2010.
3.	Laura Graesser and Wah Loon Keng, Foundations of Deep Reinforcement learning: theory and Practice in Python, Pearson India, New Delhi, 2022.

CO/PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO 1	3	2	-	-	2	-	-	-	-	-	1	3	2	1
CO 2	3	3	-	2	2	-	-	-	-	-	1	3	3	1
CO 3	3	3	2	2	3	-	-	-	-	-	1	3	3	1
CO 4	3	2	2	2	3	-	-	-	-	-	1	3	3	2
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AVG	**2.8**	**2.6**	**2.0**	**2.2**	**2.4**	**1.0**	**2.0**	**-**	**1.0**	**-**	**1.2**	**3**	**2.6**	**1.6**

Product based Projects (Team)

1	Intelligent Decision-Making Systems using Reinforcement Learning
2	Autonomous Agent Design using Deep Reinforcement Learning
3	RL-Based Resource Allocation and Scheduling Systems
4	Game-Playing Agents using Reinforcement Learning Techniques
5	Optimization of Control Systems using Reinforcement Learning
6	Recommendation Systems using Reinforcement Learning Approaches
7	RL-Based Traffic Signal Control and Smart Mobility Systems
8	Robotics Navigation and Control using Reinforcement Learning
9	Ethical and Safe Reinforcement Learning Systems
10	Real-Time Adaptive Systems using Reinforcement Learning

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U24ADP21	AI FOR INDUSTRIAL APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To apply Industrial AI in various Applications.
2	To Understand and Analyse the Digital Twin Technology in Industry 4.0
3	To Identify the role of AI in decision-making, software systems, and software engineering processes.
4	To Study distributed computing, cloud computing in information security
5	To Examine AI applications across various industries

UNIT - 1 INDUSTRIAL AI — **9**

Industrial AI- Industrial AI in action- Applying industrial AI- The IMS architecture for industrial – AI Visible and Invisible issues- Building the future with AI- Killer Applications of Industrial AI.

Content Beyound Syllabus : Syllabus Automatic design and optimization of components.

Industrial Application: AI to optimize resource usage and reduce waste

Experiential Learning (Activity Based Learning): Build a predictive maintenance model using vibration data

UNIT – 2 DATA ANALYTICS IN INDUSTRY 4.0 — **9**

Digital Twins(DT)-History of DT- Classifications- Level of integration- Characteristics- Modelling digital twins- Smart manufacturing and Applications-Uses of Digital Twin Technology- Digital twins maintenance -predictive maintenance- Planning the digital twin- Digital twin during operation phase- Hybrid analysis and Fleet data- Digital implementation- Digital twin impacts on industry 4.0.

Content Beyound Syllabus : Study of Federated Digital Twins

Industrial Application : AI-driven ecosystems

Experiential Learning (Activity Based Learning): Basic visualization of CAD models.

UNIT – 3 AI AND SOFTWARE ENGINEERING — **9**

Fundamentals in AI – Decision Making-Decision Support Systems- Business Intelligence-Database and Knowledge Base in Decision Support Systems- Inference Mechanisms in AIKnowledge Interpretation- Data, Information Knowledge and Wisdom- AI and Software Engineering-Systems thinking and Systems Engineering- Software Engineering – OverviewSystem Software- Evolution-Paradigm- Architecture Models- Software Systems and Software Engineering Processes, Component based software engineering

Content Beyound Syllabus: Cognitive AI

Industrial Application : AI-based scheduling systems in airlines

Experiential Learning (Activity Based Learning): Build a small AI agent in Python that learns from sensor data to control a simulated environment

UNIT – 4 DATA STORAGE AND COMPUTING MODELS — **9**

Distributed Computing-Cloud Computing-Fog and Edge Computing-Data Storage and Information Management-Data Fusion and Integration-Data Quality -Communication -Cognitive Computing-
Distributed Ledger-Information Security-Cybersecurity -Block chain Security.

Content Beyound Syllabus : fuzzy logic, modal logic

Industrial Application: Education and E-Learning

Experiential Learning (Activity Based Learning): Apply propositional model checking algorithm in Medical Diagnosis Systems

UNIT – 5 CASE STUDIES — **9**

AI factory for Railway- AI Factory-Mining-Augmented Reality and Virtual Reality-Cybersecurity-
AI Transformation Roadmap-AI in Healthcare-Education, Banking-Retail and E-commerce-
Gaming and Entertainment-Chatbots
Content Beyound Syllabus: AI-driven fusion for IoT sensor networks
Industrial Application: Azure Cloud for drug discovery simulations.
Experiential Learning (Activity Based Learning):Design a smart home IoT system where sensors send data to a Raspberry Pi

	TOTAL PERIODS : 45

COURSE OUTCOMES:

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

CO 1	Understand the concepts, principles, and applications of industrial AI in various domains and To analyze and apply digital twin technology for smart manufacturing and other industryspecific applications.
CO 2	Analyze and discuss the impacts and challenges of AI in industry 4.0 and other specific domains.
CO 3	To exploit AI algorithms and methodologies in software engineering projects
CO 4	Design and implement various computing models, data storage and management systems and their implications for distributed systems.
CO 5	To evaluate and analyze real-world case studies to understand the practical implementation of AI in different industries.

TEXTBOOKS

1.	AI Factory Theories, Applications and case Studies, Ramin Karim, Diego Galar and Uday Kumar, CRC Press, 2023
2.	Artificial Intelligence and Industry 4.0, Ella Hassanien, Jyotir Moy Chatterjee and Vishal Jain, Academic press, 2022, Taylor and Francis, CRC Press.
3.	Artificial Intelligence in Industrial Applications, Stevan Lawrence Fernandes Tarun K.Sharma,Springer, 2022.

REFERENCES

1.	Artificial Intelligence and the Fourth Industrial Revolution, Utpal Chakraborty, Amit banerjee, Jayanta Kumar Saha, Niloy Sarkar, Chinmay Chakraborty, 2022.
2.	http://nptel.ac.in/

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	2	3	2	1	2	2	2	1	3	2	3
CO 2	3	2	3	3	3	2	1	2	2	2	2	2	3	2
CO 3	3	3	2	3	2	2	2	2	2	2	2	3	2	3
CO 4	3	3	3	3	3	2	2	2	3	2	2	3	3	2
CO 5	3	3	3	3	3	2	2	2	3	2	2	2	3	2
AVG	2.8	2.6	2.6	2.8	2.8	2	1.6	2	2.4	2	1.8	2.6	2.6	2.4

Product based Projects (Team)

1	Human-in-the-Loop Decision Support System for Smart Manufacturing
2	Cognitive Workload Estimation Model for Control Room Operators
3	Cognitive Model-Based Intelligent Tutoring System
4	Memory Retention Prediction System for E-Learning Platforms
5	Eye-Tracking Based Attention Modeling for Web Interfaces
6	Gesture-Based Interaction System with Cognitive Feedback
7	UX Optimization using Cognitive Load Theory

8	Emotion-Aware UX Design using Cognitive Signals
9	Human-AI Trust Modeling System
10	User Behavior Modeling through Cognitive Experiments

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U24ADP22	AI IN IOT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	Understand IoT fundamentals and their integration with AI
2	Apply machine learning techniques to IoT data, focusing on classification, feature scaling, and model optimization.
3	Utilize genetic algorithms and reinforcement learning to solve IoT problems and optimize models
4	Implement generative models and explore their applications in IoT scenarios
5	Analyze and apply AI techniques for industrial IoT and smart city applications

UNIT - 1 PRINCIPLES AND FOUNDATIONS OF IOT AND AI — **6+6**

loT reference model-loT platforms-loT verticals-Big data and lot-Infusion of Al- data science in IoT-Cross-industry standard process for data mining Al platforms and loT platforms and Tools-TensorFlow, Keras, Datasets.

Practical:

1.Implement IoT data flow using a standard IoT architecture.

Content Beyound Syllabus : Digital Twins – Creating virtual models of industrial systems using real-time IoT data.

Industrial Application: Smart Agriculture- Drones and soil sensors optimizing irrigation and crop yields.

Experiential Learning (Activity Based Learning): Smart Manufacturing (Industry 4.0) – Sensors and cloud platforms monitor machinery, predict failures

UNIT – 2 ML FOR IoT — **6+6**

Cross-entropy loss Function-Classifying wine using logistic Regression-Classification using support vector Machines - Maximum Margin Hyperplane-Kernel trick-Classifying wine using SVM- Naive Bayes-Gaussian Naive Bayes for wine Quality-Decision Trees-Decision trees in scikit-Decision trees in action

Practical:

2.Build SVM classifier for IoT data.

Content Beyound Syllabus : Bayesian Optimization – More efficient than grid search for hyperparameter tuning.

Industrial Application: Fine-tuning industrial ML models for energy, telecom, or predictive maintenance solutions.

Experiential Learning (Activity Based Learning): Using logistic regression or Naive Bayes to predict purchase intent in real-time.

UNIT – 3 GENETIC ALGORITHMS AND REINFORCEMENT LEARNING FOR IoT — **6+6**

Deterministic and analytic Methods-Gradient descent method Newton-Raphson method-Natural optimization methods Simulated annealing-Coding genetic algorithms using Distributed Evolutionary Algorithms in Python-Genetic algorithm for CNN architecture--Genetic algorithm for LSTM optimization.

Practical:

3. Implement GD/Natural Optimization for IoT cost function.

Content Beyound Syllabus: Metaheuristics Comparison – Studies comparing GAs, Particle Swarm, and others.

Industrial Application: Minimizing cost functions in quality control using Gradient Descent

Experiential Learning (Activity Based Learning): Deep RL systems control traffic signals dynamically to reduce congestion.

UNIT – 4 GENERATIVE MODELS FOR IOT and HOME IoT	6+6

GANS - Implementing a vanilla GAN in TensorFlow Deep Convolutional GANS-Applications of GANS-Distributed AI-Apache MLlib-Regression in MLlib-Personal loT-Classification in MLlib.

Practical:

4. Create and train a basic GAN.

Content Beyound Syllabus : AutoML with MLlib – Automated pipeline creation in distributed environments.

Industrial Application: Synthetic medical image generation (e.g., MRI, CT scans) for data augmentation

Experiential Learning (Activity Based Learning): Smartwatches detecting arrhythmia and alerting emergency contacts.

UNIT – 5 AI FOR INDUSTRIAL IoT AND SMART CITIES	6+6

Predictive maintenance using Al-Predictive maintenance using Long Short-Term Memory

Predictive maintenance-advantages and disadvantages-Electrical load forecasting in industry-

STLF using LSTM-Components of a smart city-Smart traffic management

Practical:

5. Predict machine failure/exhaust temperature using time-series.
6. Predict short-term load for smart grids.

Content Beyound Syllabus: Transfer Learning in Load Forecasting – Applying pretrained models to new cities or grids.

Industrial Application: Energy-efficient HVAC and lighting systems using load predictions.

Experiential Learning (Activity Based Learning): AI-powered signals adjusting in real-time to reduce congestion.

TOTAL PERIODS	**: 60**

COURSE OUTCOMES:

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

CO 1	Explain IoT fundamentals, architecture, platforms, datasets and AI integration.
CO 2	Apply machine learning models (LR, SVM, NB, DT, Ensemble) for IoT data.
CO 3	Apply optimization, Genetic Algorithms and Reinforcement Learning to IoT systems.
CO 4	Implement and analyze generative models (GANs, DCGANs) and personal IoT analytics.
CO 5	Apply AI techniques for Industrial IoT and Smart City applications (LSTM, STLF, predictive maintenance).

TEXTBOOKS

1.	Kurniawan, Agus. IoT Projects with NVIDIA Jetson Nano. Apress Berkeley, CA (2021).
2.	Perry Lea, “Internet of Things for Architects”, PACKT, 2018 5. Andy King, “Programming the Internet of Things: An Introduction to Building Integrated, Device to Cloud IoT solutions”,O’REILLY’, 2021.
3.	NPTEL course on “Introduction to Internet of things” by Dr. Sudip Misra IIT Kharagpur

REFERENCES

1.	Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012

2.	Hands-On Artificial Intelligence for IoT, Packt Publishing Ltd, Birmingham, UK. Amita Kapoor, 2019
3.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry,—IoT,Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco, Press, 2017

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO 5	3	3	3	2	3	2	1	1	1	2	3	3	3	2
AVG	2.8	2.6	2	1.6	3	1	0.4	0.2	1	0.4	2.2	2.8	2.4	1.4

Product based Projects (Team)

1	Environmental Quality Forecasting.
2	Smart City Analytics Using Data Science Techniques.
3	Short-Term Electrical Load Forecasting for Smart Grids
4	Smartwatch-Based Real-Time Arrhythmia Detection
5	AI-Powered Smart Parking System
6	IoT-Driven Smart Irrigation System Enhanced
7	Deep RL–Powered Drone Navigation System for Smart Agriculture Monitoring
8	Smart Parking Occupancy Prediction
9	IoT Cyber-Physical Security System
10	IoT-Based Home Automation System

U24ADP23	AI FOR ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Learn the history, basic concepts, and classifications of robotic systems
2	Study different types of grippers and sensors used in robotics, their design considerations, and their role in robot functionality and control.
3	Understand the various drive systems, transmission methods, actuators, and control systems used in robotics
4	Learn Robot Programming Languages
5	Explore various applications of robotics along with current trends and safety considerations.

UNIT – 1 INTRODUCTION TO ROBOTICS **9**

Brief History, Basic Concepts of Robotics such as Definition, Three laws, Elements of Robotic Systems -Robot anatomy, DOF, Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, Associated parameters - resolution, accuracy, repeatability, dexterity, compliance, RCC device, Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Scope and applications of robot.

Content Beyond the Syllabus: Emerging humanoid robots and AI-driven automation integration.

Industrial Application: Automated assembly and precision manufacturing in automotive industries. Experiential Learning: Build simple robotic arm using programmable microcontroller and sensors.

UNIT – 2 GRIPPERS AND SENSORS FOR ROBOTICS **9**

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

Content Beyond the Syllabus: Smart tactile sensors and adaptive soft robotic grippers design.

Industrial Application: Robotic pick-and-place systems in electronics and packaging industries. Experiential Learning: Design and test a robotic gripper with force sensors.

UNIT – 3 DRIVES AND CONTROL FOR ROBOTICS **9**

Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control.

Content Beyond the Syllabus: Integration of AI-based motion planning and adaptive control systems.

Industrial Application Servo drive systems used in CNC machines and industrial robots

Experiential Learning: Simulate robot actuator control using MATLAB or Python environment.

UNIT – 4 PROGRAMMING LANGUAGES FOR ROBOTICS	9
Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS. Content Beyond the Syllabus: Advanced robot programming using ROS and real-time simulation tools. Industrial Application: Robotic arm programming for welding and automated inspection processes. Experiential Learning: Write and execute robot movement programs using ROS and Python.	
UNIT – 5 APPLICATIONS AND TRENDS IN ROBOTICS	**9**
Multiple robots and its coordination, Mobile and distributed robots, Automated guided vehicles, Robot assisted surgery, Robots in games. Robots in space research applications. Industrial robots in manufacturing applications, Hazardous and mission critical applications, Safety in robotics, Transformer robots. Content Beyond the Syllabus: Exploration of collaborative and autonomous mobile robots in industries. Industrial Application Use of surgical robots and space exploration robotic systems. Experiential Learning: Demonstrate multi-robot coordination through simulation or physical prototypes.	
TOTAL PERIODS	**: 45**

COURSE OUTCOMES:

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

CO 1	Understand various grippers and sensors for robotics.
CO 2	Apply logic for selection of robotic sub systems and systems
CO 3	Analyze basics of principles of robot system integration.
CO 4	Integrate knowledge of AI techniques in the area of robotic technology.
CO 5	Identify the challenges and key issues in the design of robots

TEXTBOOKS

1.	S. B. Niku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, John Wiley & Sons Ltd., (2020)
2.	Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006).
3.	Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019)

REFERENCES

1.	R. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi (2003)
2.	S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
3.	J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997).

4.	R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin, Robotic Engineering – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc. (2009

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2	1	1	1	2	1	2	2	2	1
CO 2	2	3	2	3	2	3	2	1	2	2	3	2	2	3
CO 3	3	2	3	2	3	1	1	2	2	2	2	3	3	2
CO 4	3	2	3	3	3	1	1	2	2	3	2	3	2	1
CO 5	2	3	2	3	2	2	3	2	3	3	3	3	2	3
AVG	2.6	2.4	2.4	2.6	2.4	1.6	1.6	1.6	2.2	2.2	2.4	2.6	2.2	2

Product based Projects (Team)

1	Intelligent Robotic Arm Using Vision-Based Object Detection
2	AI-Enabled Adaptive Robotic Gripper with Force Control
3	Autonomous Mobile Robot Navigation Using Reinforcement Learning
4	ROS-Based Multi-Robot Coordination System
5	Smart Obstacle Avoidance Robot Using Deep Learning
6	Voice-Controlled Service Robot Using AI Speech Processing
7	Warehouse Sorting Robot Using AI-Based Path Planning
8	Robotic Manipulator Control Using PID and Neural Networks
9	Human–Robot Interaction System Using Gesture Recognition
10	AI-Driven Fault Detection in Robotic Actuators

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24ADP25	AUTONOMOUS VEHICLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To understand the fundamental concepts and key technologies behind autonomous driving systems.
2	To understand the principles of control, sensing, and estimation in autonomous systems.
3	To understand map databases, path planning techniques, and vehicle communication technologies for practical autonomous vehicle applications
4	To learn about the use of deep learning in autonomous driving for perception, prediction, routing and reinforcement learning-based control.
5	To explore AI algorithms, data management, cognitive decision-making, and the impact of autonomous vehicle technologies on industry and society

UNIT 1: INTRODUCTION TO AUTONOMOUS GROUND VEHICLES — **9**

Introduction to Autonomous Driving-Autonomous Driving Algorithms-Autonomous Driving Client System-Autonomous Driving Cloud Platform-Autonomous Vehicle Localization-Localization with GNSS-Localization with LiDAR and High-Definition Maps-Visual Odometry-Dead Reckoning and Wheel Odometry-Sensor Fusion

Content Beyond Syllabus : Digital Twin Technology for Autonomous Driving Systems

Industrial Application : Autonomous Vehicle Navigation and Control in Smart Logistics Fleets

Experiential Learning (Activity Based Learning): Building and Testing a Mini Autonomous Vehicle Prototype

UNIT 2: CONTROL IN AUTONOMOUS SYSTEMS — **9**

Role of Control in Autonomous Systems-Feedback, Autonomous Control-System Architecture and Hybrid System Modeling-System Architecture-Hybrid System Formulation-State Machines for Different Challenge Events-Sensors and Estimation-Vehicle Internal State Sensing-External World Sensing-Estimation-Situational Awareness

Content Beyond Syllabus : Digital Twin–Based Predictive Control for Autonomous Vehicles

Industrial Application : Advanced Driver Assistance Systems (ADAS) for Autonomous Vehicles

Experiential Learning (Activity Based Learning): Designing and Testing an Autonomous Vehicle Control and Sensing System

UNIT 3: PATH PLANNING AND APPLICATIONS — **9**

Maps and Path Planning-Map Databases--Raster Vector and Utilizing Map Data-Path Planning
Vehicle to Vehicle and Vehicle to Infrastructure Communication-V2V Communications-V2I Communications-Communication Technologies-802.11p / WAVE DSRC Architecture-Applications in AutonomousVehicles-Examples of Autonomy-Cruise Control-Antilock-Brake Systems-Steering Control and Lane FollowingParking

Content Beyond Syllabus : Cooperative Autonomous Driving with Edge Computing and V2X Networks

Industrial Application : Autonomous Valet Parking System

Experiential Learning (Activity Based Learning): Path Planning and Autonomous Parking using Vehicle Communication and Control Systems

UNIT 4: DEEP LEARNING IN AUTONOMOUS DRIVING — **9**

Deep Learning in Autonomous Driving Perception -Convolutional Neural Networks-Semantic Segmentation-Prediction and Routing-Planning and Control-Traffic Prediction-Lane Level Routing
Decision-Planning and Control-Behavioral Decisions-Motion Planning-Feedback Control- BicycleModel-PID Control-Reinforcement Learning-Based Planning and Control-Reinforcement Learning-Learning-Based Planning and Control in Autonomous Driving

