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**

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 தததொழில்நுட்பமும் /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	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	U24RM314	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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SEMESTER IV								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA401	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	A24AD403	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	U24RM414	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				**480**	**17**	**1**	**14**	**23**

#Mandatory Course is a Non-credit

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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		Professional Elective I	PEC	60	2	0	2	3
5		Professional Elective II	PEC	60	2	0	2	3
6		Professional Elective III	PEC	60	2	0	2	3
PRACTICAL								
7	U24AD503	Deep Learning Lab	PCC	60	0	0	4	2
8	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
9	U24AD504	Summer Internship*	EEC					1
10	U24RM514	Domain Specific Experiments/Method ol ogy/Algorithms	RMC	30	0	0	2	1
11	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
12	U24MC513	Fitness for Life-Yoga, Food Nutrition	MC#	30	0	0	2	0
TOTAL				**510**	**15**	0	**19**	**24.5**

***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.**

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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	U24AD601	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	U24EC610	Embedded Systems and IOT	PCC	75	3	0	2	4
5	U24AD602	Network Essentials	PCC	75	3	0	2	4
6		Professional Elective IV	PEC	60	2	0	2	3
7		Professional Elective V	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**	**18**	1	**12**	**23**

#Mandatory Course is a Non-credit.

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		Open Elective -IV	OEC	45	3	0	0	3
5		Constitution of India	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
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.**

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								**165**

Meenakshi Sundararajan Engineering College

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

Department : Artificial Intelligence and Data Science , R2024, CBCS

CATEGORY OF COURSES AND CREDIT DISTRIBUTION

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	10	11	4						25
3	ESC	10	7.5	4						21.5
4	PCC			12.5	21	9	12	3		57.5
5	PEC					9	6	3		18
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	24.5	23	16.5	8	**165**

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

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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	

Meenakshi Sundararajan Engineering College

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

Department: AI&DS , R2024, CBCS

U24EN101	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives

1	To improve the communicative competence of learners.
2	To develop the basic reading and writing skills of first year engineering and technology students.
3	To improve understanding of key grammar concepts and apply those concepts in both reading and writing tasks.
4	To help learners use language effectively in professional contexts.
5	To equip students with the skills to write clearly and concisely in a variety of context.

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**

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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 and vocabulary and technical language competency.

TEXT BOOKS

English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)

English for Science & Technology Cambridge University Press, 2021.

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

Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.

English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN: 0070264244.

Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	3	3	-	-	2	2	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-	2	2	-
CO3	-	-	-	-	-	-	-	-	1	1	-	-	2	2	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	1	1	-
CO5	-	-	-	-	-	-	-	2	-	3	-	2	2	2	-
AVG	-	-	-	-	-	-	-	0.4	1.6	2.6	-	0.4	1.8	1.8	-

Meenakshi Sundararajan Engineering College

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

Department: AI&DS , R2024, CBCS

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.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.

4. Engineering Mathematics: First year.Calculus and analytical geometry,volume 2, M.K.Venketaraman,,National Publishing company,1965.

REFERENCES

1.Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, NewDelhi,2016 .

.2.Kandasamy.P.,Thilagavathy.K and Gunavathy.K.,"Engineering Mathematics For irst Year BB.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

REFERENCE LINKS

https://youtube.com/playlist?list=PLpklqhIbn1jpBog00CBB-OjKyxVxXqqFc&si=NV-LiY6Cdqu1s-92
https://youtube.com/playlist?list=PLpklqhIbn1jrUYbLgaOayAnT4i95g5Ibj&si=GbGA9cmWgvoJiVla

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	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	3	1	-	-	-	-	-	-	-	-	1	-	-
AVG	3	2.6	2.6	1	1	-	-	-	-	-	-	-	1	-	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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 ULTROSONICS — **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 - attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- pressure and displacement.

TOTAL PERIODS — **45**

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Analyze crystal structures and the influence of imperfections on their properties.
CO2	Demonstrate and explain the general concepts of elastic properties of materials.
CO3	Analyze the applications of ultrasonics to engineering and medical disciplines.
CO4	The quantum concepts and its use to explain black body radiation, Compton effect and wave equation for matter waves.
CO5	Elucidate the principle and working of lasers and their applications in the field of 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.