Content Beyond Syllabus : End-to-End Deep Reinforcement Learning for Autonomous Driving in Simulated Environments

Industrial Application : Tesla Autopilot Deep Learning–Based Autonomous Driving System

Experiential Learning (Activity Based Learning): Autonomous Driving Simulation with Deep Learning and Reinforcement Learning	
UNIT 5: AI AND SOFTWARE ENABLERS FOR AGV	**9**
Human-like reasoning-Hybrid configurable AI algorithms -Data management environment for analyzing AI Algorithms- Dynamic Selection- Dynamic Integration- Cognitive decision making for Autonomous Driving- Autonomous Support- Automation and Autonomy- Advantages of AV Technologies-Adoptions scenarios for AVs- Industry 4.0 AVs -Major Pillars in the evolution of AVs- Spillovers and Impact of AVs Content Beyond Syllabus : Multi-Agent Reinforcement Learning for Cooperative Autonomous Driving in Smart Cities Industrial Application : Cognitive Decision-Making System for Autonomous Trucks in Industry 4.0 Logistics Experiential Learning (Activity Based Learning): Cognitive Decision-Making Simulation for Autonomous Vehicles	
TOTAL PERIODS	**: 45**

COURSE OUTCOMES:

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

CO 1	To identify the fundamental concepts and algorithms used in autonomous ground vehicles.
CO 2	To Comprehend and explain the principles of deep learning in autonomous driving
CO 3	To apply AI and software enablers in the context of autonomous ground vehicles and analyze the impact of autonomous vehicles in industry.
CO 4	To evaluate the challenges and considerations related to control in autonomous systems
CO 5	To design and develop path planning algorithms and applications for autonomous vehicles and implement autonomy features

TEXTBOOKS

1.	Kurniawan, Agus. IoT Projects with NVIDIA Jetson Nano. Apress Berkeley, CA (2021).
2.	Perry Lea, “Internet of Things for Architects”, PACKT, 2018 5. Andy King, “Programming the Internet of Things: An Introduction to Building Integrated, Device to Cloud IoT solutions”,O’REILLY’, 2021.
3.	NPTEL course on “Introduction to Internet of things” by Dr. Sudip Misra IIT Kharagpur

REFERENCES

1.	Umit Ozguner, Tankut Acarman, Keith Redmill, “Autonomous Ground Vehicles”, Artech House, 2011
2.	George A. Berkey, Autonomous Robots: From Biological Inspiration to Implementation and Control (Intelligent Robotics and Autonomous Agents series) , MIT Press, 2005
3.	Hong Cheng, “Autonomous Intelligent Vehicles Theory, Algorithms, and Implementation”, Springer, 2011

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
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CO 3	3	3	2	2	3	3	2	2	2	2	1	2	2	3

CO 4	3	3	2	2	2	2	1	2	2	2	1	2	1	2
CO 5	3	3	3	2	3	2	2	2	2	2	2	2	1	3
AVG	3	2.6	1.8	2	2.8	1.8	1.4	1.8	1.8	2	1.2	1.8	1.4	2.4

Product based Projects (Team)	
1	Environmental Quality Forecasting.
2	Smart City Analytics Using Data Science Techniques.
3	Short-Term Electrical Load Forecasting for Smart Grids
4	Smartwatch-Based Real-Time Arrhythmia Detection
5	AI-Powered Smart Parking System
6	IoT-Driven Smart Irrigation System Enhanced
7	Deep RL–Powered Drone Navigation System for Smart Agriculture Monitoring
8	Smart Parking Occupancy Prediction
9	IoT Cyber-Physical Security System
10	IoT-Based Home Automation System

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24ADP26	RESPONSIBLE AI	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	To understand AI basics, misconceptions, responsible AI principles, and challenges in implementation
2	To understand and analyse biases in AI, fairness metrics, and mitigation techniques.
3	To understand explainability, challenges, methods, and evaluation for interpretable machine learning models
4	To understand AI safety, security, privacy, and resilience, including model and data protection
5	To explore ethical issues and implications of AI in various real-world applications

UNIT – 1 INTRODUCTION TO RESPONSIBLE AI **6+6**

Overview of AI – Common misconception of AI – Introduction to Responsible AI – Characteristics of Responsible AI – Key principles of responsible AI - Challenges in implementing responsible AI.

Practical:

1.Create a simple rule-based chatbot that responds to fixed user inputs.

2.Create an AI program that decides loan approval and clearly explains the reason.

Content Beyond the Syllabus: AI for social good, AI ethics boards, and international collaborations.

Industrial Application: AI diagnostics aligned with patient privacy and fairness

Experiential Learning: Explore methods like differential privacy or anonymization.

UNIT – 2 FAIRNESS AND BIAS **6+6**

Human Bias - Types of biases - Effects of biases on different demographics - Bias vs Fairness - Sources of Biases - Exploratory data analysis - Pre-processing techniques - In-processing techniques - Overview of fairness in AI

Practical:

1.Create a simple hiring decision system that unintentionally favors one group.

2.Analyze average scores across two groups to detect imbalance.

Content Beyond the Syllabus: Causal inference to understand and mitigate bias

Industrial Application: Bias-aware predictive policing tools

Experiential Learning: Analyze and interpret fairness implications

UNIT – 3 EXPLAINABILITY & INTERPRETABILITY **6+6**

Importance of Explainability and Interpretability – Challenges - Interpretability through simplification and visualization - Intrinsic interpretable methods - Post Hoc interpretability – Interpretability Evaluation methods.

Practical:

1.Create a basic decision system for loan approval using clear rules.

2.Create a model how visualize makes decisions using feature comparison.

Content Beyond the Syllabus: Risks of misleading or oversimplified explanations.

Industrial Application: Ensure AI-driven sentencing or parole decisions are transparent.

Experiential Learning: Train a black-box model (e.g., random forest).

UNIT – 4 SAFETY, SECURITY, AND PRIVACY **6+6**

Overview of safety – security – privacy - resilience - Taxonomy of AI safety and Security - Adversarial attacks and mitigation - Adopting an ML life cycle MLOps and ModelOps - Model drift - Data drift - Privacy-preserving AI techniques- Differential privacy.

Practical:

1.Demonstrate how adding noise protects sensitive data.

2.Model Drift and Data Drift Detection
Content Beyond the Syllabus: Overview of Geographical complaints to machine learning.
Industrial Application: Federated learning on edge devices to keep data local.
Experiential Learning: Generate adversarial examples on an image classifier.

UNIT – 5 CASE STUDIES	**6+6**

COMPAS Algorithm - Google Photos Tagging Controversy - ProPublica's Analysis of Recidivism Predictions - Amazon's AI Recruiting Tool - Facial Recognition Technology Misidentification.

Practical:

1.Bias in Risk Scoring (COMPAS & ProPublica Case).
2. Misidentification in Facial Recognition Systems.

Content Beyond the Syllabus: Investigate ethical challenges in facial recognition and image tagging.
Industrial Application: Risk assessment tools in criminal justice, parole decisions, and sentencing
Experiential Learning: Replicate ProPublica's analysis on a recidivism dataset

TOTAL PERIODS	**: 45**

COURSE OUTCOMES

At the end of the Course, Students will be able to

CO 1	State the aspects of Responsible AI, such as fairness, bias, privacy etc.
CO 2	Enforce fairness in models and mitigate bias in data.
CO 3	Understand the importance of explainability and interpretability in AI systems
CO 4	Implement strategies to manage safety, security and privacy in AI systems
CO 5	Evaluate the societal impact of AI applications.

TEXTBOOKS

1.	Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", 2019.
2.	Adnan Masood, Heather Dawe, "Responsible AI in the Enterprise", 2023.
3.	Beena Ammanath, "Trustworthy AI", O' Reilly, 2022.

REFERENCES

1.	I Almeida, "Responsible AI in the Age of Generative Models: Governance, Ethics and Risk Management", 2024.
2.	Silja Voeneky, Philipp Kellmeyer et. al, "The Cambridge Handbook of Responsible Artificial Intelligence", Cambridge University Press, 2022.

CO/PO, PSO Mapping
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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO 2	3	3	3	3	3	-	-	-	2	-	2	3	2	3
CO 3	3	3	3	2	3	-	-	-	2	-	2	3	2	3
CO 4	3	3	3	2	3	-	-	-	2	-	2	3	2	3
CO 5	2	2	2	2	3	-	-	-	2	-	2	2	2	2
AVG	**2.6**	**2.6**	**2.6**	**2.2**	**2.8**	**-**	**-**	**-**	**1.6**	**-**	**2**	**2.8**	**2.2**	**2.8**

Product based Projects (Team)

1	Bias Detection in Student Performance Prediction Models
2	Explainable Loan Approval System Using LIME and SHAP
3	A Fairness-Aware Hiring Recommendation Tool

4	Privacy-Preserving Image Classification Using Differential Privacy
5	Adversarial Attack Demo on a Handwritten Digit Classifier
6	Evaluating Fairness Metrics on a Public Dataset Using Fairlearn
7	Interpretable Medical Diagnosis Model Using Decision Trees
8	Federated Learning Prototype for Sentiment Analysis
9	Explainability vs Accuracy Tradeoff in ML Models
10	Responsible AI Case Study: Reproducing Bias in the COMPAS Dataset

VERTICAL 3: DATA TECHNOLOGIES								
S. No	COURSE CODE	COURSE TITLE	CATEGORY	TOTAL CONTACT PERIODS	L	T	P	C
1	U24ADP31	Business Analytics	PEC	60	2	0	2	3
2	U24ADP32	Predictive Analytics	PEC	60	2	0	2	3
3	U24CSP14	Text & Speech Analysis	PEC	60	2	0	2	3
4	U24ITP26	Health Care Analytics	PEC	45	3	0	0	3
5	U24ADP33	Optimization Techniques	PEC	45	3	0	0	3
6	U24ADP34	Social Network Analytics	PEC	45	3	0	0	3

Meenakshi Sundararajan Engineering College

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U24ADP31	BUSINESS ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	To Apply the analytics life cycle for solving business problems
2	To Understand and apply concepts of decision-making and knowledge management
3	To Apply various types of machine learning techniques.
4	To apply analytics in human resources and supply chain management for effective planning
5	To understand the analytical skills and to apply marketing and sales analytics for customer behaviour.

UNIT 1 INTRODUCTION TO BUSINESS ANALYTICS **6+6**

Analytics and Data Science- Analytics Life Cycle- Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

Practical:

I **Cycle – MS Excel**

1. Explore the features of Ms-Excel.
2. (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.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis

Content Beyound Syllabus : Geospatial Analytics: Using geographic data in analytics (used in logistics, urban planning)

Industrial Application : Retail: Analyzing customer purchase history (Descriptive), identifying churn reasons (Diagnostic), forecasting sales (Predictive), recommending inventory strategies (Prescriptive).

Experiential Learning (Activity Based Learning): Stakeholder Interview Role-Play: One student acts as a business manager, others as data scientists gathering requirements.

UNIT 2: BUSINESS INTELLIGENCE **6+6**

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

Practical:

4. Perform Z-test, T-test & ANOVA
5. Perform data pre-processing operations i) Handling Missing data ii) Normalization
6. Perform dimensionality reduction operation using PCA, KPCA & SVD

Content Beyound Syllabus : Social Knowledge Networks: Leveraging social collaboration tools and enterprise social networks to enhance knowledge sharing dynamically.

Industrial Application : Banking Sector - Loan Approval Process

Banks follow a decision-making process involving data collection, risk assessment, and decision criteria to approve or reject loan applications, balancing profitability and risk management.

Experiential Learning (Activity Based Learning):Decision Classification Case Study Present real-world business scenarios. Ask learners to classify decisions as strategic, tactical, or operational, and explain the rationale.	
UNIT 3: BUSINESS FORECASTING	**6+6**
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics. Practical 7. Perform bivariate and multivariate analysis on the dataset. 8. Apply and explore various plotting functions on the data set. 9. Explore the features of Power BI Desktop Content Beyound Syllabus : eep Learning for Predictive Analytics: Application of neural networks (CNNs, RNNs, Transformers) to capture complex patterns in large and unstructured datasets. Industrial Application : Healthcare - Patient Readmission Prediction Hospitals apply machine learning algorithms to patient records, treatment history, and socio-economic factors to predict the risk of patient readmission, helping to improve care quality and reduce costs. Experiential Learning (Activity Based Learning): Forecasting Sales Using Historical Data Provide learners with a time-series dataset (e.g., monthly sales data). Guide them to apply simple forecasting techniques like moving averages or exponential smoothing using Excel or Google Sheets. Then compare their forecasts with actual data.	
UNIT 4: HR & SUPPLY CHAIN ANALYTICS	**6+6**
Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year. Practical: 10. Prepare & Load data 11. Develop the data model 12. Perform DAX calculations Content Beyound Syllabus : Green Logistics & Carbon Footprint Analytics: Measuring and reducing environmental impact through route optimization and modal shifts. Experiential Learning (Activity Based Learning): Build a Predictive Model for Hourly Workforce Demand Learners are provided with past data on sales, customer footfall, seasonal trends, and employee schedules. They build a regression or time-series forecasting model (in Excel, Python, or Power BI) to predict how many hourly workers are needed per month over the next year. Industrial Application : E-commerce – Last-Mile Delivery Optimization Amazon or Flipkart analyze real-time location data and delivery patterns to optimize last-mile delivery routes, reducing delivery time and cost.	
UNIT 5: MARKETING & SALES ANALYTICS	**6+6**
Marketing Strategy, Marketing Mix, Customer Behaviour – selling Process – Sales Planning –Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales. Practical: 13. Design a report 14. Create a dashboard and perform data analysis 15. Presentation of a case study Experiential Learning (Activity Based Learning): Customer Persona Creation & Journey Mapping Learners analyze survey or social media data to segment customers and build personas. Then, they map the customer journey highlighting pain points and decision triggers. Industrial Application :Industrial Application:	

E-commerce – Personalized Recommendations Based on Customer Behavior Analytics.
Content Beyound Syllabus : Social Listening and Sentiment Analysis: Mining social media and online reviews to gauge customer mood and emerging trends.

TOTAL PERIODS	**: 60**

COURSE OUTCOMES:

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

CO 1	Explain the real world business problems and model with analytical solutions
CO 2	Identify the business processes for extracting Business Intelligence
CO 3	Apply predictive analytics for business fore-casting
CO 4	Apply analytics for supply chain and logistics management
CO 5	Use analytics for marketing and sales

TEXTBOOKS

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

REFERENCES

1.	VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010
2.	Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

CO/PO, PSO Mapping
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CO 4	2	1	1	2	2	-	-	-	3	3	2	1	3	1
CO 5	2	3	2	3	2	-	-	-	3	3	1	3	1	1
AVG	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2.6	1.6	1.4

Product based Projects (Team)

1.	Sales Forecasting Using Predictive Analytics for Retail Businesses
2.	Customer Segmentation Using Clustering Techniques for Marketing Optimization

3.	Employee Attrition Prediction Using Machine Learning Models
4.	Financial Risk Analysis and Fraud Detection in Banking Data
5.	Supply Chain Optimization Using Data Analytics and Forecasting Models
6.	Social Media Sentiment Analysis for Brand Performance Evaluation
7.	Demand Prediction and Inventory Management Using Time Series Analytics
8.	Credit Scoring Model Development Using Classification Algorithms
9.	Churn Prediction Model for Telecom Users Using Supervised Learning
10.	Business Performance Dashboard Creation Using Power BI/Tableau

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U24ADP32	PREDICTIVE ANALYTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	Understand the fundamentals of predictive analytics, the CRISP-DM process, data roles, and statistical tools
2	Learn how to prepare and preprocess data, handle missing values, and select features for predictive modeling.
3	Study and use various models like decision trees, logistic regression and neural network
4	Understand time series analysis, including trend and seasonality, and apply forecasting methods.
5	Study deep learning, unsupervised learning, ensemble methods and consider ethical issues in predictive analysis.

UNIT – 1 INTRODUCTION TO PREDICTIVE ANALYTICS **6+6**

Predictive analytics: definition, scope, applications - Descriptive vs predictive analytics - CRISP-DM process model - Role of data and basic statistics - Data visualization basics

Practical:

1. Import a dataset and identify data types, variables, and basic descriptive statistics.
2. Visualize data using histograms, bar charts, and box plots.

Content Beyond the Syllabus: Real-time predictive analytics in IoT and smart systems

Industrial Application: Predictive maintenance in manufacturing and logistics industries

Experiential Learning: Hands-on predictive modeling using real-world datasets in Python

UNIT – 2 DATA PREPARATION AND FEATURE SELECTION **6+6**

Data quality and preparation - Data cleaning and pre-processing - Handling missing values and outliers - Feature engineering and selection - Correlation analysis

Practical:

3. Handle missing values and clean the dataset using simple pre-processing techniques.
4. Perform correlation analysis and select relevant features.

Content Beyond the Syllabus: Advanced feature engineering and automated data cleaning tools

Industrial Application: Customer churn prediction using cleaned telecom data.

Experiential Learning: Data preprocessing and feature selection using real datasets in Python

UNIT – 3 PREDICTIVE MODELING TECHNIQUES **6+6**

Predictive modeling workflow - Linear and logistic regression - Decision trees - KNN and Naïve Bayes (overview) - Model evaluation metrics

Practical:

5. Build and evaluate a Decision Tree classifier.

6. Implement Logistic Regression or KNN for classification.

Content Beyond the Syllabus: Deep learning and ensemble stacking for complex predictions

Industrial Application: Credit risk assessment using predictive modeling in banking

Experiential Learning: Building and tuning machine learning models using Scikit-learn

UNIT – 4 TIME SERIES ANALYSIS AND FORECASTING **6+6**

Time-series data and applications - Trend and seasonality - Moving average and exponential smoothing - Introduction to ARIMA and LSTM - Forecast evaluation basics

Practical:

7. Plot time-series data and identify trend and seasonality.
8. Apply moving average and exponential smoothing for forecasting.

Content Beyond the Syllabus: Hybrid deep learning models for time series forecasting
Industrial Application: Demand and sales forecasting in retail and supply chain sectors
Experiential Learning: Implementing ARIMA and LSTM models on real-time datasets

UNIT – 5 ADVANCED TOPICS IN PREDICTIVE ANALYSIS	**6+6**

Deep learning overview - Unsupervised learning and clustering - Ensemble learning (overview) -- Ethical and legal issues in predictive analytics - Case studies

Practical:

9. Apply K-Means clustering and interpret clusters
10. Mini case study using any one predictive analytics technique

Content Beyond the Syllabus: Generative AI and transformer models in predictive systems
Industrial Application: Fraud detection and recommendation engines using deep learning
Experiential Learning: Implementing clustering and ensemble models on industry case studies

TOTAL PERIODS	**:30+30**

COURSE OUTCOMES:

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

CO 1	Understand fundamentals of predictive analytics, CRISP-DM process, and basic statistical concepts.
CO 2	Perform data pre-processing, cleaning, and feature selection for predictive modelling.
CO 3	Develop and evaluate basic predictive models using standard machine learning techniques.
CO 4	Analyze time-series data and apply basic forecasting methods.
CO 5	Apply advanced predictive analytics techniques and address ethical considerations.

TEXTBOOKS

1.	Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017
2.	Daniel T. Larose, Chantal D. Larose, “Data Mining and Predictive Analytics”, Wiley, 2015.

REFERENCES

1.	Dean Abbott, “Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst”, Wiley, 2014.
2.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013.
3.	Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	1	0	0	2	0	0	0	0	2	1	1	2
CO 2	3	3	2	1	0	0	0	0	0	0	2	2	2	0
CO 3	2	3	3	1	2	0	0	1	0	0	2	3	2	1

CO 4	3	3	2	3	2	0	0	0	0	0	2	2	3	0
CO 5	2	2	3	2	2	2	2	0	1	1	3	2	2	3
AVG	**2.6**	**2.6**	**2.2**	**1.4**	**1.2**	**0.8**	**0.4**	**0.2**	**0.2**	**0.2**	**2.2**	**2.0**	**2.0**	**1.2**

Product based projects(Team)	
1.	Predictive Analytics and Intelligent Decision Systems
2.	AI-Driven Real-Time Systems and Applications
3.	Data-Driven Web and Cloud Application Development
4.	Machine Learning Models for Business and Social Impact
5.	Intelligent Data Visualization and Knowledge Engineering
6.	Time-Series Analytics and Forecasting Systems
7.	Smart Recommendation and Personalization Systems
8.	AI-Based Optimization and Scheduling Solutions
9.	Ethical and Responsible AI System Design
10.	End-to-End Full-Stack AI Application Development

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24CSP14	TEXT AND SPEECH ANALYSIS	L	T	P	C
		2	0	2	3

Course Objectives

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

UNIT I NATURAL LANGUAGE BASICS — **6+6**

Language Syntax and Structure-Edit Distance-Text Preprocessing and Wrangling Text Tokenization, Stemming, and Lemmatization -Removing Stopwords, Feature Engineering for Text Representation-Bag of Words Model, Bag of N-Grams Model and TF–IDF Model

Lab Components

1. Create Regular expressions in Python for detecting word patterns and tokenizing text
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.

Content Beyond the Syllabus: Architecture design for large-scale customer feedback mining in e-commerce.
Industrial Application: Next world prediction in smartphone keyboards
Experiential Learning: Build a modular text mining pipeline to process and analyze product reviews

UNIT II TEXT CLASSIFICATION — **6+6**

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

Lab Components

5. Implement the Word2Vec model
6. Use a transformer for implementing classification

Content Beyond the Syllabus: Privacy, bias mitigation, and responsible AI.
Industrial Application: Clustering and classifying medical reports to streamline diagnostics.
Experiential Learning: Implement a clustering algorithm on a collection of documents and analyze cluster coherence using different similarity measures.

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS — **6+6**

Information retrieval and IR-based question answering-knowledge-based question answering-language and classic QA models-Dialogue Systems-chatbots-Design of dialogue systems-Overview of GROK AI

Lab Components

7. Design a chatbot with a simple dialog system

Content Beyond the Syllabus: Fundamentals of Context Engineering
Industrial Application: Speaker identification and verification systems.
Experiential Learning: "Design a Smart Voice-Driven Emotion Detector" using DSP and phonetics concepts

UNIT IV TEXT-TO-SPEECH SYNTHESIS — **6+6**

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

Lab Components

8. Convert text to speech and find accuracy

Content Beyond the Syllabus: Spectral Distortion using Warped Frequency Scales (e.g., Bark/Mel)

ndustrial Application: Forensic Audio Analysis Experiential Learning: recognition accuracy using LPC vs. MFCC vs. PLP features.	
UNIT V AUTOMATIC SPEECH RECOGNITION	**6+6**
Speech Recognition-Acoustic Modelling-Feature Extraction-HMM-DNN systems **Lab Components** 9.Design a speech recognition system and find the error rate Content Beyond the Syllabus: Deep Neural Architectures for End-to-End Speech Recognition Industrial Application: Real-Time Voice Assistants and Voice Search Systems Experiential Learning: Implement a Simplified Speech Recognition System Using HMMs	
TOTAL PERIODS	**:60**

Course Outcomes

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

CO1	Explain existing and emerging deep learning architectures for text and speech processing
CO2	Apply deep learning techniques for NLP tasks, language modelling and machine translation
CO3	Explain coreference and coherence for text processing
CO4	Build question-answering systems, chatbots and dialogue systems
CO5	Apply deep learning models for building speech recognition and text-to-speech systems

TEXT BOOKS

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

REFERENCES

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

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	-	-	1	2	1	2	1	1	1
CO2	3	1	2	1	3	-	-	-	2	2	1	3	3	2	1
CO3	2	2	1	3	1	-	-	-	3	3	1	2	3	3	1
CO4	2	1	1	1	2	-	-	-	2	1	2	2	3	1	1
CO5	1	3	2	2	1	-	-	-	3	2	1	1	2	3	1
AVG	2.2	1.8	1.8	1.6	2	-	-	-	2.2	2	1.2	2	2.4	2	1

Product based Projects (Team)	
1	Cross-Language Text Translator Using Machine Learning
2	Email Response Suggestion System Using NLP

3	Real-Time Voice-to-Text Converter Using NLP
4	Text-Based Sentiment Analysis for Financial News
5	Spam Detection System for Emails
6	Emotion Detection in Conversations
7	Named Entity Recognition (NER) for Legal Documents
8	Sentiment Analysis for Product Reviews
9	Language Detection Tool
10	Text Summarization for News Articles

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U24ITP26	HEALTH CARE ANALYTICS	L	T	p	C
		3	0	0	3

Course Objectives

1	To know the sources of healthcare data and basic analytics
2	To introduce various bio-medical imaging modalities and applications.
3	To learn the application of sensors in healthcare data collection and analytics.
4	To understand mining from clinical text data
5	To learn the usage of advanced analytics in healthcare applications.

UNIT 1 - HEALTHCARE DATA SOURCES AND BASIC ANALYTICS — **9**

Overview of Healthcare Data Sources: Electronic Health Records (EHR), Biomedical Images, Senor Data, Biomedical signals, Genomic data, Clinical Data, Social Media data, and its analysis - Overview of Coding Systems: International Classification of Diseases (ICD - 9, 10, 11), International Classification of Functioning, Disability, and Health (ICF), Unified Medical Language System (UMLS), Digital Imaging and Communications in Medicine (DICOM) - Introduction to Data Analytics for Healthcare: Clinical prediction, Temporal and visual analytics, Clinic-Genomic Data Integration, Privacy Preservation Data Publishing.

Experiential Learning (Activity Based Learning): Exploring Healthcare Datasets
Industrial Application : Hospitals & Clinics (EHR Systems) Implement Electronic Health Records (EHR) for storing patient data and enabling interoperability between healthcare providers.
Content Beyond Syllabus : Genomic Data Analytics:Analyzing DNA sequences for disease susceptibility and precision medicine using bioinformatics tools.

UNIT 2 - BIOMEDICAL – IMAGE AND SIGNAL ANALYSIS — **9**

Overview of Biomedical Imaging Modalities: Computed Tomography, Positron Emission Tomography, Magnetic Resonance Imaging, Ultrasound, Microscopy - Object Detection: Template Matching, Model-Based Detection, Data-Driven Detection Methods - Image Segmentation - Image Registration - Feature Extraction - Introduction to biomedical signals - Types of Biomedical Signals - ECG Signal Analysis - Denoising of Signals using Principal Component Analysis - Multivariate Biomedical Signal Analysis - Cross-Correlation Analysis .

Experiential Learning (Activity Based Learning):Object Detection using Template Matching
Industrial Application : Hospital Information Systems:Integration of DICOM imaging standards with EHRs for centralized patient record access
Content Beyond Syllabus :AI & Deep Learning in Biomedical Imaging:Convolutional Neural Networks (CNNs) for tumor classification, lesion detection, and organ segmentation.

UNIT 3 -MINING OF SENSOR DATA IN HEALTHCARE — **9**

Sensor Data in Medical Informatics: Scope and challenges - Challenges in Healthcare Data Analysis - Sensor Data Mining Applications: Intensive Care Data Mining, Sensor Data Mining in Operating Rooms, General Mining of Clinical Sensor Data - Nonclinical Healthcare Applications: Chronic Disease and Wellness Management, Activity Monitoring and Reality Mining - Data Analytics for Pervasive Health: Body area Networks, Dense/Mesh Sensor Networks, Sensor Technology – Applications: Continuous Monitoring, Assisted Living, Therapy and Rehabilitation, Persuasive Well-Being, Emotional Well-Being and Smart Hospitals.

Experiential Learning (Activity Based Learning): Mining ICU Sensor Data
Industrial Application : Wearable Health Technology:Devices like Fitbit, Apple Watch, and Garmin continuously monitor activity, sleep, and heart rate.
Content Beyond Syllabus : Smart Textiles and Wearable Biosensors:Integration of sensors into clothing for continuous, unobtrusive monitoring.

UNIT 4 -NLP AND SOCIAL MEDIA ANALYTICS FOR HEALTHCARE — **9**

Introduction to Natural Language Processing - Core NLP Components - Mining Information from Clinical Text: Information Extraction and Methodologies Rule-Based, pattern-based Approaches - Clinical Text Corpora and Evaluation Metrics - Challenges of Processing Clinical Reports - Clinical Applications - Social Media Analytics for Healthcare: Introduction - Social Media Analysis for Detection and Tracking of Infectious Disease Outbreaks, Public Health Research, Analysis of Social Media Use in Healthcare Experiential Learning (Activity Based Learning): Text Preprocessing and Tokenization Industrial Application : Health Insurance Firms:Use NLP and pattern extraction for claim validation and fraud detection. Content Beyond Syllabus :Voice-Based Healthcare Systems:Speech-to-text models for doctor dictation and virtual nursing assistants using ASR (Automatic Speech Recognition).	
UNIT 5 -ADVANCED DATA ANALYTICS FOR HEALTHCARE	**9**
Introduction to Clinical Prediction Models: Basic Statistical Prediction Models, Alternative Clinical Prediction Models, Survival Models, Evaluation and Validation - Visual Analytics for Healthcare: Introduction, Visual Analytics in Public Health and Population Research, Visual Analytics for Clinical Workflow, Visual Analytics for Clinicians, Visual Analytics for Patients - Legal and Ethical Issues in Clinical Decision Support Systems - Fraud Detection in Healthcare: Definition and Types of Healthcare Fraud, Identifying Healthcare Fraud from Data, Knowledge Discovery-Based approaches for Identifying Fraud Experiential Learning (Activity Based Learning): Healthcare Fraud Detection Mini-Project Industrial Application :Patient Engagement Platforms Visual Analytics for Chronic Disease Monitoring Content Beyond Syllabus : Blockchain for Fraud Detection Use of distributed ledgers for secure healthcare transactions and traceability in insurance claims	
TOTAL PERIODS	**:45**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the various sources of healthcare data and perform basic analytics on those data
CO2	Explore various biomedical modalities and describe the basic properties of each kind
CO3	Recognize and articulate the foundational assumptions, definitions, and usage of sensors in healthcare analytics.
CO4	**Demonstrate application of natural language processing on healthcare data collected from social media.**
CO5	Apply the various advanced data analytics techniques for different real-time healthcare applications.
TEXT BOOKS	
1.	1. Chandan K. Reddy and Charu C. Aggarwal, Healthcare Data Analytics, CRC Press, 2020.
2.	1. A. Jaya, K. Kalaiselvi, Dinesh Goyal, Handbook on Intelligent Healthcare Analytics: Knowledge Engineering with Big Data, Wiley, 2022.
REFERENCES	
1.	Pantea Keikhosrokiani, Big Data Analytics for Healthcare: Datasets, Techniques, Life Cycles, Management, and Applications, Academic Press, Elsevier, 2022

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CO2	3	3	3	2	3	1	1	2	1	1	2	3	2	2
CO3	3	3	3	3	3	1	1	2	1	1	2	3	2	2

CO4	3	3	3	3	3	1	2	2	3	1	2	3	2	2
CO5	3	3	3	3	3	2	2	2	3	1	2	3	2	2

Product Based Project(Teams)	
1.	EHR Data Analysis Dashboard
2.	Clinical Report Keyword Extractor
3.	Healthcare Fraud Detection
4.	Hospital Readmission Prediction
5.	Tweet Sentiment Analysis for Public Health Monitoring
6.	Activity Recognition from Wearable Sensor Data
7.	Heart Rate Monitoring Using Mobile App or Smartwatch Data
8.	Simple Medical Image Segmentation
9.	ECG Signal Noise Removal
10.	ICD Code Classifier

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U24ADP33	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To understand the student with Single and Multivariable optimization methods
2	To Apply and solve real life situations using Linear programming tools
3	To implement methods to solve problems with limitations on the decision variables
4	To Analyse problems when a range is prescribed for the decision variables aided with numerical methods
5	To develop based on certain characteristics and behaviour of biological, molecular, swarm of insects and neurobiological systems

UNIT – 1 CLASSICAL OPTIMIZATION TECHNIQUES **9**

Single-Variable Optimization – Multivariable Optimization with No Constraints – Multivariable Optimization with Equality Constraints – Multivariable Optimization with Inequality Constraints

Content Beyond the Syllabus: Convex Optimization**:** Used in large-scale AI, control, and network systems for guaranteed global minima.

Industrial Application: Telecommunication: Bandwidth allocation, signal strength optimization, and data routing

Experiential Learning: Implement single-variable and multivariable optimization in Python using libraries like SciPy and NumPy

UNIT – 2 LINEAR PROGRAMMING **9**

Introduction to Operations Research – assumptions of linear programming problems – Formulations of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two phase method – Big M method – Transportation and Assignment problems.

Content Beyond the Syllabus: Optimization is foundational for training neural networks, reinforcement learning, and predictive modeling.

Industrial Application: Finance: Portfolio optimization, capital allocation, risk management

Experiential Learning: Formulate LP problems and solve using the Graphical Method and Simplex Algorithm in Python or Excel.

UNIT – 3 INTEGER PROGRAMMING **9**

Graphical Representation – Branch and Bound – Cutting Plane Method –All-Integer Programming Problems – Mixed-Integer Programming Problem

Content Beyond the Syllabus: AI Integration**:** Machine learning assists in predicting good branching strategies or generating cuts, speeding up solution times.

Industrial Application:Manufacturing Job-shop scheduling, production sequencing, machine allocation

Experiential Learning: Formulate simple all-integer and mixed-integer problems and solve using graphical methods and LP relaxation.

UNIT – 4 NON-LINEAR MODELS **9**

Dichotomous Search – Fibonacci Method – Golden Section Method – Comparison of Elimination Methods – Powell's Method – Conjugate Gradient (Fletcher–Reeves) Method – Newton's Method

Content Beyond the Syllabus: Derivative-Free Optimization**:** Methods like Nelder-Mead or Pattern Search for noisy or non-differentiable functions.

Industrial Application: Neural network training, hyperparameter tuning

Experiential Learning: Implement Dichotomous, Fibonacci, and Golden Section methods to minimize single-variable functions.	
UNIT – 5 MODERN OPTIMIZATION ALGORITHMS	**9**
Genetic Algorithms – Simulated Annealing – Particle Swarm Optimization – Ant Colony Optimization Content Beyond the Syllabus: Combining GA, PSO, and SA to improve convergence speed and robustness. Industrial Application: Vehicle routing, supply chain optimization, fleet management Experiential Learning: Implement GA, SA, and PSO in Python to solve single and multi-objective optimization problems.	
TOTAL PERIODS	**: 45**

COURSE OUTCOMES:

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

CO 1	Understand the fundamental concepts of Optimization Problems.
CO 2	Apply linear models for optimization problems.
CO 3	Understand and implement Integer programming models for optimization problems
CO 4	Analyse and apply nonlinear models for optimization problems
CO 5	Evaluate and Apply Bio-Inspired Algorithms for optimization problems.

TEXTBOOKS

1.	**Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2018**
2.	**S. S. Rao, Engineering Optimization Theory and Practice, New Age International (P), 5th Edition, 2019**
3.	Optimization Techniques in Operation Research (C.B. Gupta) 2nd Edition, published 2020.

REFERENCES

1.	**David G.Luenberger, "Linear and Nonlinear Programming", Springer Publications, 3rd Edition, 2008**
2.	**Bertsekas, Dimitri P. Nonlinear Programming. 3rd Edition. Athena Scientific Press, 2016.**
3.	**Optimization Techniques by A.K. Malik, S.K. Yadav, S.R. Yadav, Published 2020.**

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

AVG	1.2	8	2	0.4	2	0.4	0	0	0	0	0	3	1.6	0.4

Product based Projects (Team)	
1	Solve a real-world cost minimization problem using Single-Variable Optimization methods.
2	Perform unconstrained multivariable optimization on a manufacturing process model using Gradient Descent/Newton's method.
3	Formulate and solve a Linear Programming problem for optimal resource allocation using the Simplex method.
4	Solve a Transportation Problem to minimize shipping cost between multiple warehouses and destinations.
5	Solve an Assignment Problem for optimal task–worker allocation using the Hungarian method.
6	Implement Integer Linear Programming to optimize job-shop scheduling using Branch and Bound.
7	Use the Fibonacci or Golden Section method to minimize a nonlinear cost function in engineering design.
8	Apply Conjugate Gradient or Powell's method to optimize a multivariable performance function.
9	Implement Genetic Algorithms to optimize a multi-variable engineering design problem.
10	Apply Particle Swarm Optimization (PSO) or Simulated Annealing to solve a real-world routing or scheduling problem.

U24ADP34	SOCIAL NETWORK ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To Develop a solid Understanding of complex networks and social network analysis.
2	To Analyse and predict relationships in Social Networks.
3	To Understand and Apply game-theoretic and behavioural models.
4	To Develop expertise in modelling, representing, and aggregating social network data for building social-semantic applications
5	To Analyse, Visualize and explore social network data using structural semantic, and statistical techniques.

UNIT - 1 INTRODUCTION TO SOCIAL NETWORKS — **9**

Complex Networks, Overview of Social Network Analysis, Social Media Content, Levels of Network Analysis, Network Statistics, Representation of the Networks, Network Models, Network Centrality, Security and Privacy in Social Networks

Experiential Learning (Activity Based Learning): Build and visualize a small real-world complex network (e.g., airport routes, power grids, or internet topology) using tools like Gephi or NetworkX

Industrial Application: Employee collaboration analysis in HR analytics.

Content Beyound Syllabus : Dynamic SNA: how relationships evolve over time

UNIT – 2 LINK PREDICTION — **9**

Link Analysis. Link Prediction, Link Prediction Methods, Metrics for Link prediction, prediction of Performance Metrics, Community Detection, Taxonomy of community criteria, Community evaluation, Ego Networks - Characteristics of Ego Networks, Ego Network Measures, Network Cohesion.

Experiential Learning (Activity Based Learning): Compare modularity, conductance, and normalized mutual information (NMI) across different algorithms.

Industrial Application : Understanding community structures in transportation or utility networks.

Content Beyound Syllabus : Evaluation using stability and persistence across time.

UNIT – 3 INFORMATION DIFFUSION — **9**

Game Theoretic models, User behavior in social networks, Strategic Interaction in networks, Information Networks, Information Cascades, Cascading behavior in Networks, Diffusion in Network, Modeling, Cascades and Clusters, Diffusion, Thresholds, Six degrees of separation Decentralized search, Epidemics, Influence maximization, Outbreak detection, Markets and Information, Voting, Property Rights, Social Network Analysis Tools.

Experiential Learning (Activity Based Learning): Analyze retweet or comment patterns on Twitter using sentiment and engagement metrics.

Industrial Application : Pricing and bandwidth allocation among competing providers

Content Beyound Syllabus: Evolutionary game theory in dynamic networks.