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	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-
CO2	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-
CO3	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-
CO4	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-
CO5	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-
AVG	3	2	-	1	1	-	1	-	-	2	-	-	-	-	-

Meenakshi Sundararajan Engineering College

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

Department: AI&DS , R2024, CBCS

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

Course Objectives

1	To make the students to be aware of various treatment processes of water for potable and industrial purposes.
2	To impart knowledge to the students on the basic concepts and properties of polymeric materials for various engineering applications
3	To develop an understanding of the basic concepts of energy storage devices and Nano materials with its applications.
4	To develop a thorough understanding of phase rule and spectroscopy with its applications.
5	To acquire the basic knowledge on sensors along with photochemistry which is essential for the software engineers for developing new devices.

UNIT 1 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 (Ion Exchange, zeolite) – Internal conditioning (Carbonate, phosphate, calgon, sodium aluminate conditioning) –– Brackish water treatment - Reverse osmosis.

UNIT 2 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.

UNIT 3 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 Evaporation method -chemical vapour deposition, - Applications of nanomaterials - Application - A Case Study – Medicine,Agriculture,Industry and Electronics.

UNIT 4 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 diagram-Ultraviolet (UV) and visible spectroscopy-Infrared spectroscopy.

UNIT 5 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.

Introduction-Photochemical reaction-Laws of photochemistry-Grothus-Draper law-Stark-Einstein law and Lambert-Beer Law-Photo physical processes Internal Conversion-Intersystem crossing-Fluorescence 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 basic principles of water Quality parameters, their analysis and various water treatment processes for domestic and industrial applications.
CO2	Interpolate the properties and applications of important polymers.
CO3	Describe the preparation and applications of nano materials and illustrate the methods of harnessing energy from non-conventional energy sources.
CO4	Utilize the thorough knowledge on phase rule to form a system and various applications of spectroscopy.
CO5	Acquire the knowledge on sensors along with photochemistry to develop an interdisciplinary approach among the students which is essential for the software engineers.

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

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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'

Meenakshi Sundararajan Engineering College

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

Department: AI&DS , R2024, CBCS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	2	3	2	-	2	2	-	2	-	-	-
CO2	3	-	-	-	1	2	1	-	1	1	-	3	-	-	-
CO3	3	1	1	-	2	1	2	-	1	1	-	2	-	-	-
CO4	3	1	1	-	2	1	2	-	1	1	-	2	-	-	-
CO5	3	1	2	-	2	2	2	-	2	1	-	3	-	-	-
AVG	3	1	1.25	-	1.8	1.8	1.8	-	1.4	1.2	-	2.4	-	-	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

U24TA101	தமிழர்மரபு / 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 – திரொவிட 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 இளகிய 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, பொம்பைகள் - 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 TAMIL**	**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.

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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 .

UNIT 1 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 – Variables-Constants – 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.
4.Create Looping statements- for, while, do-while.

UNIT 2 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.

UNIT 4 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**

Preprocessor 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.

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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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	1	2	2	-
CO3	2	2	2	2	-	-	-	1	-	1	-	1	2	2	1
CO4	2	2	2	-	1	1	-	-	1	-	1	1	2	2	-
CO5	2	-	2	2	1	1	-	1	1	1	1	1	2	2	1
AVG	2	2	2	2	1	1	-	1	1	1	1	1	2	2	1

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

U24CE102	ENGINEERING GRAPHICS AND COMPUTER APPLICATION	L	T	P	C
		3	0	2	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 the role of simulations in engineering graphics and perform geometric transformations.

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 2 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 3 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 4 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 5 GEOMETRIC MODELLING	**6+9**

Role of simulations in engineering graphic, 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	Construct engineering curves and apply projection techniques for conic curves, points, and lines.
CO2	Effectively project and visualize surfaces and solids in various orientations.
CO3	Determine true shapes and develop lateral surfaces of sectioned solids.
CO4	Apply 3D and perspective projection techniques to model simple solids in various views.
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.Introduction to Blender 3.0:Learn Organic and Architectural Modeling,Lighting,Materials,Painting, Rendering and Compositing with Blender Gianpiero Moioli Apress,Year :2022

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	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2
CO2	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2
CO3	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2
CO4	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2
CO5	3	1	2	-	2	-	-	-	-	3	-	2	2	-	3
AVG	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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 equipment; 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.				
PART I CIVIL ENGINEERING PRACTICES					
PLUMBING WORK					
	Theory				
1	Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in households.				
2	Connecting pipes of different materials: Metal, plastic and flexible pipes				
	Experiment				
1	Preparing plumbing line sketches.				
2	Laying pipe connection to the suction side of a pump				
3	Laying pipe connection to the delivery side of a pump.				
	Demo				
1	**In-Campus -** - Water supply lines (RO plant) - Drainage systems - Water Harvesting				
	Self Study				
1	Household Appliances.- pipes of different materials: Metal, plastic and flexible pipes are utilized in various applications, such as: - Water supply lines - Drainage systems - Gas lines(if any) - Heating and cooling systems - Solar water heating (if any) - Chimney				
WOOD WORK					
	Theory				
1	Tools used in Carpentry & safety measures.				
2	Studying common industrial trusses - https://www.youtube.com/watch?v=-1w4_4Sr2kg				
	Experiment				
1	Sawing,				