UNIT – 4 SOCIAL SEMANTIC AND RECOMMENDER SYSTEM — **9**

Modeling and aggregating Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Developing social-semantic applications - Recommendation in Communities - Social Collaboration Platforms-Recommendation Types-Partner Recommendation -Social Network-Based Collaboration .-Reputation Model - Structural Importance Model -

Framework and Ranking Algorithm - Social Broker Recommendation - Virtual Organizations -Expert Communities - Broker Ranking Experiential Learning (Activity Based Learning): Track interaction metrics and analyze network density and communication flow Industrial Application: Open-source project collaboration (GitHub social graph). Content Beyound Syllabus : AI-powered virtual meeting summarization and social signal analysis.	
UNIT – 5 VISUALIZING, MINING SOCIAL NETWORKS	**9**
Taxonomy of Visualizations - Structural Visualization, Semantic and Temporal Visualization, Statistical Visualization, The Convergence of Visualization, Interaction and Analytics - Structural and Semantic Filtering with Ontologies, Centrality-based Visual Discovery and exploration, Mining Social Network Graphs - Clustering, Discovery of Communities, Partitioning, overlapping Communities, Simrank, Triangles in social networks, Neighborhoods, Transitive closure Experiential Learning (Activity Based Learning): Annotate nodes with metadata and visualize using colour or shape Industrial Application: Fraud Detection via Community Anomalies, transaction graph Mining Content Beyound Syllabus :Model Evolving Community and Temporal Centrality.	
TOTAL PERIODS	**: 45**

COURSE OUTCOMES:	
At the end of the course, the student will be able to	
CO 1	Grasp the fundamental principles of networks and social network analysis
CO 2	Discover different community and analyzing information diffusion in social networks
CO 3	Employ data mining and techniques for social network analysis
CO 4	Utilize advanced extraction and mining tools for social network analysis.
CO 5	Develop personalized and immersive visualizations for social networks

TEXTBOOKS	
1.	Social Network Modelling and Analysis, Niyati Aggrawal, Adarsh Anand, Taylor and Francis, CRC Press, 2022
2.	Social Networks and the Semantic Web, Peter Mika, Springer 2007
3.	Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, Cambridge University Press, 2011

REFERENCES	
1.	Social Network data Analytics, Charu C Aggarwal, Springer, 2011
2.	Networks, Crowds, and Markets reasoning about a highly connected world, David Easley and Jon Kleinberg, Cambridge University Press, 2010
3.	Social Network Analysis and Education, Theory Methods & Applications by Brain V, Carolan, Sage Publications, 2014
4.	Understanding Social Networks Theories, Concepts and Findings, Charles and Kadushin, Oxford University Press, 2012
5.	Analyzing Social Networks, Stephan P Borgatti, Martin G Everett, Jeffrey C Johnson, Sage Publications, 2017

6.	Social Recommender Systems, Daniel Schall, Springer, 2015

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	2	2	-	2	-	-		2	2	2
CO 2	2	2	2	-	2	-	-	2	-	2	2	2	2	2
CO 3	3	2	2	2	3	1	1	2	1	3	2	2	2	2
CO 4	3	2	2	3	3	2	1	1	1	3	2	3	3	3
CO 5	2	2	2	3	3	2	-	2	2	3	2	2	2	2
AVG	2.2	1.8	2	2.7	2.3	1.5	1	2	1.3	2.7	2	2	2	2

Product based Projects (Team)	
1	AI-Driven Social Media Sentiment Analysis Platform
2	Decentralized Social Media Network Using Blockchain
3	Privacy-Focused Social Media App with End-to-End Encryption
4	Micro-Influencer Recommendation System for Social Platforms
5	Fake News Detection System for Social Media Feeds
6	Social Media Analytics Dashboard for Brand Monitoring
7	Event-Based Social Networking App with Geo-Tagging
8	Smart Content Moderation System Using NLP
9	Interest-Based Social Network Using Graph Algorithms
10	Gamified Social Media Platform for Community Engagement

VERTICAL 4: AGILE SOFTWARE TECHNOLOGIES								
S.No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP41	Web Engineering	PEC	60	2	0	2	3
2	U24CSP31	Cloud Computing	PEC	60	2	0	2	3
3	U24CSP24	UI & UX Design	PEC	60	2	0	2	3
4	U24ADP42	Software Engineering	PEC	45	3	0	0	3
5	U24CSP23	Devops	PEC	45	3	0	0	3
6	U24ADP43	AI Based Mobile Application Development	PEC	45	3	0	0	3

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U24ADP41	WEB ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	Understand the fundamental concepts of web design and development using modern standards and frameworks.
2	Apply and explore client-side technologies such as HTML, CSS, and JavaScript to create responsive and interactive web pages.
3	Analyze and learn server-side programming concepts to develop dynamic web applications with backend logic.
4	Implement and analyses database connectivity and data representation for efficient web data management.
5	To develop front-end, back-end, and database layers to design and deploy full-stack web applications.

UNIT – 1 WEB FUNDAMENTALS **6 + 6**

Web architecture: Client-Server communication, HTTP protocol, Restful services, HTML5 and CSS: Semantic Elements, interactive elements, CSS Style sheets, CSS layouts, Responsive web design, Transforms and animations, Bootstrap Framework

PRACTICALS:

1. Create a responsive website using HTML5 and CSS3.
2. Create an interactive web with animations.
3. Create a mobile first responsive design using Bootstrap.

Content Beyond the Syllabus: Progressive Web Apps (PWA): Combine the best of web and mobile apps — offline access, push notifications, and faster performance.

Industrial Application: Online stores with responsive product pages and RESTful payment gateways

Experiential Learning: Build a responsive webpage using HTML5 semantic tags and CSS Flexbox/Grid.

UNIT – 2 CLIENT -SIDE PROGRAMMING **6 + 6**

Java Script Fundamentals: DOM Manipulation, Event Handling, Error Management, DHTML with Java script. Advanced Script:ES6+ Features, Async Programming, AJAX and JSON, APIs and Form Validation.

PRACTICALS:

1. Develop a client-side form validation system using JavaScript.
2. Design an interactive User Interface application design.
3. Implement dynamic content loading.

Content Beyond the Syllabus: modern frameworks and technologies such as React.js, Node.js, and RESTful APIs, which extend JavaScript's capabilities to both client and server sides.

Industrial Application: In Banking and Finance, form validation, secure API integration, and real-time data updates improve transaction safety and user trust.

Experiential Learning: Develop a responsive registration form with real-time validation and error handling using JavaScript and Bootstrap.

UNIT – 3 SERVER- SIDE PROGRAMMING **6 + 6**

Java Servlets and JSP: Architecture, Lifecycle, Request-Response Mechanism, Elements and Directives, Session Tracking and Cookies, MVC pattern.

PRACTICALS:

1. Create Dynamic Web Applications using Servlets and JSP.
2. Develop MVC- based Application using Servlet and JSP.
3. Implement Session Management and Authentication.

Content Beyond the Syllabus: Servlets and JSP such as Spring MVC, Jakarta EE, and JSF (Java Server Faces).

Industrial Application: Patient record systems, appointment portals, and data-driven reporting

Experiential Learning: Use JSP Directives and JavaBeans to create dynamic web pages that display database-driven content (e.g., product catalogs).

UNIT – 4 DATABASE INTEGRATION AND XML	**6 + 6**

JDBC Fundamentals, JDBC Architecture and Components, Driver Types and Connection Management, Statement Types, Result Set Handling.XML: Basic XML-Document Type Definition XML Schema, XML Parsers and Validation, XSL

PRACTICALS:

1. Build a Database driven Web Application.
2. Develop Transaction based Applications.
3. Dynamically display a structured student mark list on a web page.

Content Beyond the Syllabus: JSP Expression Language (EL) and JSTL (JSP Standard Tag Library) for cleaner, tag-based data binding instead of scriptlets

Industrial Application: Stock management systems with automatic updates from the database Experiential Learning: Connect JSP and JavaBeans to a backend database (e.g., MySQL) using JDBC. Implement operations like adding, deleting, and updating product details.

UNIT – 5 MODERN WEB FRAMEWORKS	**6 + 6**

Angular Framework: Angular Fundamentals, Events and attributes, Components and Modules, Data binding and Services. Web Applications Frameworks and Tools – Firebase – Docker– Node JS – React – Django.

PRACTICALS:

1. Develop web applications using Angular.
2. Implement User Authentication.
3. Create a full-stack web application.

Content Beyond the Syllabus: Firebase for real-time database management and authentication

Industrial Application: Firebase for real-time database management and authentication

Experiential Learning: Implement two-way data binding in Angular to dynamically update product or user data in response to user input.

TOTAL PERIODS	**: 60**

COURSE OUTCOMES:

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

CO 1	Design and develop responsive Web Solutions.
CO 2	Design and Implement Interactive Client-Side Programming.
CO 3	Design and Build Server-side web applications.
CO 4	Construct data representation and integrate database connectivity.
CO 5	Build modern full-stack Web Applications.

TEXTBOOKS

1.	Deitel and Deitel and Nieto, Internet and World Wide Web – How to Program, Prentice Hall, 5th Edition, 2011.
2.	David Flanagan, “JavaScript:The Definitive Guide”, O’Reilly Media, 7th Edition,2020
3.	Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley,2011.

REFERENCES

1.	Terry Felke-Morris, Web Development & Design Foundations with HTML5, 9th Edition.

2.	Marty Hall, "Core Servlets and JavaServer Pages", Prentice Hall,2nd Edition,2003.
3.	Adam Freeman, "Pro Angular Build Powerful and Dynamic Web Apps", Fifth Edition, APress
4.	White Fisher, et al.," JDBC API Tutorial and Reference", 3rd eds, Addison Wesley, 2003.
5.	Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO 2	-	3	3	-	3	-	-	-	-	-	-	3	2	-
CO 3	-	3	3	2	3	-	-	-	-	-	-	3	-	-
CO 4	2	3	3	-	3	-	-	-	-	-	-	3	2	-
CO 5	-	3	3	-	3	-	-	-	2	2	-	3	3	2
AVG	**2.5**	**2.8**	**3**	**2**	**2.8**	**0**	**0**	**0**	**2**	**2**	**0**	**3**	**2.3**	**2**

Product based Projects (Team)

1	Create a fully responsive product landing page using HTML5, CSS3, and Bootstrap.
2	Develop an interactive registration form with real-time JavaScript validation.
3	Build a dynamic webpage that loads content using AJAX and JSON from an external API.
4	Create a Java Servlet + JSP application that displays user details from a database.
5	Implement session management and user login authentication using Servlets/JSP.
6	Design a database-driven web application using JDBC to perform CRUD operations.
7	Generate and display XML data (student mark list or product list) using XSL transformations.
8	Develop a small Angular application with components, routing, and two-way data binding.
9	Implement Firebase-based authentication and store user data in Firestore.
10	Create a full-stack web application using Node.js (backend) and React (frontend).

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U24CSP31	CLOUD COMPUTING	L	T	P	C
		2	0	2	3

Course Objectives

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

UNIT 1 CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE — **6+6**

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

PRACTICALS:

1. Explore public cloud services including Amazon, Google, Salesforce, and Digital Ocean
2. Install Oracle Virtual Box/VMware Workstation and Create a Blackboard Application

[Hint: One VM should act as a master and other VMs will act as listeners. When any content is written by the master VM, the content should be displayed in all the Listener VMs].

Experiential Learning (Activity Based Learning): Build a simple distributed application using microservices architecture

Industrial Application : IBM Cloud and Azure Hybrid in banking and healthcare sectors

Content Beyond Syllabus : Cloud Cost Optimization and FinOps

UNIT 2 WEB SERVICES AND VIRTUALIZATION BASICS — **6+6**

Introduction to Services and Service Oriented Architecture – SOAP, REST – Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

PRACTICALS:

1. Install KVM / Xen and create VM using image templates
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

Experiential Learning (Activity Based Learning): Build and test a SOAP web service using Apache Axis or Spring Boot

Industrial Application : Intel VT-x and AMD-V used in data centers

Content Beyond Syllabus : AI-Driven Virtualization Management (AIOps)

UNIT 3 CLOUD STORAGE AND CONTAINERS — **6+6**

Introduction to Cloud Storage, Definition, Provisioning – Unmanaged and Managed cloud storage – Creating cloud storage systems – Cloud Backup types, Features – Cloud attached backup – Cloud Storage Interoperability, Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

PRACTICALS:

1. Creating and Executing Your First Container using Docker.
2.Run a Container from Docker Hub

Experiential Learning (Activity Based Learning): Use MinIO or Ceph to simulate an on-premise cloud storage

setup Industrial Application : Backup and Disaster Recovery using Veeam, AWS Backup, and Azure Recovery Vault Content Beyond Syllabus : Data Lake Architecture on Cloud	
UNIT 4 CLOUD DEPLOYMENT ENVIRONMENT AND PROGRAMMING	**6+6**
Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus and OpenNebula– Insight into OpenStack Architecture and Components – Programming Google App Engine– Programming on EC2, S3 **PRACTICALS:** 1. Install Google App Engine. Create a hello world app and other simple web applications using python/java. 2. Use GAE launcher to launch the web applications. Experiential Learning (Activity Based Learning): Create a simple Python or Node.js web app and deploy it on Google App Engine Industrial Application : OpenStack - Adopted by telecom and enterprise sectors (e.g., AT&T, CERN) Content Beyond Syllabus : DevOps on Cloud	
UNIT 5 CLOUD SECURITY	**6+6**
Virtualization System– Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Data Security and Storage; Identity and Access Management (IAM) – IAM Challenges – IAM Architecture and Practices. **PRACTICALS:** 1.Implementing Identity and Access Management (IAM) Using AWS IAM. 2. Find a procedure to transfer the files from one virtual machine to another virtual machine-VM migration. Experiential Learning (Activity Based Learning): Simulate live migration of a VM using OpenStack or VMware vMotion Industrial Application : Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. Content Beyond Syllabus : Privileged Access Management (PAM)	
TOTAL PERIODS	**: 60**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Analyze the design challenges in the cloud.
CO2	Implement the concept of virtualization.
CO3	Implement virtualization on hardware resources and Docker.
CO4	Develop and deploy services on cloud and set up a cloud environment.
CO5	Analyze security challenges in cloud environment

TEXT BOOKS	
1	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2	James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.

REFERENCES	
1	James Turnbull, “The Docker Book”, Turnbull Press, 2014.
2	Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.
3	Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

4	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering the Cloud Computing Foundations and Applications Programming", Morgan Kaufmann,2013
5	John Gilbert, "Cloud Native Development Patterns and Best Practices: Practical architectural patterns for building modern, distributed cloud-native systems", Packt Publishing, 2018.
6	Chris Dotson , "Practical Cloud Security: A guide for secure design and deployment", O'Reilly Media, 2019

CO-PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	-	-	-	2	3	3	3	3
CO2	3	3	3	3	3	2	-	-	2	2	2	3	3	3
CO3	3	3	3	3	3	2	-	-	2	2	2	3	3	3
CO4	3	3	3	3	3	2	-	-	2	2	2	3	3	3
CO5	3	3	3	3	3	2	-	-	2	3	2	3	3	3
AVG	3	3	3	2.8	2.6	2	-	-	2	2.2	2.2	3	3	3

Product Based Projects (Team)

1. Microservices-Based Distributed Blackboard Application Using Virtual Machines
2. Hybrid Cloud Architecture Design for Banking and Healthcare Systems
3. Implementation of NIST Cloud Reference Architecture for Enterprise Applications
4. Comparative Deployment of Public, Private, and Hybrid Cloud Models
5. SOAP-Based Web Service Application Using Apache Axis
6. RESTful Service Implementation for Cloud-Based Applications
7. Virtual Machine Provisioning and Performance Analysis Using KVM/Xen
8. CPU, Memory, and I/O Virtualization Analysis in Hypervisor Environments
9. Private Cloud Storage System Using MinIO/Ceph
10. Cloud Backup and Restore Application Using Docker Containers
11. Managed vs Unmanaged Cloud Storage Performance Evaluation
12. Containerized File Sharing Application Using Docker Images and Repositories
13. Web Application Deployment on Google App Engine Using Python
14. Scalable Cloud Application Deployment Using AWS EC2 and S3
15. Private Cloud Setup and Resource Management Using OpenStack
16. DevOps-Enabled Cloud Application Deployment with CI/CD Pipeline
17. Identity and Access Management (IAM) Implementation Using AWS IAM
18. Virtual Machine Live Migration Simulation Using OpenStack or VMware vMotion
19. Cloud Security Attack Simulation: Guest Hopping and VM Migration Attacks
20. Custom Cloud Scheduling Algorithm Implementation Using CloudSim

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U24CSP24	UI AND UX DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

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

UNIT –1 FOUNDATIONS OF DESIGN **6+4**

Design Thinking – Divergent- Convergent-Lateral -Context- Know your Audience – Research: Ways to Understand Context and Goals- direct Observation-Surveys- Personas-The Patterns: Cognition and Behaviour Related to Interface Design-Self Exploration-Gratification-Organizing the Content: Information Architecture and Application Structure-Meet the Goals of People and the Organization

Experiential Learning (Activity Based Learning):Students design a user-centered interface by researching users, creating personas, and structuring content to solve a problem.

Industrial Application : Design Thinking plays to build intuitive digital products that align user needs with business goals.

Content Beyond Syllabus : Exposure to design sprints, UX analytics, and real-world product case studies.

PRACTICALS:

1. Exploring various UI Interaction Patterns
2. Developing an interface with proper UI Style Guides
3. Defining the Look and Feel of the new Project

Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)

UNIT II DESIGN FUNDAMENTALS **6+4**

Understanding the Information and Task Space–Navigation Models: Hub and spoke-fully connected multilevel-pyramid-flat navigation-Patterns-clear Entry Points-Menu pages- - Signposts-Way finding- Layout of screen Elements- Visual Style and Aesthetics-Laws governing UI

Experiential Learning (Activity Based Learning):Students design app navigation and screen layouts for a real-world example like an e-commerce or banking application.

Industrial Application : Designing user-friendly and scalable interfaces for enterprise software to enhance efficiency.

Content Beyond Syllabus : Accessibility standards, modern UI laws, and case studies from real enterprise applications.

PRACTICALS:

5. Hands on Design Thinking Process for a new product
6. Brainstorming feature for proposed product
7. Identify a customer problem to solve

UNIT III DISPLAY AND ELEMENTS **6+4**

Types of Display – Actions and Commands – Pinch-Buttons-Drop-Down Menus-Action-Hover- Keyboard action-Direct Manipulation-Showing Complex Data – Forms and Controls – Labels - Menus - Tabs - Buttons - Accordion - Carousel - Breadcrumbs — pagination-Scrollers-Two Panel Selection-Text input fields-Builder and Editors-UX writing Tools.

Experiential Learning (Activity Based Learning):Students design a functional UI prototype using common controls and display types for a web or mobile application.

Industrial Application : usage of UI elements in CRM, ERP, and e-commerce platforms to enable efficient user interaction.

Content Beyond Syllabus : Modern UX writing tools in industry

PRACTICALS:

8. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

UNIT IV UI SYSTEMS	**6+12**

SUI Frameworks – Smart Systems- Connected Devices – Anticipatory Systems-Assistive Systems- Natural User Interfaces- Challenges and Opportunities of Model Design-Screen Design - Text Display – Representing Physical Environment – Location – Social Influence – Various Design Pattern-Desktop Applications-Mobile Interfaces

Experiential Learning (Activity Based Learning):Students design responsive desktop and mobile interfaces using modern UI frameworks

Industrial Application : Assistive System Applied in smart home apps, wearable devices, and enterprise platforms to deliver intuitive, adaptive, and user experiences.

Content Beyond Syllabus : Voice-based UI, AI-driven anticipatory design, and real-world smart system case studies.

PRACTICALS:

9. Designing a Responsive layout for a societal application
10. Developing Wireflow diagram for application using open source software

Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

UNIT V UX DESIGN	**6+6**

IUser Research-Interviews-Persons--Content Strategy-Transition-Design Principles-Site Maps and Task Flows-Sketching-Wireframes and Annotations-Prototyping-Design Testing With Users- TransitionMeasuring UX Content Effectiveness-Analytics

Experiential Learning (Activity Based Learning):Develop user stories, flow diagrams, and information architecture for a product.

Industrial Application: Web design, enterprise systems, and user journey mapping in IT solutions.

Content Beyond Syllabus: Design documentation tools, card sorting, and data-driven IA optimization.

PRACTICALS:

12. Exploring various open source collaborative interface Platform
13. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

TOTAL PERIODS	**: 30 + 30**

COURSE OUTCOMES:

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

CO 1	Understand the user needs and requirements to build an effective User Interface.
CO 2	Implement UI design principles in the creation of a User Interface.
CO 3	Design and implement perfect layouts for UI design to develop real world UX products.
CO 4	Analyse various types of User Interface systems.
CO 5	Create User Interfaces by applying Design Principles and evaluate the UI design

TEXTBOOKS

1.	Uijun Park , “Introduction to Design Thinking For UX Beginners” ,Wiley 2023
2.	Joel Marsh, “ UX for Beginners”, O’Reilly,2022
3.	Jenifer Tidwill , Charles Brewer and Aynne Valencia , “Designing Interfaces: Patterns for Effective Interaction Design “ Third Edition, O’Reilly Publications,2020
4.	Jeff Johnson , “Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules” Third Editions, Elsevier publication, 2020

REFERENCES	
1.	Jon Yabionski, " Laws of UX using Psychology to design Better Products & services" O'Reilly, 2021
2.	Torrey Podmajersky, "Strategic Writing for UX", O'Reilly Medis, inc, 2019
3.	Ben shneiderman, Catherine Plaisant, Marine Cohen and Steven M.Jacobs, "Designing the User Interface-Strategies for Effective Human Computer Interaction", Fifth Edition, Pearson, 2012
4.	Russ Unger and Carolyn Chandler, "A Project Guide to UX Design: For User Experience Designers in the Field or in the Making",Second Edition, New Riders Publishers,2012

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Product based Projects (Team)

1.	Responsive Web Application for Social Good
2.	AI-Powered Brainstorming Tool
3.	UI Pattern Library for E-Commerce
4.	Automated UI Element Grouping System
5.	UX Research for Automotive Interfaces
6.	Wireframing & Prototyping a Mobile Banking App
7.	Collaborative Open-Source Design Platform
8.	Adaptive Cross-Cultural UX System
9.	Emotion-Centered UX for FinTech
10.	End-to-End User-Centered Mobile App Prototype

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U24ADP42	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1	To introduce the basics and necessity of software testing.
2	To provide various testing techniques along with concepts of software bugs and its impact.
3	To develop and validate a test plan.
4	To build a testing team required.
5	To understand the need for and challenges in test automation and to develop testing scripts.

UNIT I TESTING PRINCIPLES AND AXIOMS — **9**

Testing as a Process – Testing Maturity Model- Testing Axioms –Software development and life cycle-Software Testing Principles – Origins and Cost of Defects – Defect Classes and Examples –Developer/Tester Support of Developing a Defect Repository – The Defect Life Cycle-Defect Analysis and Prevention Strategies.

Experiential Learning (Activity Based Learning):Defect Identification Workshop, Building a Defect Repository

Industrial Application : Real-world defect repositories help companies maintain quality standards. Continuous defect analysis supports Six Sigma and CMMI quality improvement, Defect prevention reduces rework and improves time-to-market.

Content Beyond Syllabus : Defect Prediction Models: Using machine learning to predict defect-prone modules. Test Automation Maturity Model: Assessing automation readiness and ROI.

UNI II BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY — **9**

Test Case Design Strategies – Black Box Approach –Boundary Value Analysis – Equivalence Class Partitioning – Syntax testing - Finite State-Based Testing – User Documentation Testing –White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Cyclomatic Complexity – Test Adequacy Criteria-Evaluating Test Adequacy Criteria.

Experiential Learning (Activity Based Learning):Syntax Testing Workshop,Test Case Design using Black Box Techniques

Industrial Application : User Documentation Testing in Consumer Software,White Box Testing for Critical Systems

Content Beyond Syllabus :Automated Test Case Generation, Advanced Syntax Testing Techniques

UNIT III LEVELS OF TESTING — **9**

Unit Test Planning - Designing and Running the Unit Tests – Integration Test Planning – Scenario Testing– System Testing–Defect Bash Elimination System Testing-Acceptance-Testing–Performance Testing– Regression Testing – Internationalization Testing – Ad-Hoc Testing – Alpha, Beta Tests.Experiential Learning (Activity Based Learning): Unit Test Planning and Execution,Alpha and Beta TestingIndustrial Application : Regression Testing,Scenario and System Testing

Content Beyond Syllabus : Security Testing Integration, Continuous Testing in DevOps

UNIT IV TEST MANAGEMENT — **9**

Organization Structures for Testing Teams – Testing Services – Test Planning – Locating Test Items –Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Structure of Testing Group - Building a Testing Group.

Experiential Learning (Activity Based Learning):Creating a Test Plan for a Sample Project,Mapping Testing Team Structures

Industrial Application : Test Planning & Management,Reporting

Content Beyond Syllabus : Collaborative Tools and Platforms, Agile Testing Teams

UNIT V TEST AUTOMATION AND TOOLS	**9**
Software Test Automation – Framework for test automation-Skill Needed for Automation – Scope of Automation – Generic Test Automation Architecture – Requirements & Criteria for Test Tool selection - Challenges in Automation – Test Metrics and Measurements – Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events-– Web Security testing tool: Vega - Functional testing in Cloud:Apache JMeter - CASE STUDY: Web Accessibility Testing, Disabled Object Verification Through Force. Experiential Learning (Activity Based Learning):Hands-on Selenium WebDriver automation scripts, Using Vega for security scans. Industrial Application: Security Testing in Agile Environments, Performance Testing for Cloud-Based Applications Content Beyond Syllabus: Continuous test automation and integration with DevOps.	
TOTAL PERIODS:	**45**

Course Outcomes

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

CO1	Obtain an insight into software testing
CO2	Apply both black box testing and white box testing
CO3	Understand and apply multiple levels of testing
CO4	Understand the role of a tester as an individual and as a team member.
CO5	Apply software testing for large projects using automated testing tools

TEXT BOOKS

1	Jorgensen, Paul C. Software testing: a craftsman's approach. Fifth edition, Auerbach Publications, 2021.
2	Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing – Principles and Practices",
3	Palani, N. Automated Software Testing with Cypress. Taylor & Francis. CRC Press, 2021.
4	Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018.

REFERENCES

1	Kossiakoff, A., Biemer, S. M., Seymour, S. J., & Flanigan, D. A. Systems engineering principles and practice. John Wiley & Sons. 2020.
2	Aniche, M. Effective Software Testing: A developer's guide. Simon and Schuster, 2022.
3	https://onlinecourses.nptel.ac.in/noc24_cs47 by By Prof. Rajib Mall | IIT Kharagpur
4	https://onlinecourses.nptel.ac.in/noc22_cs61 by By Prof. Meenakshi D'souza | IIIT Bangalore
5	Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", Third Edition,
6	John Wiley & Sons, 2012.
7	Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packet Publishing. https://www.tutorialspoint.com/jmeter.

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CO1	3	1	1	1	2	-	-	1	3	-	3	3	3	3
CO2	3	3	2	3	3	-	-	-	3	-	-	3	3	3

CO3	3	3	3	3	3	-	1	-	3	-	2	3	3	3
CO4	2	3	3	3	3	1	1	-	3	-	2	3	3	3
CO5	3	3	3	3	3	1	-	1	3	-	3	3	3	3
AVG	2.8	2.6	2.4	2.6	2.8	1	1	1	3	-	2.5	3	3	3

Product Based Projects(Team)	
1.	Test Plan and Test Case Development for an E-Commerce Web Application
2.	Automated Login Functionality Testing for an E-Commerce Website Using Selenium and TestNG
3.	Automation of Payment Gateway Workflow Using Selenium
4.	Bug Tracking & Test Management for a Food Delivery App Prototype
5.	Test Case Design and Boundary Value Analysis for a Calculator Web App
6.	Automated Test Suite for a Banking Login Portal Using Selenium Grid
7.	Data-Driven Testing for an Inventory Control System Using Selenium
8.	API Testing Framework for a Weather Forecast Service Using Postman/Newman
9.	Performance Testing of an Online Food Ordering System Using Jmeter
10.	Functional Testing and Defect Reporting for a Student Management System

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U24CSP23	DEVOPS	L	T	P	C
		3	0	0	3

Course Objectives - Gain comprehensive expertise in DevOps principles, tools, and practices by bridging development and operations; automating builds, testing, integration, and deployments using Maven, Gradle, Jenkins, and Ansible; and building, monitoring, and optimizing end-to-end CI/CD pipelines using Azure DevOps.

1	Gain knowledge of DevOps principles, culture, and practices to bridge the gap between development and operations.
2	Learn to compile and build applications using Maven and Gradle to streamline software development workflows.
3	Develop the ability to automate builds, testing, and integration processes using Jenkins.
4	Acquire skills in configuration management and deployment automation using Ansible.
5	Build, monitor, and optimize end-to-end CI/CD pipelines using Microsoft Azure DevOps services.

UNIT 1 INTRODUCTION TO DEVOPS — **9**

History & Evolution of DevOps -Software Development Life Cycle (SDLC) & Agile Overview-DevOps Lifecycle Stages- Basic Linux Commands for DevOps - Devops Essentials - Introduction to Cloud Platforms (IaaS, PaaS, SaaS) -Version control systems: Git and Github.

Experiential Learning (Activity Based Learning): Building a mini CI/CD pipeline with open-source tools (Git → Jenkins → Docker → Deploy).

Industrial Application : Agile methodologies are adopted across product-based and service-based companies.

Content Beyond Syllabus : Case studies on DevOps adoption at companies like Netflix, Amazon, and Google.

UNIT 2 COMPILE AND BUILD USING MAVEN & GRADLE — **9**

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

Experiential Learning (Activity Based Learning): Hands-on installation and configuration of Maven & Gradle on student systems.

Industrial Application : Standard practice in IT companies for artifact management (Nexus, Artifactory).

Content Beyond Syllabus : Case studies on how large companies (e.g., Google using Gradle for Android) optimize builds

UNIT 3 CONTINUOUS INTEGRATION USING JENKINS — **9**

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

Experiential Learning (Activity Based Learning): Creating and configuring Jenkins jobs for building Java projects with Git and Maven.

Industrial Application : Jenkins is the most widely used Continuous Integration (CI) tool in the software industry.

Content Beyond Syllabus : Blue Ocean UI for visualization of pipelines.

UNIT 4 CONFIGURATION MANAGEMENT USING ANSIBLE — **9**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Error Handling & Debugging, Ansible playbooks, Ansible Vault, Ansible Roles, adhoc commands in ansible

Experiential Learning (Activity Based Learning): Configuring master/slave (control node/managed node) architecture.

Industrial Application : Widely used in enterprises for IT automation and configuration management.

Content Beyond Syllabus : Case studies: How enterprises like NASA and Verizon use Ansible for large-scale automation.

UNIT 5 BUILDING DEVOPS PIPELINES USING AZURE	**9**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file, Integrate Azure Pipelines with GitHub Actions, Container Build & Deployment, Infrastructure as Code (IaC)

Experiential Learning (Activity Based Learning): Integrating GitHub Actions with Azure Pipelines for hybrid workflows.

Industrial Application : Supports large-scale deployments of cloud-native applications on Azure.

Content Beyond Syllabus : Case studies: How Microsoft and enterprise clients adopt Azure DevOps for global-scale software delivery.

TOTAL PERIODS	**:45**

Course Outcomes

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

CO1	Explain the concepts, principles, and culture of DevOps to understand its role in modern software development.
CO2	Demonstrate the use of build automation tools like Maven and Gradle for compiling and packaging applications.
CO3	Implement Continuous Integration workflows using Jenkins to automate builds and testing.
CO4	Apply configuration management techniques using Ansible to automate infrastructure provisioning and deployment.
CO5	Design and develop complete CI/CD pipelines using Azure DevOps for cloud-based application delivery.

TEXT BOOKS

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

REFERENCES

1	Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure:
2	Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015
3	David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016
4	Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2

CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
AVG	3	3	3	**2**	**3**	-	-	-	-	-	-	2	2	2

Product Based Projects(Team)	
1.	End-to-End CI/CD Pipeline for a Web Application Using Jenkins & Azure DevOps
2.	DevOps Maturity Model Assessment for an Enterprise Application
3.	Blue-Green Deployment Strategy Implementation Using DevOps Tools
4.	Monitoring and Logging Setup for CI/CD Pipelines (Case Study)
5.	DevOps Automation for Microservices Deployment
6.	Hybrid CI/CD Pipeline Using GitHub Actions and Azure Pipelines
7.	Configuration Management System Using Ansible Roles and Playbooks
8.	Cloud Deployment of a Java Application with Docker and Jenkins
9.	Infrastructure Automation Using Ansible for Web & Database Servers
10.	Automated Build and Deployment Pipeline Using Maven, Jenkins, and GitHub

U24ADP43	AI BASED MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

1	To identify different types of mobile applications
2	Implement Android applications using XML, Java/Kotlin, and SDK tools.
3	Create iOS applications using Objective-C/Swift, XCode, and SDK tools.
4	Integrate AI technologies into mobile applications by exploring AI-powered features and applications
5	Apply AI tools such as CoreML, TensorFlow, ML Kit, and OpenCV to build and implement AI features in mobile applications

UNIT - 1 INTRODUCTION — **9**

Mobile Applications – Types of Mobile Applications – Mobile Web, Native Applications, Hybrid Applications - Characteristics and Benefits - Mobile Frameworks and Tools – Web Based Cross Frameworks-Native Based Cross Frameworks-Xamarin-Codename One-Flutter-React Native Native Script-Pros and Cons; Mobile Platforms – Types: Mobile App UI/UX Design Tools.

Experiential Learning:Design a basic mobile UI/UX layout using Figma or Adobe XD and implement it in one framework.

Industrial Application: Web-based frameworks like React Native are uses in rapid prototyping and MVP development.

Content Beyond the Syllabus: Study of no-code/low-code app builders (e.g., Glide, AppGyver).

UNIT - 2 ANDROID APPLICATION DEVELOPMENT — **9**

Introduction to Android – Architecture – SDK Tools – Languages for Android - XML – Java / Kotlin - UI widgets – Layouts – Event Handling - Overview of Application Components - Android Intents, Types - SQLite Database – CRUD.

Experiential Learning:Implement a CRUD operation using SQLite database in Android Studio.

Industrial Application: SQLite database is uses in many apps

Content Beyond the Syllabus:Introduction to Jetpack Compose for declarative UI.

UNIT - 3 IOS APPLICATION DEVELOPMENT — **9**

Introduction to iOS- architecture – features – XCode and SDK tools – Objective C / Swift – UI Controls – Container Views – Event Handling - Overview of iOS Data Persistence – Connectivity: SQLite Database with IOS application

Experiential Learning:Implement local data persistence using Core Data or SQLite

Industrial Application:Uses in Apple ecosystem apps like HealthKit, Siri integration, and Apple wallet.

Content Beyond the Syllabus:Introduction to SwiftUI for modern UI design.

UNIT - 4 AI IN MOBILE APPLICATION DEVELOPMENT — **9**

AI technologies for mobile applications - A simple AI based Chatbot using Android / iOS; AI powered mobile apps – Architecture: Google Assistant, Siri, Replika, Cortona, Elsa – FaceApp, Amazon Alexa.

Experiential Learning:Create an image recognition app using a pre-trained AI model.

Industrial Application: Demonstration of AI-powered apps like FaceApp, Snapchat, and Alexa

Content Beyond the Syllabus:Introduction to Edge AI and On-device inference for privacy and speed

UNIT - 5 AI TOOLS FOR MOBILE APPLICATION DEVELOPMENT — **9**

Usage of AI in mobile apps; Build AI mobile apps – Implementation considerations; AI tools: CoreML-TensorFlow – ML Kit -OpenCV – Caffe2 – Emerging AI applications in smartphones.
Experiential Learning:Implement a real-time object detection app using TensorFlow Lite.
Industrial Application: TensorFlow Lite and ML Kit uses in Snapchat, Pinterest, and Google Photos for AI features
Content Beyond the Syllabus:Ethical and privacy issues in AI-enabled mobile app

TOTAL PERIODS	**45**

Course Outcomes

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

CO1	Understand the frameworks, platforms and tools of mobile application development.
CO2	Learn native Android application development using Java / kotlin.
CO3	Understand native iOS application development using Objective-C / Swift.
CO4	Learn implementation aspects of AI in mobile application development.
CO5	Develop AI based mobile application using Android / iOS

TEXT BOOKS

1	Laurence Moroney, “AI and Machine Learning for On-Device Development: A Programmer's Guide”, O'Reilly Media, 1st Edition, 2021.
2	Dawn Griffiths and David Griffiths, “Head First Android Development: A Learner’s Guide to Building Android Apps with Kotlin”, Shroff/O’Reilly, 3rd Edition, 2021.
3	Ahmad Sahar and Craig Clayton, “iOS 15 Programming for Beginners: Kickstart your mobile app development journey by building iOS apps with Swift 5.5 and Xcode 13”, Packt Publishing, 6th Edition, 2021.

REFERENCES

1	Laurence Moroney, “AI and Machine Learning for On-Device Development: A Programmer's Guide”, O'Reilly Media, 1st Edition, 2021.
2	Ahmad Sahar and Craig Clayton, “iOS 15 Programming for Beginners: Kickstart your mobile app development journey by building iOS apps with Swift 5.5 and Xcode 13”, Packt Publishing, 6th edition, 2021
3	Jakob Iversen, Michael Eierman, “Mobile App Development for iOS and Android”, Prospect Press 2nd edition, 2017.
4	Jakob Iversen, Michael Eierman, “Mobile App Development for iOS and Android”, Prospect Press, 2nd edition, 2017
5	https://www.apptunix.com/blog/artificial-intelligence-tools-for-mobile-app-development/

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	1	0	1	1	0	2	2	2	0
CO2	3	3	3	2	3	1	0	2	2	2	2	3	2	0
CO3	3	2	3	1	3	1	0	2	2	2	2	3	2	0

CO4	2	3	2	3	3	2	1	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	1	3	3	3	3	3	3	3
AVG	**2.8**	**2.6**	**2.6**	**2**	**3**	**1.4**	**0.4**	**2**	**2**	**1.8**	**2.4**	**2.8**	**2.4**	**1**

Product Based Projects(Team)	
1.	AI-Powered Personal Health & Wellness Monitoring App
2.	Smart Grocery Assistant Using Computer Vision for Product Recognition
3.	AI-Based Real-Time Language Translation Mobile App
4.	Intelligent Travel Planner with Route Optimization and Cost Prediction
5.	Voice-Enabled Virtual Study Assistant for Students
6.	AI-Driven Emotion Recognition and Mood Tracking App
7.	Plant Disease Detection Mobile App Using Deep Learning
8.	Smart Expense Manager with Automatic Bill & Receipt Classification
9.	AI-Based Personalized Workout and Diet Recommendation App
10.	Real-Time Traffic Sign Recognition App for Driver Assistance

VERTICAL 5:CYBER SECURITY AND FORENSICS								
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24CSP41	Ethical Hacking	PEC	60	2	0	2	3
2	U24CSP42	Digital And Mobile Forensics	PEC	60	2	0	2	3
3	U24ADP41	Social Network Security	PEC	60	2	0	2	3
4	U24CSP44	Modern Cryptography	PEC	45	3	0	0	3
5	U24CSP45	AI for Cyber Security	PEC	45	2	0	2	3
6	U24CSP46	Cryptocurrency And Block chain Technologies	PEC	45	3	0	0	3

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U24CSP41	ETHICAL HACKING	L	T	P	C
		2	0	2	3

Course Objectives

1	Explain ethical hacking roles, legal/ethical boundaries, and basic TCP/IP layers.
2	Perform foot printing, reconnaissance, scanning, enumeration, and vulnerability analysis using industry tools.
3	Execute controlled system, web-application, and wireless exploits in a lab environment.
4	Design and configure defenses (ACLs, firewalls, IDS/IPS, honeypots) and prepare incident response.
5	Produce professional penetration-test reports with findings and remediation.

UNIT 1 INTRODUCTION — **6+6**

Ethical Hacking Overview - Role of the ethical hacker and Penetration Testing -methodologies – Gaining access –front doors- back doors- Trojan Horses – software vulnerability exploitation- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing. - Network and Computer Attacks - Malware – Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

Experiential Learning (Activity Based Learning): Create an incident response checklist for a small enterprise

Industrial Application: Playbooks for SOCs and Managed Security Service Providers

Content Beyond Syllabus: Zero Trust and identity-centric security.

Practical:

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP.

UNIT 2 FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS — **6+6**

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

Experiential Learning (Activity Based Learning): Find specific pieces of intel from a seeded target

Industrial Application: Brand protection & threat intelligence for marketing/legal teams.

Content Beyond Syllabus: Dark web basics and ethical boundaries for OSINT.

Practical:

1. Check your digital footprint: www.saymine.com/digital-footprint-assistant
2. Practice the basics of reconnaissance.
3. Using FOCA / Search Diggity tools, extract metadata and expanding the target list.