2	Planing and
3	Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.
	Demo
1	Studying joints in door panels and wooden furniture
2	Study of truss in workshop
	Self study
1	In house- Types of joints used in window, door, chair, table,specific type of furniture or fixture
ELECTRICAL ENGINEERING PRACTICES 15	
	Theory
1	Electrical Installation tools, equipment & safety measures.
2	Introduction and application of switches, fuses,boards, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
	Demo
1	Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box,
2	Electrical wiring system from the Electricity Board (EB) to a classroom on a campus
3	Earth Pit & its maintenance in campus
4	Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.
5	Bringing Renewable Energy to the Classroom: A Solar Smart Grid Demonstration
	Experiment
1	Fluorescent Lamp wiring with introduction to CFL and LED types.
2	Energy meter wiring and related calculations/ calibration
3	Iron Box wiring and assembly
4	Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
5	emergency lamp wiring/Water heater
	Self Study
1	House - electrical wiring system from the Electricity Board (EB) to a dining Room
2	Building (Common area)- electrical wiring system from the Electricity Board (EB) to a staircase of the building & water pump
3	Types of fuse / MDB/ MCB/RCD/CU/Switchboard
4	Earth Pit at house
MECHANICAL ENGINEERING PRACTICES	
	Theory
1	Tools and its handling techniques & safety measures.
2	Welding Procedure, Selection & Safety Measures.
3	types of Welding joints Butt Joints, Lap Joints, and Tee Joints
4	Basic of foundry operations- Various types of casting processes Types of patterns used in casting processes Types of moulding sand and materials used for pattern making
5	Making of a cone using sheet metal
	Demo
1	Demonstrating basic foundry operations.- Mold Cavity, Air Vents, Liquid Passages

	Gates,Runners, Sprues
2	Demonstrating components made out of casting at workshop
3	Demonstration of shaft in gearbox of lathe machine
4	Demonstration of screws RH, LH (Turning, Facing and Thread)
5	Demonstration of Bolted joint
6	Demonstration of sheet metal fabricated components
7	Making of a cone using sheet metal
	Experiment
1	Dis-assembly and assembly of a centrifugal pump.
2	Dis-assembly and assembly of a household mixer /Grinder Mixer
3	Dis-assembly and assembly of an air conditioner.
4	Dis-assembly and assembly of a Ceiling Fan/Table Fan
5	Simple Turning using Lathe machine
6	Drilling & Tapping in Plate (Simple Bolted joint)
7	Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
8	Making of a square tray
1 2 3 4	**Self-Study** List examples of sheet metal fabricated component used in house Application of shaft List examples of welded components commonly used in a house List components made by foundry - casting process
ELECTRONIC ENGINEERING PRACTICES 15	
	Theory
1	Electronic components, equipment & safety measures.
2	Soldering simple electronic circuits and checking continuity.
	Demo
1	Study an elements of smart phone
2	Assembly and dismantle of LED TV
	Experiment
1	Soldering simple electronic circuits and checking continuity.
2	Hands-on session of Soldering Practices in a Printed Circuit Breaker.
3	Assembling and testing electronic components on a small PCB
4	Assembly and dismantle of computer/ laptop
5	Hands-on session of integration of sensors and actuators with a Microcontroller.
6	Hands-on session of Bridge Rectifier, Op-Amp and Trans impedance amplifier.
	Self-Study (mini Project)
1	Sensor-based projects: Create projects using sensors like temperature, humidity, or motion sensors
2	Automatic Fan Controller: Create a system that turns on a fan when the temperature exceeds a certain limit
3	Automatic Night Light: Design a circuit that turns on an LED light when it gets dark.
4	Water Level Indicator
5	Door Alarm: Create a simple alarm system that triggers when a refrigerator door is open for a

	more than a one minute
Course Outcomes	
Upon completion of this course, the students will be able to:	
CO1	To practice and experience the plumbing work
CO2	To gain practical experience in carpentry by crafting a variety of joints.
CO3	To acquire knowledge in the methodology and techniques of wiring for electrical connections.
CO4	To gain knowledge in welding, sheet metal fabrication, and lathe operations.
CO5	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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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

Course Objectives	
1	To improve the communicative competence of learners
2	To help learners use language effectively in academic /work contexts
3	To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
4	To use language efficiently in expressing their opinions via various media."
5	To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.