UNIT 3 ENUMERATION AND VULNERABILITY ANALYSIS — **6+6**

Access control requirements for Cloud infrastructure – User Identification – Authentication and Enumeration Concepts – NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration – Vulnerability Assessment Concepts – Desktop and Server OS Vulnerabilities – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities in Windows– Linux OS Vulnerabilities – Vulnerabilities of Embedded OS

Experiential Learning (Activity Based Learning): Run authenticated and unauthenticated Nessus/open-source scans, then triage results — mark true/false positives.

Industrial Application: Vulnerability scanning programs in DevOps pipelines (SAST/DAST + vulnerability triage).

Content Beyond Syllabus: False positive handling & scan tuning for enterprise tooling.

Practical:

1. Aggregate information from public databases using online free tools like Paterva's Maltego.
2. Information gathering using tools like Robtex.

UNIT 4 SYSTEM HACKING — **6+6**

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

Experiential Learning (Activity Based Learning): End-to-end web app pentest

Industrial Application: Web application red teaming and secure SDLC reviews.

Content Beyond Syllabus: Container and microservices security pitfalls

Practical:

1. Scan the target using tools like Nessus.
2. View and capture network traffic using Wireshark.

UNIT 5 NETWORK PROTECTION SYSTEMS	**6+6**

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

Experiential Learning (Activity Based Learning): Configure a basic Suricata/Zeek/OSSEC instance to detect seeded attacks; analyze alerts and tune rules.

Industrial Application: Building incident response playbooks and running tabletop exercises.

Content Beyond Syllabus: Automation in IR (SOAR playbooks).

Practical:

1. Automate dig for vulnerabilities and match exploits using Armitage.

TOTAL: 60 PERIODS

Course Outcomes

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

CO1	Explain basics of computer based vulnerabilities.
CO2	Analyze different foot printing, reconnaissance and scanning methods.
CO3	Demonstrate the enumeration and vulnerability analysis methods
CO4	Apply ethical hacking options available in Web and wireless applications.
CO5	Analyze the solutions for network protection.

TEXT BOOKS

1	Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2	Patrick Engebretson, The Basics of Hacking and Penetration Testing, SYNGRESS, Elsevier, 2013.

REFERENCES

1	Dafydd Stuttard and Marcus Pinto, The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws, 2011.
2	Justin Seitz, Black Hat Python: Python Programming for Hackers and Pentesters, 2014.
3	Daniel G. Graham, Ethical Hacking: A Hands-on Introduction to Breaking In, 2021
4	Lee Allen Advanced Penetration Testing for Highly-secured Environments: The Ultimate Security Guide, Packt publishing 2012

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	1	-	-	1	2	2	1	2	2	3

CO2	3	3	3	2	1	-	-	2	2	1	1	2	2	2
CO3	3	3	3	2	1	-	-	1	2	1	2	3	3	1
CO4	3	3	3	2	1	-	-	1	3	3	3	1	1	2
CO5	3	3	3	2	1	-	-	2	1	1	1	1	1	3
AVG	3	3	3	2	1	-	-	1.4	2	1.6	1.6	1.8	1.8	2.2

Product Based Projects (Teams)

1. Vulnerability Assessment of a Web Application Using Kali Linux
2. Penetration Testing of Wi-Fi Networks
3. SQL Injection Detection and Prevention Tool
4. Password Cracking and Defense Techniques
5. Web Application Firewall (WAF) Implementation
6. Network Sniffing and Traffic Analysis Tool
7. Phishing Attack Simulation and Awareness System
8. Ethical Hacking of Android Applications
9. Brute Force Attack Detection System
10. Cross-Site Scripting (XSS) Attack Simulation
11. Secure Login System with Attack Mitigation
12. Malware Analysis Using Sandbox Environment
13. Social Engineering Attack Simulation Tool
14. Denial of Service (DoS) Attack Detection System
15. Ethical Hacking of Cloud-Based Applications
16. Secure Network Design Against Common Attacks
17. Keylogger Detection and Prevention Tool
18. Email Spoofing Detection System
19. Penetration Testing Report Automation Tool
20. Ethical Hacking Framework for Educational Labs

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U24CSP42	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		2	0	2	3

Course Objectives

1	Understand the fundamentals of digital forensics and phases of the forensic process.
2	Explain digital crimes, related laws, and evidence collection methods.
3	Apply forensic readiness frameworks for law enforcement and enterprises.
4	Perform iOS and Android forensic investigations using standard tools.
5	Analyze and present digital evidence in a legally admissible format.

UNIT 1 INTRODUCTION TO DIGITAL FORENSICS — **6**

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

Industrial Application : Digital evidence handling in **cybercrime investigations**

Content Beyond Syllabus : Forensic imaging and hashing standards

Experiential Learning (Activity Based Learning): Simulate the five-phase forensic process on a sample incident

UNIT 2 DIGITAL CRIME AND INVESTIGATION — **6+6**

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

Experiential Learning (Activity Based Learning): Install and use **Sleuth Kit** to list and analyze allocated/unallocated disk blocks.

Industrial Application : investigation of hacking, phishing, and cyber fraud.

Content Beyond Syllabus : Digital evidence admissibility laws in India, US, and EU.

Practical:

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.

UNIT 3 DIGITAL FORENSIC READINESS — **6+6**

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

Experiential Learning (Activity Based Learning): Extract call logs and SMS data using Sleuth Kit and generate forensic summaries.

Industrial Application : **Cloud service providers** implementing forensic-ready logging and audit trails.

Content Beyond Syllabus : Frameworks: ISO/IEC 27037 – Guidelines for identification, collection, and preservation of digital evidence.

Practical:

1. Data extraction from call logs using Sleuth Kit.
2. Data extraction from SMS and contacts using Sleuth Kit.

UNIT 4 IOS FORENSICS — **6+6**

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

Experiential Learning (Activity Based Learning): Install **Mobile Verification Toolkit (MVT)**, decrypt an encrypted iOS backup, and parse records.

Industrial Application : **App security analysis** for mobile developers and security firms.

Content Beyond Syllabus : Forensic implications of **Apple's CSAM scanning** and privacy policies.

Practical:

1. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
2. Process and parse records from the iOS system..

UNIT 5 ANDROID FORENSICS	**6+12**

Android basics – Key Codes – Android Debug Bridge (ADB) – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling – Mobile and Embedded Forensics

Experiential Learning (Activity Based Learning): Extract installed apps and system data via **ADB**.

Industrial Application : **Mobile app developers** validating data security and privacy compliance.

Content Beyond Syllabus : Reverse engineering and **APK decompilation** for evidence extraction.

Practical:

1. Extract installed applications from Android devices.
2. Extract diagnostic information from Android devices through the ADB protocol.
3. Generate a unified chronological timeline of extracted records.

TOTAL: 60 PERIODS

Course Outcomes

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

CO1	Explain the concepts of digital forensics.
CO2	Analyze digital crimes and its investigations.
CO3	Apply digital forensics in real world applications
CO4	Investigate digital evidence from iOS devices.
CO5	Investigate digital evidence from Android devices.

TEXT BOOKS

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

REFERENCES

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

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	1	-	-	1	1	3	3	1	3	1
CO2	3	3	3	2	1	-	-	2	2	1	2	1	3	1
CO3	3	3	3	2	1	-	-	3	2	1	1	3	2	3
CO4	3	3	3	2	1	-	-	1	3	3	2	1	3	3
CO5	3	3	3	2	1	-	-	2	3	2	3	1	2	1
AVG	3	3	3	2	1	-	-	1.8	2.2	2	2.2	1.4	2.6	1.8

Product Based Projects (Teams)

1. Mobile Phone Data Extraction and Analysis Tool
2. Digital Evidence Collection and Preservation System

3. Android Forensic Analysis Application
4. Call Log and SMS Forensic Analyzer
5. Deleted File Recovery Tool
6. Email Forensics Investigation System
7. Image Metadata (EXIF) Analysis Tool
8. Browser History and Cache Forensic Analyzer
9. Memory Dump Analysis Tool
10. GPS Location Tracking and Forensic Analysis
11. File Integrity Verification Using Hashing
12. Digital Timeline Reconstruction Tool
13. Mobile Malware Forensic Detection System
14. Cloud Storage Forensic Investigation Tool
15. Chat Application Forensics (WhatsApp/Telegram)
16. USB Device Activity Forensic Analysis
17. Network Forensics Traffic Analyzer
18. Cybercrime Evidence Management System
19. Disk Imaging and Analysis Tool
20. Mobile Device Usage Pattern Forensics

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U24ADP41	SOCIAL NETWORK SECURITY	L	T	P	C
		2	0	2	3

Course Objectives

1	To develop semantic web related simple applications
2	To explain Privacy and Security issues in Social Networking
3	To explain the data extraction and mining of social networks
4	To discuss the prediction of human behavior in social communities
5	To describe the Access Control, Privacy and Security management of social networks

UNIT 1 FUNDAMENTALS OF SOCIAL NETWORKING — **6+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.

Practical:

1. Build a social network using Python (NetworkX)
2. Design own social media application

Industrial Application: Influence analysis in digital marketing

Experiential Learning (Activity Based Learning): Sample High-Impact Activities

Content Beyond Syllabus: Historical overview of privacy and security

UNIT 2 SECURITY ISSUES IN SOCIAL NETWORKS — **6+6**

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

Practical:

3. Read and write Data from Graph Database
4. Implement secure search in social media

Industrial Application: Anonymization in healthcare social platforms

Experiential Learning (Activity Based Learning): Privacy Violation Case Study

Content Beyond Syllabus : Dark web social networks

UNIT 3 EXTRACTION AND MINING IN SOCIAL NETWORKING DATA — **6+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, Big data and Privacy

Practical:

5. Implementation of Fake account detection using ML
6. Implementation of Privacy risk scoring system

Industrial Application: Social graph mining for ad personalization

Experiential Learning (Activity Based Learning): Community Detection Game

Content Beyond Syllabus : Applications of community mining algorithms

UNIT 4 PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES — **6+6**

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

Practical:

7. Find "Friend of Friends" using Neo4j
8. Neo4j graph database creation

Industrial Application: Neo4j-based recommendation engines

Experiential Learning (Activity Based Learning): Fake Profile Detection

Content Beyond Syllabus : Trust in online environment

UNIT 5 ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT	**6+6**

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

Practical:

9. Create a simple Security & Privacy detector
10. Implement Anonymization using k-anonymity

Industrial Application: Zero Trust Security models

Experiential Learning (Activity Based Learning): Role-Based Access Simulation

Content Beyond Syllabus :Role of Identity provisioning

TOTAL PERIODS	**: 60**

Course Outcomes

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

CO1	Develop semantic web related simple applications
CO2	Address Privacy and Security issues in Social Networking
CO3	Explain the data extraction and mining of social networks
CO4	Discuss the prediction of human behavior in social communities
CO5	Describe the applications of social networks

TEXT BOOKS

1	Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2	BorkoFurht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3	Learning Neo4j 3.x – Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4	David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES

1	Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.
2	Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
3	GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.
4	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
5	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling", IGI Global Snippet, 2009.
6	John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	3	2	-	-	-	3	2	1	3	3	2
CO2	2	2	2	3	3	-	-	-	1	2	2	3	3	2
CO3	2	1	1	3	2	-	-	-	1	2	1	1	3	3
CO4	3	3	3	3	2	-	-	-	1	1	1	2	1	3
CO5	1	3	2	2	2	-	-	-	1	1	3	2	3	3
AVG	2.2	2	2	2.8	2.2	-	-	-	1.4	1.6	1.6	2.2	2.6	2.6

Product Based Projects (Teams)

1. Fake Social Profile Detection using ML
2. Phishing Attack Detection in Social Media
3. Privacy Leakage Analyzer Tool
4. Deep fake Detection System
5. Social Engineering Attack Simulator
6. Community Detection in Online Forums
7. Influence Maximization System
8. Social Recommendation Engine
9. Opinion Mining on Social Data
10. Human Behavior Prediction System

Meenakshi Sundararajan Engineering College

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

Department: Artificial Intelligence and Data Science, R2024, CBCS

U24CSP44	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

Course Objectives

1	Understand the basic principles of cryptography and general cryptanalysis.
2	Understand the concepts of symmetric encryption and authentication.
3	Identify the use of public key encryption, digital signatures, and key establishment.

UNIT 1 INTRODUCTION — **9**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap– door permutation, Goldwasser– Micali Encryption. Goldreich– Levin Theorem: Relation between Hardcore Predicates and Trap– door permutations.

Experiential Learning (Activity Based Learning): Semantic Security (SS) & Message Indistinguishability (MI) Simulation

Industrial Application: Symmetric Key Cryptography for VPN & TLS Sessions

Content Beyond Syllabus : Trapdoor Permutations

UNIT 2 FORMAL NOTIONS OF ATTACKS — **9**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND– CPA), Chosen Ciphertext Attacks (IND– CCA1 and IND– CCA2), Attacks under Message Non– malleability: NM– CPA and NM– CCA2, Inter– relations among the attack model

Experiential Learning (Activity Based Learning): IND–CPA (Chosen Plaintext Attack) Simulation

Industrial Application: Chosen Ciphertext Attack (IND–CCA1 & IND–CCA2)

Content Beyond Syllabus : Message Non-Malleability Attacks (NM–CPA & NM–CCA2)

UNIT 3 RANDOM ORACLES — **9**

Provable Security and asymmetric cryptography, hash functions. One– way functions: Weak and Strong one– way functions. Pseudo– random Generators (PRG): Blum– Micali– Yao Construction, Construction of more powerful PRG, Relation between One– way functions and PRG, Pseudo– Random Functions (PRF)

Experiential Learning (Activity Based Learning): Pseudo-Random Generator (PRG) – Blum–Micali–Yao Construction

Industrial Application: Provable Security and Asymmetric Cryptography on Blockchain & Cryptocurrencies

Content Beyond Syllabus : Pseudo-Random Generators (PRG)

UNIT 4 BUILDING A PSEUDORANDOM PERMUTATION — **9**

Secure Strong Pseudorandom Permutation (SPRP) - The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

Experiential Learning (Activity Based Learning): Implementing a 3-Round Luby-Rackoff Feistel Network

Industrial Application: DES in the Light of Luby-Rackoff Construction for Legacy Systems

Content Beyond Syllabus : Application to Block Cipher Construction

UNIT 5 MESSAGE AUTHENTICATION CODES — **9**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One– way functions – Secure One– time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols. Coin flopping over telephone protocol

Experiential Learning (Activity Based Learning): Demonstrate the concept of indistinguishability in encryption.

Industrial Application: Public Key Signature Schemes (PKS) for Full Domain Hash (FDH)

Content Beyond Syllabus: Security reductions of MACs to PRFs.

TOTAL: 45 PERIODS

Course Outcomes

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

CO1	Interpret the basic principles of cryptography and general cryptanalysis.
CO2	Analyze the concepts of symmetric encryption and authentication.
CO3	Identify the use of public key encryption, digital signatures, and key establishment.
CO4	Analyze the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
CO5	Analyze the use of Message Authentication Codes.

TEXT BOOKS

1	Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
2	Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2003.

REFERENCES

1	Mark Stamp, “Information Security Principles and Practices”, John Wiley & Sons, 2011.
2	Shaffi Goldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/., 2001.
3	OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23, 2009.
4	William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 3rd Edition, 2006.
5	Jonathan Katz and Yehuda Lindell, Introduction to Modern Cryptography, 2nd edition, CRC Press 2014

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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CO1	3	3	3	3	1	-	-	2	1	1	2	2	1	1
CO2	1	3	2	1	2	-	-	3	2	2	2	2	1	3
CO3	3	1	2	1	3	-	-	1	1	1	3	1	1	3
CO4	3	1	2	1	3	-	-	3	2	1	2	3	2	1
CO5	2	3	3	3	3	-	-	3	1	1	1	2	1	1
AVG	2	2	2	2	2	0	0	2	1	1	2	2	1	2

Product Based Projects (Teams)

1. Secure File Encryption Using AES and RSA
2. Image Encryption and Decryption System
3. Secure Chat Application Using Cryptography
4. Digital Signature Implementation System
5. Public Key Infrastructure (PKI) Simulation
6. Secure Password Storage Using Hashing Algorithms
7. Hybrid Encryption System Design
8. Blockchain-Based Secure Data Storage
9. Cryptographic Key Management System
10. Secure Cloud Storage Using Encryption

11. Performance Comparison of Encryption Algorithms
12. Steganography with Cryptographic Security
13. Secure E-Voting System Using Cryptography
14. Cryptanalysis of Weak Encryption Schemes
15. Authentication System Using Hash and Salt
16. Secure File Sharing Application
17. Encrypted Database Management System
18. Secure Email Communication System
19. Quantum Cryptography Concept Simulation
20. Cryptography-Based Digital Rights Management System

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U24CSP45	AI FOR CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1.	Understand the fundamentals of cybersecurity.
2.	Explore network security techniques and tools.
3.	Learn about application security practices.
4.	Analyze malware through static and dynamic analysis, classification methods, and detection techniques.
5.	Examine the role of AI in cybersecurity.

UNIT 1- OVERVIEW OF CYBER SECURITY — **9**

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security Attacks– Policy, Mission and Vision of Cyber Security Program. Cyber security management system – goals, technology categories – perimeter defense and encryption. Cyber security management framework.

Industry Application: Overview of Cyber Security Operations Centers (SOC)

Experiential Learning: Simulating password attacks using Kali Linux.

Content Beyond Syllabus :Block chain for cybersecurity

UNIT 2- NETWORK SECURITY — **9**

Introduction to Intrusion detection – Types of IDS– IDS threat taxonomy - IDS Evaluation Metrics - AI based techniques for ID - Detecting DDos Attack – Credit Card fraud detection – Counterfeit bank note detection – Ad blocker –IoT device type identification – Deepfake recognition. Anomaly Detection – Types of anomalies – Anomaly detection with data and algorithms – Challenges in Anomaly detection.

Industry Application: Framework of Telecom network monitoring

Experiential Learning: Kaggle cybersecurity dataset analysis

Content Beyond Syllabus: Federated learning for security

UNIT 3- APPLICATION SECURITY — **9**

Phishing Webpage and Email detection - Introduction to detecting spam – Spam filters – Perceptron based spam filter – Spam detection with SVMs – Phishing detection using logistic regression and decision trees – Spam detection with Naïve Bayes

Industry Application: Study of Banking anti-phishing systems

Experiential Learning: Create phishing URL detector

Content Beyond Syllabus: Secure software development lifecycle (SSDLC)

UNIT 4- MALWARE ANALYSIS — **9**

Understanding Malware – Defining Malware Classification – Static and dynamic malware analysis –Feature Generation and classification - Malware detection using decision trees – Random forest malware classifier – Clustering malware with k-means – Detecting metamorphic malware with HMMs.

Industry Application: Overview of Endpoint protection systems

Experiential Learning: Clustering malware families

Content Beyond Syllabus: AI-based rootkit detection

UNIT 5- AI IN CYBER SECURITY AND TOOLS — **9**

Alert management – Raw data analysis – Risk Exposure Assessment– Cyber threat Intelligence. - Problems of AI in Cyber Security – Future of AI in Cybersecurity- Cyber Vulnerability Tools – Cyber Monitoring tools – Cyber risk assessment tools.

Industry Application: Study of Automated SOC using AI

Experiential Learning: Compare human vs AI analyst

Content Beyond Syllabus: Generative AI for cyber attacks	
TOTAL PERIODS:	**45**

COURSE OUTCOMES:	
At the end of the Course Students will be able to	
CO 1	Grasp the fundamentals of Cyber security.
CO 2	Knowledge of malware and countermeasures.
CO 3	Ability to detect Intrusion and Anomaly detection using AI algorithms.
CO 4	Able to realize Application security using AI.
CO 5	Gain knowledge of other roles of AI in Cyber security.
TEXTBOOKS	
1.	Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
2.	Clarence Chio, David Freeman, " Machine Learning and Security : Protecting Systems with Data and Algorithms", O'Reilly publication, 1st Edition, ISBN -1491979909.
3.	Garnett,"Cybersecurity in the Digital Age: Tools, Techniques, and Best Practices, Wolters Kluver, 2019.
REFERENCES	
1.	Apruzzese, Giovanni, et al. "The role of machine learning in cybersecurity." Digital Threats: Research and Practice 4.1 (2023): 1-38.
2.	Sumeet Dua, Xian Du, "Data Mining and Machine Learning in Cybersecurity", CRC Press Publication, 1st Edition, ISBN 9781439839423
3.	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011
4.	Research papers on AI for Cyber Security.