UNIT 1	**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 speaking & Writing will be conducted in the classroom	

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	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	3	-	3	2	2	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	2	2	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	2	2	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
AVG	-	-	-	-	-	-	-	-	1.2	3	-	1.8	1.2	1.2	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

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.

TEXT BOOKS

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

REFERENCES

1. Peter F. Drucker," Innovation and Entrepreneurship" .

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

Meenakshi Sundararajan Engineering College

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Department: AI&DS , R2024, CBCS

	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	2	1	-	2	-	1	1	1	-	-	-	2	-	3	1
CO2	2	1	1	-	1	-	1	-	-	-	2	2	3	1	-
CO3	2	1	1	2	-	-	-	1	-	-	-	2	1	-	1
CO4	-	1	1	2	2	-	-	-	-	-	-	2	2	2	1
CO5	-	1	1	2	3	1	-	-	1	1	2	2	2	2	1
AVG	2	1	1	2	2	1	1	1	1	1	2	2	2	2	1

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

U24IP201	BIOLOGY FOR AI ENGINEERS	
Course Objectives		
1	Understand biological systems.	
2	Recognize biological inspiration in AI.	
3	Apply biological concepts to AI.	
4	Analyse the intersection of biology and AI.	
5	Communicate with biologists and domain experts.	
UNIT 1 INTRODUCTION TO BIOLOGY AND AI		**8**
Overview of biology and its importance for engineers - Biological Systems-Cells, genetics and evolution - Health Care standards and Protocols, AI fundamentals, Neural Network, Artificial Neural Network. Practical: 1. Biological Data import. 2. Plotting and exploring biological data.		
UNIT 2 MACHINE LEARNING AND BIOLOGY		**8**
Introduction to machine learning - Supervised and Unsupervised learning - Applications in genomics, proteomics and transcriptomics. Practical: 1. Classification (e.g., cancer diagnosis) using SVM 2. Clustering (e.g., gene expression) using K-means and hierarchical clustering.		
UNIT 3 AI APPLICATIONS IN BIOLOGY		**8**
Image analysis for biomedical imaging - Predictive modeling for disease diagnosis and treatment. Practical: 1. Tumor detection using image segmentation. 2. Predicting gene expression or protein levels.		
	TOTAL PERIODS	**24**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Explain the fundamental principles of biology and their relevance to AI.
CO2	Design and develop bio - inspired AI solutions.
CO3	Analyze the intersection of biology and AI, including ethics and challenges.
CO4	Communicate effectively with biologists and domain Experts.
CO5	Apply biological concepts to develop innovative AI solutions.
TEXT BOOKS	
1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig.	
2. "Bioinformatics and Computational Biology" by Jonathan Pevsner.	
REFERENCES	
1. “Python for Biologists” by Martin O. Jones	
2. ”Deep learning for Life sciences” by Bharath Ramasundar et al.	

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

	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	2	-	2	-	-	-	-	1	-	2	1	-	1
CO2	3	2	3	2	3	-	-	-	2	2	-	3	1	-	1
CO3	2	3	3	3	3	-	1	-	2	2	1	3	1	1	1
CO4	3	3	3	2	3	2	3	2	2	3	2	3	1	1	1
CO5	3	2	3	3	3	2	3	3	3	3	3	3	1	1	1
AVG	2.8	2.6	2.8	2.5	2.8	2	2.3	2.5	2.25	2.2	2	2.8	1	1	1

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

U24EN201	PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives

1	To engage learners in meaningful language activities to improve their reading and writing skills.
2	To enhance learners' vocabulary with a focus on technical terms and enabling them to communicate more effectively in both technical and professional contexts.
3	To master key grammar concepts and apply those concepts to produce clear and correct written communication.
4	To help learners understand the purpose, audience, contexts of different types of writing.
5	To demonstrate an understanding of job applications and interviews for internship 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	
CO1	Read and comprehend various forms of technical and informational texts and extract the necessary information for application or analysis.
CO2	Improve their vocabulary to articulate ideas clearly and effectively in professional and academic contexts.
CO3	Use grammar accurately in written communication.
CO4	Demonstrate proficiency in writing clear, structured responses, reviews, essays, and professional documents using appropriate tone, format, and language.
CO5	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, New Delhi

3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

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	2	2	-
CO2	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO3	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO4	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO5	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
AVG	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

U24MA202	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	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 PERIODS	60

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the fundamental concepts of probability with a thorough 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 , Ist 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", 5th Edition, Elsevier, 2014.