CO-PO, PSO Mapping

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Product Based Projects (Teams)	
1.	AI-Based Intrusion Detection System
2.	Real-Time DDoS Attack Detector
3.	IoT Device Fingerprinting System
4.	Credit Card Fraud Detection

5.	Network Traffic Anomaly Analyzer
6.	Email Spam Detection System
7.	Phishing Website Detection Tool
8.	Fake News Detection System
9.	Ad Fraud Detection System
10.	Social Media Bot Detection
11.	Malware Family Classification System
12.	Ransomware Detection Tool
13.	Ransomware Detection Tool
14.	Metamorphic Malware Analyzer
15.	Malware Clustering Engine
16.	Dynamic Malware Behavior Tracker
17.	AI-Powered SOC Dashboard
18.	Cyber Risk Prediction System
19.	Cyber Threat Intelligence Platform
20.	Autonomous Cyber Defense Agent

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U24CSP46	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives

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

UNIT 1 INTRODUCTION TO BLOCKCHAIN — **9**

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

Experiential Learning (Activity Based Learning) : Implement a mini blockchain prototype using Python/Java demonstrating block creation, chaining, and hash validation.

Industrial Application : Secure data recording and auditing systems in financial institutions using blockchain-based ledgers for tamper-proof transaction tracking.

Content Beyond Syllabus : Deep analysis of Merkle Trees and Hash Pointers for data integrity verification in decentralized systems.

UNIT 2 BITCOIN AND CRYPTOCURRENCY — **9**

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

Experiential Learning (Activity Based Learning) : Simulate a Bitcoin transaction flow and demonstrate double-spending prevention using wallet and block simulation tools.

Industrial Application : Cryptocurrency payment networks such as Bitcoin and Ethereum used for cross-border payments, remittances, and digital asset management.

Content Beyond Syllabus : Exploration of Layer-2 scaling solutions like the Lightning Network to enable faster, low-cost Bitcoin transactions.

UNIT 3 BITCOIN CONSENSUS — **9**

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

Experiential Learning (Activity Based Learning) : Compare PoW vs PoS by simulating mining difficulty

Industrial Application : Consensus algorithms like Proof of Work (PoW) and Proof of Stake (PoS) applied in IoT security and energy-efficient distributed networks.

Content Beyond Syllabus : Study of Hybrid Consensus Mechanisms and Proof of Authority (PoA) for enterprise blockchain solutions.

UNIT 4 HYPERLEDGER FABRIC & ETHEREUM — **9**

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

Experiential Learning (Activity Based Learning) : Develop a smart contract using Solidity on the Remix IDE and test deployment on a local Ethereum test network.

Industrial Application : Use of Hyperledger Fabric in supply chain management and healthcare data sharing;

Ethereum powering DeFi and NFT marketplaces. Content Beyond Syllabus : Introduction to Layer-2 protocols (e.g., Polygon) and smart contract optimization techniques in Solidity.	
UNIT 5 BLOCKCHAIN APPLICATIONS	**9**
Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study. Experiential Learning (Activity Based Learning) : Implement a Pseudo-Random Generator (PRG) using the Blum–Micali–Yao Construction and analyze its cryptographic strength. Industrial Application : Provable Security and Asymmetric Cryptography in Blockchain & Cryptocurrencies ensuring non-repudiation, confidentiality, and integrity in decentralized systems. Content Beyond Syllabus : Pseudo-Random Generators (PRG) and their role in cryptographically secure blockchain algorithms	
TOTAL: 45 PERIODS	

Course Outcomes

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

CO1	Explain emerging abstract models for Blockchain Technology
CO2	Analyze challenges and technical gaps in the crypto currency domain.
CO3	Analyze consensus mechanism in bitcoin
CO4	Compare hyperledger Fabric and Ethereum platform to implement the Blockchain Application.
CO5	Implement blockchain in real world applications

TEXT BOOKS

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

REFERENCES

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

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	2	1	1	2	2	1	1
CO2	3	3	3	3	1	-	-	3	2	2	2	2	1	3
CO3	3	3	3	3	1	-	-	1	1	1	3	1	1	3
CO4	3	3	3	3	1	-	-	3	2	1	2	3	2	1

CO 5	3	3	3	3	1	-	-	3	2	1	2	3	2	1
AVG	3	3	3	3	1	-	-	2	1	1	2	2	1	2

Product Based Projects (Teams)

1. Blockchain-Based Secure Voting System
2. Cryptocurrency Wallet Application
3. Smart Contract Development and Testing
4. Blockchain-Based Supply Chain Management System
5. Secure Digital Identity Using Blockchain
6. Cryptocurrency Price Prediction Using AI
7. Blockchain-Based Land Registration System
8. Decentralized File Storage System
9. Blockchain-Based E-Commerce Platform
10. Smart Contract Vulnerability Detection Tool
11. Blockchain-Based Healthcare Record Management
12. Decentralized Payment Gateway
13. Token-Based Crowdfunding Platform
14. Blockchain-Based Certificate Verification System
15. Cryptocurrency Mining Simulation Tool
16. Blockchain-Based Access Control System
17. Decentralized Social Networking Platform
18. Secure IoT Data Sharing Using Blockchain
19. Blockchain-Based Copyright Protection System
20. Blockchain Explorer and Transaction Analyzer

VERTICAL 6: MULTIMODEL PROCESSING								
S. No	**COURSE CODE**	**COURSETITLE**	**CATEGORY**	**TOTAL CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	U24ADP61	Quantum Computing	PEC	45	3	0	0	3
2	U24ITP55	Augmented Reality	PEC	60	2	0	2	3
3	U24ITP56	Virtual Reality	PEC	60	2	0	2	3
4	U24ADP62	Game Development	PEC	60	3	0	0	3
5	U24ADP63	Large Language Models	PEC	45	3	0	0	3
6	U24ADP64	Agentic AI	PEC	60	2	0	2	3

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U24ADP61	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

1	Learn the basic concepts of quantum computation and experimental quantum information processing.
2	Study quantum mechanics principles along with traditional computational models like Turing machines and circuits.
3	To explore and acquire knowledge of quantum circuits, algorithms, universal quantum gates and the Quantum Fourier Transform.
4	To study about quantum noise, quantum operations, error correction, entropy and distance measures for quantum information.
5	Explore quantum algorithms for machine learning and understand quantum versions of linear and probabilistic models.

UNIT I FUNDAMENTAL CONCEPTS — **9**

Global Perspectives - Quantum Bits - Quantum Computation - Quantum Algorithms - Experimental Quantum Information Processing - Quantum Information.
Content Beyond Syllabus: Quantum Machine Learning (QML) basics.
Experiential Learning: Students simulate quantum search vs classical search performance comparison.
Industrial Application: Cybersecurity: Quantum-resistant algorithm development.

UNIT II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS — **9**

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications - EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems. Content Beyond Syllabus:Quantum Gate Decomposition techniques.
Experiential Learning: Create and execute a quantum circuit on IBM Quantum Experience Cloud.
Industrial Application:Quantum communication networks using teleportation and entanglement.

UNIT III QUANTUM COMPUTATION — **9**

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit - Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers
Content Beyond Syllabus:Variational Quantum Algorithms (VQE, QAOA).
Experiential Learning: Students simulate quantum search vs classical search performance comparison.
Industrial Application: Quantum optimization for portfolio management.

UNIT IV QUANTUM INFORMATION — **9**

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy
Content Beyond Syllabus:Quantum Capacity Theorem.
Experiential Learning:Design a quantum communication model with noisy channels and analyze error rates.
Industrial Application:Cybersecurity: Quantum cloud computing with error correction encoding.

UNIT V QUANTUM MACHINE LEARNING — **9**

Quantum Clustering - Quantum K-Means and K-Medians- Quantum Classifiers - Nearest neighbours - Support Vector Machine (SVM) in quantum space - Quantum Principal Component Analysis - Feature Maps - Linear Models - Probabilistic Models - Quantum Neural Networks Content Beyond Syllabus: Quantum blockchain and quantum-secure communication protocols. Experiential Learning: Simulate secure key exchange using BB84. Industrial Application: Quantum-secure financial transactions (banks adopting QKD).	
TOTAL PERIODS	**: 45**
Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the basics of quantum computing.
CO2	Understand the background of Quantum Mechanics.
CO3	Analyse the computation models.
CO4	Model the circuits using quantum computation.
CO5	Understand the quantum operations such as noise and error–correction.
TEXT BOOKS	
1	Santanu Ganguly, "Quantum Machine Learning: an Applied Approach : The Theory and Application of Quantum Machine Learning in Science and Industry", Publisher Apress L. P., 2021.
2	Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition, 2020.
3	Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
REFERENCES	
1	Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
2	Jack D. Hidary, "Quantum Computing: An Applied Approach" 1st edition, Springer, 2019.
3	Chris Bernhardt, "Quantum Computing for Everyone", The MIT Press; Reprint edition, 2020.
4	N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-	-	-	-	-	-	-	-	1	1	1
CO2	3	3	3	-	-	-	-	-	-	-	-	1	1	1
CO3	3	3	3	3	2	-	-	-	-	-	3	2	2	2
CO4	3	3	3	3	2	1	-	1	-	-	3	2	2	2

CO5	3	3	3	3	2	-	-	-	-	-	-	1	1	1
AVG	3	3	2.8	3	2	**1**	**-**	**1**	-	**-**	**3**	1.4	1.4	1.4

Product based Projects (Team)	
1	Simulation of Quantum Bit Operations using IBM Quantum Experience
2	Design and Analysis of Quantum Teleportation Protocol
3	Implementation of Superdense Coding using Quantum Circuits
4	Bell Inequality Violation Analysis through Quantum Simulation
5	Implementation of Grover's Quantum Search Algorithm
6	Shor's Algorithm for Integer Factorization using Qiskit
7	Quantum Error Correction using Noise Models
8	Quantum Key Distribution (QKD) Simulation for Secure Communication
9	Quantum Principal Component Analysis (Quantum PCA)
10	Quantum Support Vector Machine (QSVM) for Classification

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24ITP55	AUGMENTED REALITY	L	T	P	C
		2	0	2	3

Course Objectives:

1	Understand AR Fundamentals
2	Develop AR Applications
3	Integrate Digital and Physical Worlds.
4	Optimize AR Experiences
5	To equip learners with skills to design, develop, and monetize engaging augmented reality games using Unity with interactive and social features.

UNIT 1 INTRODUCTION TO AUGMENTED REALITY **6+6**

Overview of Augmented Reality (AR) and its applications - Evolution of AR technologies and devices - Introduction to Unity 3D for AR development - Setting up Unity for AR development - Creating a simple AR project in Unity using AR Foundation

Practical:

1. **Introduction to AR and Project Setup**
   - Install Unity and AR Foundation package.
   - Set up a new AR project for Android/iOS.
   - Familiarize with Unity's AR interface and basic components.
2. **Basic AR Scene Setup**
   - Create a basic AR scene with AR Session and AR Session Origin.
   - Understand and configure AR Camera.
3. **Plane Detection and Visualization**
   - Implement plane detection using AR Plane Manager.
   - Visualize detected planes in the real world.

Experiential Learning (Activity Based Learning): AR solutions for remote assistance, fault diagnosis

Industrial Application : Build an AR application for product visualization, or maintenance support.

Content Beyond Syllabus :Introduction to markerless AR, cloud anchors, and AI-based object recognition in AR

UNIT 2 AR DEVELOPMENT TOOLS AND PLATFORMS **6+6**

Exploring AR development platforms and tools - Understanding ARCore and ARKit - Introduction to Vuforia for AR content creation - Implementing image recognition and tracking in AR projects - Integrating real-world data into AR applications

Practical:

4. Placing Objects on Detected Planes
   - Place 3D objects on detected planes.
   - Implement touch-based interaction to place objects.
5. Object Manipulation (Move, Rotate, Scale)
   - Implement object manipulation features.
   - Allow users to move, rotate, and scale placed objects.

Experiential Learning (Activity Based Learning):AR application using Vuforia that performs image recognition and displays contextual digital content based on tracked real-world images.

Industrial Application: AR solutions for marketing, manufacturing, and education for interactive product

catalogues, equipment identification, and smart manuals.
Content Beyond Syllabus :Introduction to cloud-based image targets, WebAR, and integration of IoT sensor data into AR applications

UNIT 3 AR INTERACTION DESIGN	**6+6**

Principles of interaction design for AR - User input methods in AR: touch, gestures, voice commands - Designing intuitive AR user interfaces (UI) - Implementing interactive AR elements in Unity - User testing and feedback iteration in AR projects

Practical:

6. Image Tracking
   - Implement image tracking to recognize and augment images.
   - Place 3D objects based on recognized images.

7. Face Tracking
   - Implement face tracking using AR Face Manager.
   - Augment face with 3D models or effects.

Experiential Learning (Activity Based Learning): Implement an interactive AR user interface in Unity using touch, gesture, or voice-based inputs.
Industrial Application : Interactive AR interfaces in training systems, retail experiences, and smart field-service applications to improve user engagement and usability
Content Beyond Syllabus :Introduction to adaptive AR interfaces, usability analytics, and accessibility considerations for AR experiences.

UNIT 4 ADVANCED AR TECHNIQUES	**6+6**

Advanced AR development techniques and best practices - Implementing AR physics and animations - Creating marker-based and markerless AR experiences - Exploring AR cloud and persistent content - Optimizing AR projects for performance and scalability

Practical:

8. **Light Estimation and Shadows**
   - Implement light estimation to match real-world lighting conditions.
   - Add shadows to AR objects for more realism.

9. AR Navigation and Pathfinding
   - Implement basic AR navigation using AR Pathfinding.
   - Allow users to place waypoints and navigate through AR space.

Experiential Learning (Activity Based Learning):Build an AR application in Unity incorporating physics, animations, and both marker-based and marker less tracking
Industrial Application :AR solutions in manufacturing, architecture, and logistics for simulation
Content Beyond Syllabus: Introduction to AR cloud anchors, multi-user persistent AR experiences, and deployment strategies

UNIT 5 AR GAMING AND ENTERTAINMENT	**6+6**

Overview of AR gaming and entertainment industry - Designing and developing AR games in Unity - Implementing game mechanics in AR experiences - Integrating multiplayer and social features in AR games - Exploring monetization strategies for AR applications

Practical:

10. AR User Interface (UI)
    - Create a basic AR UI to control AR features.
    - Implement UI elements for toggling plane detection, resetting AR scene, etc.

Experiential Learning (Activity Based Learning): Develop a playable AR game in Unity with core game

mechanics and basic multiplayer or social interaction features.
Industrial Application : AR games in studios and media companies to create immersive, location-based and social gaming experiences.
Content Beyond Syllabus :Introduction to cross-platform AR gaming, analytics-driven monetization models, and live-ops strategies used in commercial AR games.

TOTAL PERIODS	**:60**

Course Outcomes

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

CO1	Demonstrate the ability to use Unity3D and relevant AR SDKs to develop AR applications.
CO2	Design and implement interactive AR applications that blend digital content with the physical world, enhancing user engagement.
CO3	Utilize advanced techniques for object recognition, tracking, and anchoring digital content to physical objects and environments.
CO4	Develop Marker & Marker Less AR Applications using Unity3D.
CO5	Integrate and manipulate 3D models and animations within AR environments to create compelling and immersive experiences

TEXT BOOKS

1.	Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia" by Jonathan Linowes and Krystian Babilinski.
2	Unity AR & VR by Tutorials" by Chris Byers, Brian Moakley, and Ray Wenderlich Tutorial Team
3	Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing" by Erin Pangilinan, Steve Lukas, and Vasanth Mohan
4	Augmented Reality Game Development: Build immersive AR experiences with Unity and ARCore" by Raja B.

REFERENCES

1	**https://learn.unity.com/**
2	**https://learn.unity.com/**

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PS O1**	**PS O2**	**PS O3**
CO1	2	3	3	1	3	-	-	-	-	-	-	3	3	3
CO2	2	3	3	2	3	1	-	-	1	-	2	3	3	3
CO3	3	3	3	2	3	1	-	-	1	-	2	3	3	3
CO4	3	2	3	3	3	2	-	2	1	-	2	3	3	3
CO5	2	2	3	3	3	2	1	2	1	1	2	3	3	3
AVG	2.5	2.6	3	2.2	3	1.5	1	2	1	1	2	3	3	3

PRODUCT BASED OUTCOMES

1.A VR environment (Unity/Unreal) with 3D objects, navigation, and interaction.

2.A flowchart tool or mini-software showing the graphics rendering pipeline (modeling → transformation →

lighting → rasterization → display).
3.A 3D object created using geometric primitives and mesh modeling (cube, sphere, complex shape).
4.An AR application that detects a marker/object and computes its 6DoF pose.
5.Ability to build an immersive AR experience demonstrating realistic interaction and rendering.
PRODUCT BASED PROJECTS(In Teams)
1. Solar System Model using AR
2. Museum Walkthrough using AR R
3. AR Face Filters Application
4. AR Classroom Environment
5. AR Navigation for Indoor Buildings
6. AR Tourism Guide
7. AR Furniture Placement Application
8. AR Flashcards for Alphabets / Numbers
9. AR Animated Textbook
10. AR Campus Tour

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U24ITP56	VIRTUAL REALITY	L	T	P	C
		2	0	2	3

Course Objectives

1	Introducing the concepts of Virtual Reality, Hardware & Industry usage.
2	Understand VR Concepts and Technologies.
3	Develop Immersive VR Experiences
4	Utilize VR Tools and SDKs.
5	Optimize Performance for VR.

UNIT 1 Introduction to Virtual Reality (VR) and Unity 3D — **6+6**

Overview of Virtual Reality (VR) and its applications - Introduction to Unity 3D for VR development - Setting up Unity for VR development - Understanding VR hardware: Oculus Rift, HTC Vive, etc. - Creating a basic VR project in Unity

Practical:

1. Introduction to VR and Project Setup

Install Unity and set up a new VR project.

Install and configure XR Plugin Management for Oculus, SteamVR, or other VR platforms.

Familiarize with Unity's VR interface and basic components.

2. Basic VR Scene Setup

Create a basic VR scene with XR Rig.

Configure VR camera and controllers.

Experiential Learning (Activity Based Learning): Build an VR-based virtual factory walkthrough in Unity that allows users to navigate and observe workflows

Industrial Application : VR applications for safety education.

Content Beyond Syllabus : Introduction to standalone VR devices, VR interaction toolkits

UNIT 2 VR Development Fundamentals — **6+6**

Design considerations for VR experiences - Implementing VR locomotion techniques - Creating immersive VR environments - Introduction to VR interaction mechanics - Optimizing VR projects for performance,

Practical:

3. VR Player Movement

- Implement basic player movement (teleportation and smooth locomotion).
- Use VR controller input to navigate the environment**.**

4. Interacting with Objects

- Implement object interaction using VR controllers.
- Allow users to pick up, move, and drop objects.

Experiential Learning (Activity Based Learning): VR environment in Unity that includes locomotion techniques and interactive objects

Industrial Application : VR for virtual prototyping to enhance safety and efficiency.

Content Beyond Syllabus : Introduction to motion-sickness mitigation techniques

UNIT 3 Advanced VR Interaction — **6+6**

Advanced VR interaction techniques - Implementing hand presence and hand tracking in VR - Creating interactive objects and UI elements in VR - Exploring physics interactions in VR environments - User testing and feedback iteration in VR projects

Practical:

5. UI in VR

- Create a basic VR UI using Unity's Canvas system.

- Implement UI elements that can be interacted with using VR controllers.