4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum’s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

CO-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	3	2	1	-	-	-	-	-	-	-	1	1	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
AVG	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

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.

UNIT 1 ELECTRICAL PROPERTIES OF MATERIALS

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 in periodic potential -Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentrations in metals- Electron effective mass-concept of hole.

UNIT 2 SEMICONDUCTOR PHYSICS

Properties of semi-conductor -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

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

Classification of optical materials – Absorption emission and scattering of light in metals, insulators and semiconductors (quantitative) – 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

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.

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	PO12	PSO1	PSO2	PSO3
CO1	3	1					-	-	-	-	-	-	-	-	-
CO2	3	1	2				-	-	-	-	-	-	-	-	-
CO3	3	-		1	2	1	1	-	-	-	-	-	-	-	-
CO4	3	-	2	1	3		1	-	-	-	-	-	-	-	-
CO5	3	2	2	2	2	1	2	-	-	-	-	2	-	-	-
AVG	3	1.3	2	1.3	2.3	1	1.3	-	-	-	-	2	-	-	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

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

UNIT I/ நெசவு மற்றும் பானைத் தொழில்நுட்பம்/WEAVING AND CERAMIC TECHNOLOGY	**3**

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியிடுகள்

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

UNIT II வடிவமைப்பு மற்றும் கட்டிடக் தொழில்நுட்பம்: / DESIGN AND CONSTRUCTION TECHNOLOGY	**3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் கால கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சரோசெனிக் 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.

UNIT III உற்பத்தித் தொழில் நுட்பம் / MANUFACTURING TECHNOLOGY	**3**

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

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

UNIT IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம் /AGRICULTURE AND IRRIGATION TECHNOLOGY	**3**

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

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

UNIT V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்/SCIENTIFIC TAMIL & TAMIL COMPUTING	**3**
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இனையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - 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 - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

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

3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

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

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

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

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

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. applications of Operational amplifiers, Ideal op amp characteristics, Inverting and Non-inverting amplifier.

UNIT IV DIGITAL ELECTRONICS	9

Review of number systems, conversion of number systems, binary codes, error detection and correction 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	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
AVG	2	1	1	-	-	-	-	2	-	-	-	-	-	-	-

Meenakshi Sundararajan Engineering College

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

Department: AI&DS, R2024, CBCS

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 minimize 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.

UNIT 1 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 conservation of bio-diversity Millenium development goals (MDG) and sustainable development goals (SDG), clean development mechanism(CDM).	
UNIT 2 SUSTAINABLE ENVIRONMENTAL CHEMISTRY	**6**
Climate change – greenhouse effect - global 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.Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, NewDelhi,2016.

3.Gilbert M Masters, ‘Introduction to Environmental Engineering and Science’,2nd edition, Pearson Education, 2004.

4.Allen, D.T. Shonnard, D.R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

5.Bradley. A.S, Adebayo, A.O.,Maria, 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 Application”, ANE Publisher, First Edition, 2010

2.Matlack,A.S.Introduction to green chemistry, Marcel Dekker:Newyork,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.ErachBharucha “Textbook of Environmental Studies for Undergraduate Courses” Orient Blackswan Pvt. Ltd. 2013.

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	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	-	1	1	2	2	1	2	-	3	-	-	-
CO2	3	1	1	-	1	1	3	1	2	2	-	2	-	-	-
CO3	3	1	1	-	1	1	2	1	2	2	-	2	-	-	-
CO4	3	-	1	-	2	2	3	2	2	2	-	3	-	-	-
CO5	3	1	1	-	2	2	3	2	1	2	-	3	-	-	-
AVG	3	1	1	-	1.4	1.4	2.6	1.6	1.6	2	-	2.6	-	-	-

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

U24CS201	PYTHON PROGRAMMING	L	T	P	C
		3	0	3	4.5

Course Objectives

1	To understand the basics of python programming.
2	To define Python functions and strings.
3	To use Python data structures - lists, tuples, dictionaries to represent complex data.
4	To perform file operations in Python.
5	To learn & use 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.

Practical:

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.

Practical:

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.).