Experiential Learning (Activity Based Learning): VR application in Unity featuring hand tracking and physics-based interactions

Industrial Application : VR interaction systems are used training industries for skill practice, design review, and immersive simulations

Content Beyond Syllabus :Introduction to mixed reality (MR) interactions, haptic gloves

UNIT 4 VR Game Development	**6+6**

Overview of VR gaming industry - Designing and developing VR games in Unity - Implementing game mechanics in VR experiences - Integrating audio and spatial sound in VR games - Exploring multiplayer and social VR experiences

Practical:

6. Grabbing and Throwing Objects
   - Enhance object interaction to include grabbing and throwing objects.
   - Implement trajectory prediction for thrown objects.

Experiential Learning (Activity Based Learning): Develop a VR game in Unity that includes core gameplay mechanics and spatial audio

Industrial Application : VR games and social VR platforms for gaming studios and entertainment companies to deliver immersive and collaborative virtual experiences.

Content Beyond Syllabus :Introduction to cross-platform VR gaming, live multiplayer networking frameworks

UNIT 5 VR Simulation and Training Applications	**6+6**

Introduction to VR simulation and training applications - Design considerations for VR simulations - Creating realistic environments and scenarios in VR - Integrating AI and machine learning in VR simulations - Case studies of VR training applications

Practical:

7. VR Audio Integration
   - Add spatial audio for a more immersive experience.
   - Implement 3D sound effects and background music

8. Hand Presence and Animation
   - Implement hand presence using VR controller models.
   - Add animations to hand models for more realistic interactions

Experiential Learning (Activity Based Learning): Develop a VR-based training simulation in Unity for task-based scenarios

Industrial Application : VR training simulations for manufacturing, healthcare, aviation, and defense for safe, cost-effective skill training

Content Beyond Syllabus : Introduction to digital twin–based simulations and adaptive AI trainers

TOTAL PERIODS	**:60**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Comprehend the Concepts of XR, Hardware
CO2	Comprehend the XR experience & content types
CO3	Comprehend Industry 4.0, application XR for industry.
CO4	Comprehend delivery of XR content.
CO5	Design and Develop Metaverse & XR Content
TEXT BOOKS	
1	"Unity Virtual Reality Projects" by Jonathan Linowes
2	"Mastering Virtual Reality Development with Unity" by Jesse Glover

3	"Virtual Reality Beginner's Guide" by Samuel Greengard
4	"Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile" by Tony Parisi
5	
REFERENCES	
1	**https://learn.unity.com/**
2	https://community.unity.com/

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	3	-	-	-	-	-	-	2	2	2
AVG	3	3	3	2	3	-	-	-	-	-	-	2	2	2

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U24ADP63	GAME DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1	To acquire knowledge in game design and development
2	To learn the mathematics behind game development
3	To know the mechanics involved in game design
4	To acquire knowledge about the algorithms related to game development
5	To survey the gaming development environment and tool kits

UNIT – 1 INTRODUCTION TO GAME DESIGN **6+6**

Games- Designing and Developing Games-Genres- Understanding: Players, Machine-Game: Concepts, Worlds-Creative and Expressive Play- Character Development-Storytelling-Screenplay-Storyboard-Pre-visulaization- Script-Creating User Experience-Game play- Introduction to Core Mechanics- Game Balancing- Level Design

Practicals:

1.To design and develop a simple game concept using game genres, character development.

Content Beyond the Syllabus: Emotionally intelligent NPCs using GPT-like models

Industrial Application: Therapeutic games for mental health (e.g., VR for PTSD, anxiety)

Experiential Learning: Practical problems in game level design and Game Balancing.

UNIT – 2 FOUNDATIONS TO GAME DESIGN **6+6**

Cartesian Coordinate Systems-Vectors-Linear Interpolation- Multiple Coordinate Spaces-Matrices and Linear – Transformations - Polar Coordinate Systems-3D Rotations, Transformation, Scaling - Geometric Primitives-Viewing in 3D-Viewing Pipeline-Clipping Algorithms-Text Transformation.

Practicals:

1.To implement 2D Cartesian coordinate plotting and perform basic vector operations (addition, subtraction, magnitude).

Content Beyond the Syllabus: Homogeneous coordinates in 3D graphics

Industrial Application: 3D transformation for motion planning, inverse kinematics

Experiential Learning: problems in translation, scaling, zooming and rotation of 2D and 3D objects.

UNIT – 3 MECHANICS FOR GAME DESIGN **6+6**

Linear Kinematics and Calculus –Linear and Rotational Dynamics –Curves and Surfaces- Curves in 3D – Lighting-Shading - Shadowing- Depth Cueing- Projections - Perspective - Orthogonal -Intersection Testing - Rigid Body Dynamics - Animation System – Controller based animation- Cameras Details.

Practicals:

1.To simulate linear and rotational motion of an object.

Content Beyond the Syllabus: Constraint-based systems (e.g., inverse kinematics)

Industrial Application: Character rigs use procedural and mocap-driven animation

Experiential Learning:Discussion of Lighting and shading of objects, Open source language for Game development like PyGame	
UNIT – 4 ARCHITECTURE AND ALGORITHMS FOR GAME DEVELOPMENT	**6+6**
Foundation- Low-Level Engine System – State Based Behaviours – Strategy and Planning-Game Play - Path and Waypoints – Navigation – Behaviours - Collision Detection - Game Logic - Game Artificial Intelligence - Spatial Sorting - singleton - Object pooling-Basic Sound – 3D Sound - Event-Based Input Systems Practicals: 1.To implement a simple game engine module containing state-based behaviors Content Beyond the Syllabus: Hierarchical Finite State Machines (HFSMs) Industrial Application: Collision detection, navigation, and behavior logic used in training simulators (military, flight, driving) Experiential Learning: Input systems adapted to hand tracking, motion sensing, and spatial audio for immersive experience	
UNIT – 5 LANGUAGES FOR GAME DEVELOPMENT	**6+6**
Scripting Languages and Data Format – PyGame/Unity-Networked Games – Sample Game – iOS, Windows, Android-Developing 2D and 3D interactive games using Unity - DirectX – Isometric and Tile Based Games - Puzzle games - Single Player games - Multi Player game-Marker Systems Practicals: 1.To develop a simple 2D/3D game using scripting languages (Python/PyGame) Content Beyond the Syllabus: PyGame for prototyping and educational use Industrial Application: Using PyGame for teaching programming and game design fundamentals Experiential Learning:Pygame routines for character rendering, transformations and sound processing	
TOTAL PERIODS	**:60**

COURSE OUTCOMES:

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

CO 1	Understand the concepts and techniques used in game development.
CO 2	Understand the mathematical and graphical concepts used for game development
CO 3	Apply the physical and mechanical concepts for interactive and real time game development
CO 4	Design and develop algorithms for effective gaming environments
CO 5	Create and implement various applications for game development.

TEXTBOOKS

1.	Adam Kramarzewski and Ennio De Nucci, " Practical Game Design: A modern and Comprehensive Guide to Video game Design" Packt Publishing Ltd.2023.
2.	tering Game Design with Unity 2021: Immersive Workflows, Visual Scripting, Physics Engine, Game Objects" , BPB Publications, 2022.

3.	Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
4.	Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", First edition, Prentice Hall 2006.

REFERENCES

1.	Sebastiano M.Cossu, "Beginning Game AI with Unity: Programming Artificial Intelligence with C#", Apress, 2020.
2.	James M, Van Verth, Lars M.Bishop, "Essential Mathematics for Game anf Interactive Application", Third Edition, CRC Press, 2015.
3.	Michael Dawson, "Beginning C++ Through Game Programming", Fourth Edition, Cengage Learning PTR, 2015.
4.	Jason Gregory, "Game Engine Architecture", Third Edition, A K Press, 2015
5.	Fletcher Dunn, LanParberry ," 3D Math Primer for Graphics and Game Development", Second Edition, CRC Press, 2011.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	3	3	-	-	-	-	-	2	3	2	3
CO 2	3	3	3	3	3	-	-	-	2	-	2	3	2	3
CO 3	3	3	3	3	3	-	-	-	2	-	2	3	2	3
CO 4	2	3	3	3	3	1	2	1	2	1	3	3	3	3
CO 5	2	3	3	3	3	1	2	-	2	1	3	3	3	3
AVG	2.5	3	3	3	3	1	2	1	2	1	2	3	2	3

Product based Projects (Team)

1	Design and Development of a 2D Platformer Game
2	End-to-End Development of a 2D Adventure Game
3	Development of a Vector and Linear Interpolation Module for Real-Time Graphics
4	Development of a 3D Graphics Pipeline Including Modeling, Viewing, and Clipping
5	Development of a Kinematics-Driven Character Animation Controller
6	Design of a 3D Rendering Pipeline with Perspective Projection and Intersection Testing
7	Design and Development of a Lightweight Game Engine

8	Design of a Strategy-Based Gameplay System
9	Mini Game Engine with AI Navigation
10	3D Third-Person Adventure Game

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U24ADP63	LARGE LANGUAGE MODELS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Introduce the fundamental concepts and evolution of large language models in natural language processing.
2	Explain the transformer architecture and attention mechanisms used in modern LLMs
3	Develop conceptual understanding of prompt engineering for effective interaction with LLMs.
4	Familiarize students with open-source LLM ecosystems, including DeepSeek models.
5	Create awareness of real-world applications, ethical issues, and future trends of large language models.

UNIT I FOUNDATIONS OF LARGE LANGUAGE MODELS — **9**

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Evolution of Natural Language Processing – Rule-Based and Statistical NLP – Neural Language Models – Concept of Language Modeling – Tokens, Vocabulary, and Embeddings – Word-Level, Subword-Level, and Sentence-Level Representations – Introduction to Large Language Models – Pretraining Objectives – Capabilities and Limitations of LLMs – Overview of Popular LLM Families – Use Cases of LLMs in Modern AI Systems.

Content Beyond the Syllabus: Multimodal language models

Industrial Application: Used in enterprise knowledge assistants deployed in IT service and consulting companies.

Experiential Learning: Explore and analyze outputs of different pretrained language models for the same input text.

UNIT II TRANSFORMER ARCHITECTURE FOR LLMS — **9**

Limitations of RNNs and CNNs in NLP – Introduction to Transformer Architecture – Attention Mechanism – Scaled Dot-Product Attention – Self-Attention – Multi-Head Attention – Positional Encoding – Encoder Architecture – Decoder Architecture – Training Large-Scale Transformer Models – Computational and Memory Challenges – Model Scaling Laws.

Content Beyond the Syllabus: Sparse attention mechanisms

Industrial Application: Applied in large-scale document processing systems within cloud service providers.

Experiential Learning: Conceptually trace attention flow across transformer layers for a sample sentence.

UNIT III PROMPT ENGINEERING AND INTERACTION WITH LLMS — **9**

Role of Prompts in Language Models – Prompt as Interface Paradigm – Components of an Effective Prompt – Zero-Shot, One-Shot, and Few-Shot Prompting – Instruction-Based Prompting – Chain-of-Thought Prompting – Prompt Templates and Prompt Optimization – Prompt Sensitivity and Variability – Limitations and Biases in Prompt-Based Interaction.

Content Beyond the Syllabus: Automated prompt optimization Industrial Application: Used in conversational AI platforms for customer support and virtual assistants. Experiential Learning: Design and refine multiple prompts to improve reasoning quality of LLM responses.	
UNIT IV DEEP SEEK MODELS AND OPEN-SOURCE LLM ECOSYSTEM	**9**
Overview of Proprietary and Open-Source LLMs – Introduction to **DeepSeek** Models – Design Philosophy of DeepSeek – Model Variants and Capabilities – Training Strategies and Data Considerations – Comparison with Other Open-Source LLMs – Performance Benchmarks – Deployment Considerations – Role of Open LLMs in Research and Industry. Content Beyond the Syllabus: Model fine-tuning strategies Industrial Application: Study and compare documentation and benchmarks of DeepSeek models with other open-source LLMs. Experiential Learning: Adopted in research labs and startups for cost-effective deployment of language models.	
UNIT V APPLICATIONS, ETHICS, AND FUTURE DIRECTIONS OF LLMS	**9**
Applications of LLMs in Chatbots, Education, Healthcare, Finance, and Data Science – LLMs as Knowledge Assistants – LLM Integration in Software Systems – Hallucination and Reliability Issues – Bias, Fairness, and Ethical Challenges – Data Privacy and Security – Explainability and Trustworthiness – Environmental and Cost Considerations – Emerging Trends in Large Language Models – Future Research Directions. Content Beyond the Syllabus: Responsible AI governance Industrial Application: Implemented in AI compliance and governance frameworks in healthcare and fintech industries. Experiential Learning:Analyze real-world case studies involving bias, hallucination, and misuse of LLMs.	
TOTAL PERIODS	45

COURSE OUTCOMES:

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

CO 1	Describe the principles, components, and capabilities of large language models.
CO 2	Explain the transformer architecture and attention mechanisms underlying LLMs.
CO 3	Apply prompt engineering concepts to analyze LLM behavior and responses.
CO 4	Compare open-source and proprietary LLMs, including DeepSeek models, based on design and use cases.
CO 5	Analyze applications, ethical challenges, and emerging trends related to large language models.

TEXTBOOKS

1.	Eisenstein, J., Introduction to Natural Language Processing, MIT Press, 2019.
2.	Jurafsky, D., & Martin, J. H., Speech and Language Processing, 3rd Edition (Draft/Latest), Pearson Education, 2023.

REFERENCES

1.	Alammar, J., & Keller, M., The Illustrated Transformer, Independently Published, 2023.
2.	Lewis, M., Liu, Y., Goyal, N., et al., Pretrained Language Models: A Survey, Morgan & Claypool Publishers, 2021.

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CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	2	-	-	-	-	-	1	3	2	1
CO 2	3	3	2	2	2	-	-	-	-	-	1	3	2	1
CO 3	2	3	2	1	3	-	-	1	-	-	2	2	3	2
CO 4	2	2	2	1	3	1	-	-	1	-	2	2	3	2
CO 5	1	2	2	2	2	2	2	-	1	-	3	2	2	3
AVG	2.2	2.4	2	1.4	2.4	1.5	2	1	1	-	1.8	2.4	2.4	1.8

Product based Projects (Team)

1	Design a question answering system using a pretrained large language model.
2	Develop a prompt-based text summarization system for long documents.
3	Build an LLM-powered chatbot for college or department information services.
4	Implement a prompt engineering framework to improve reasoning responses of an LLM.
5	Create a comparative study of open-source LLM outputs for the same task.
6	Design an LLM-based content generation system for educational materials.
7	Develop a bias analysis tool to study fairness issues in LLM-generated text.
8	Build an intelligent resume screening assistant using a large language model.
9	Design a domain-specific virtual assistant using prompt templates.
10	Analyze hallucination behavior of large language models across different prompts.

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U24ADP64	AGENTIC AI	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

1	Introduce the fundamental concepts and terminology of agentic artificial intelligence.
2	Explain different types of intelligent agents and their interaction with environments.
3	Provide understanding of basic agent architectures and control mechanisms.
4	Develop awareness of learning and adaptive behavior in intelligent agents.
5	Familiarize students with real-world applications and ethical aspects of agentic AI.

UNIT – 1 Introduction to Agentic AI **6+6**

Introduction to Artificial Intelligence Agents – What is an Agent – Difference between Programs and Agents – Examples of Everyday Intelligent Agents – Agent and Environment – Characteristics of Agents: Autonomy, Reactivity, Proactiveness – Types of Environments – Simple Agent Life Cycle – Applications of Agentic AI.

Practical:

1. Design a simple agent for an everyday real-life problem.
2. Simulate agent interaction with a basic environment.

Content Beyond the Syllabus: Agentic AI in generative systems

Industrial Application: Used in customer support chat agents deployed in IT service companies.

Experiential Learning: Create a simple software agent that reacts to user inputs in a simulated environment.

UNIT – 2 Types of Intelligent Agents **6+6**

Simple Reflex Agents – Model-Based Agents – Goal-Based Agents – Utility-Based Agents – Learning Agents – Comparison of Agent Types – Agent Performance Measures – PEAS Framework – Introduction to Rational Agents.

Practical:

1. Implement a simple reflex agent using condition–action rules.
2. Model a goal-based agent using the PEAS framework.

Content Beyond the Syllabus: Autonomous decision agents

Industrial Application: Applied in rule-based automation systems used in banking and insurance workflows.

Experiential Learning: Implement different agent types and compare their performance on a simple task.

UNIT – 3 Agent Architectures and Control **6+6**

Agent Architecture Overview – Sensors and Actuators – Agent Control Loop – Internal State Representation – Reactive and Deliberative Architectures – Simple Planning Concepts – Task Execution in Agents – Limitations of Basic Agents.

Practical:

1. Simulate an agent control loop using sensor–actuator interaction.
2. Design a simple planning agent for task execution.

Content Beyond the Syllabus: Hybrid agent architectures
Industrial Application: Used in robotics control systems in manufacturing and warehouse automation.
Experiential Learning: Simulate an agent control loop using sensors, internal state, and actuators.

UNIT – 4 Learning in Agent	**6+6**

Introduction to Learning Agents – Learning from Experience – Components of a Learning Agent – Feedback and Reward Concepts – Introduction to Reinforcement Learning for Agents – Exploration vs Exploitation – Adaptive Behavior in Agents – Examples of Learning Agents.

Practical:

1. Implement a basic learning agent using reward feedback.
2. Demonstrate agent adaptation through repeated interactions.

Content Beyond the Syllabus: Adaptive autonomous agents
Industrial Application: Implemented in recommendation engines used by e-commerce platforms.
Experiential Learning: Develop a learning agent that improves its actions based on reward feedback.

UNIT – 5 Applications and Ethical Aspects of Agentic AI	**6+6**

Agentic AI in Real Life – Chat bot and Virtual Assistants – Autonomous Systems – Smart Applications – Human–Agent Interaction – Ethical Issues in Autonomous Agents – Safety and Responsibility – Future Scope of Agentic AI – Career Opportunities.

Practical:

1. Design an agent-based solution for a simple real-world application.
2. Analyze ethical concerns in an autonomous agent scenario.

Content Beyond the Syllabus: Responsible agentic AI
Industrial Application: Adopted in AI governance frameworks within healthcare and fintech industries.
Experiential Learning: Analyze real-world scenarios to identify ethical risks in autonomous agents.

TOTAL PERIODS	**: 60**

COURSE OUTCOMES:

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

CO 1	Define the concepts, characteristics, and components of agentic AI systems.
CO 2	Classify intelligent agents based on functionality and environment types.
CO 3	Explain basic agent architectures and agent–environment interaction mechanisms.
CO 4	Demonstrate simple learning and adaptation strategies in intelligent agents.
CO 5	Analyze practical applications and ethical considerations of agentic AI systems.

TEXTBOOKS

1.	Russell, S., & Norvig, P., *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2021.
2.	Wooldridge, M., *An Introduction to MultiAgent Systems*, 2nd Edition, John Wiley & Sons, 2009.

REFERENCES

1.	Poole, D. L., Mackworth, A. K., & Goebel, R., Computational Intelligence: A Logical Approach, Oxford University Press, 1998.

2.	Shoham, Y., & Leyton-Brown, K., Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009.
3.	Weiss, G. (Ed.), Multiagent Systems, MIT Press, 2013.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	1	1	1	1	1	1	1	1	1	2	1	1	2
CO 2	3	2	1	1	1	1	1	1	1	1	2	1	1	1
CO 3	3	2	2	1	2	1	1	1	1	1	2	2	1	1
CO 4	3	3	2	2	3	1	1	1	1	1	2	3	2	1
CO 5	2	3	2	2	2	2	3	1	2	1	3	2	1	3
AVG	**2.8**	**2.2**	**1.6**	**1.4**	**1.8**	**1.2**	**1.4**	**1**	**1.2**	**1**	**2.2**	**1.8**	**1.2**	**1.6**

Product based Projects (Team)

1	Design a rule-based intelligent agent for smart home light control.
2	Develop a goal-based agent for simple task scheduling.
3	Implement a reflex agent for traffic signal control simulation.
4	Create a chat bot agent for answering college-related queries.
5	Build a learning agent for game score optimization.
6	Simulate an autonomous agent for basic robot navigation.
7	Design a personal reminder agent using event-based triggers.
8	Implement a recommendation agent for book or movie suggestions.
9	Develop a multi-agent system for cooperative task allocation.
10	Create an ethical decision-making agent for simple real-world scenarios.