3.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.

Practical:

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. .

Practical:

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. **Practical:** 1.Implement a Python program to create a weather data chart using Python Standard Libraries (pandas, numpy. Matplotlib, scipy) .	
TOTAL HOURS	**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 Ed, 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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	2	3	3	-
CO4	2	3	2	2	-	-	-	-	2	1	1	2	3	3	-
CO5	2	3	2	2	2	1	1	1	2	1	1	2	3	3	1
AVG	2	3	2	2	2	1	1	1	2	1	1	2	3	3	1

Meenakshi Sundararajan Engineering College

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Department: AI&DS, R2024, CBCS

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 analyses 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 analyses 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 fiber -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

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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.
CO2	Comprehend the principles of stress, strain& elasticity of the given materials & Gain knowledge about diffraction of laser light.
	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
CO3	Understand how sound waves are traveling in liquid medium and comprehend the light accepting power of given optical fiber and its transmission.
	Employ complexometric titrations to estimate total hardness of a water sample and determine the amount of chloride present in water using Argentometric method.
TEXT BOOKS	
1. Mechanics Part I and Part II, Narayanamoorthy National Publishing Company, 2001.	
2. Optics - Dr. Murugesan	
3.. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Textbook of Quantitative Chemical Analysis.	
REFERENCES	
1. Engineering physics Visvesvaraya Technological University.	
2. Vogel's Textbook of Quantitative Chemical Analysis (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	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
AVG	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-

Meenakshi Sundararajan Engineering College

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

Department: AI&DS, R2024, CBCS

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

Course Objectives

1	To enhance their ability to understand spoken English in various contexts and take part in effective discussions in a professional context.
2	To enhance speaking and presentation skills.
3	To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
4	To develop students' critical thinking skills.
5	To prepare for real-life communication situations and workplace discussions through the practice of 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 speaking & Writing will be conducted in the classroom
TEXT BOOKS
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
REFERENCES
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 BalckSwan: 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'														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO2	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO3	-	-	-	-	-	-	-	-	3	3	-	2	2	2	-
CO4	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
CO5	-	-	-	-	-	-	-	-	-	3	-	2	2	2	-
AVG	-	-	-	-	-	-	-	-	1.8	3	-	2	2	2	-

Meenakshi Sundararajan Engineering College

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

Department: AI&DS, R2024, CBCS

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**

- How To `Empathize'?
- How To `Define'
- How To `Ideate'?
- How To `Prototype'?
- How To `Test'?

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

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

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

- 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 HOURS	**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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	1	3	2	1	3	3	3	3	-	-	-
CO2	2	3	3	3	1	3	2	1	3	3	3	3	-	-	-
CO3	2	3	3	3	1	3	2	1	3	3	3	3	-	-	-
CO4	2	3	3	3	1	3	2	1	3	3	3	3	-	-	-
CO5	2	3	3	3	1	3	2	1	3	3	3	3	1	1	1
AVG	2	3	3	3	1	3	2	1	3	3	3	3	1	1	1

Meenakshi Sundararajan Engineering College
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Department: Artificial Intelligence and Data Science, R2024, CBCS

SEMESTER III								
S. NO.	**COURSE CODE**	**COURSETITLE**	**CATEGORY**	**TCP**	**PERIODS PERWEEK**			**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
THEORYCUMPRACTICAL								
4	U24AD302	OOPS and Data Structures	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	U24RM314	Introduction To Problem Solving	RMC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**22.5**

[#]**Mandatory Course is a Non-credit.**

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24MA302	DISCRETEMATHEMATICS	L	T	P	C
		3	1	0	4

COURSEOBJECTIVES	
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 applicationof 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**
PropositionalLogic–PropositionalEquivalences–NormalForms-PredicatesandQuantifiers–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–PermutationsandCombinations–RecurrenceRelations-GeneratingFunctions-SolvingLinear Recurrence Relations Using Generating Functions– Inclusion– Exclusion – Principle and Its Applications.	
UNIT 3 GRAPHS	**9+3**
GraphsandGraphModels–GraphTerminologyandSpecialTypesofGraphs –MatrixRepresentationof Graphs and Graph Isomorphism– Connectivity – Euler and Hamilton Paths.	
UNIT 4 ALGEBRAIC STRUCTURES	**9+3**
Algebraicsystems–Semigroupsandmonoids-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**
Partialordering–Posets–Latticesasposets–Propertiesoflattices-Latticesasalgebraicsystems–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	Understandingtheknowledgeofvarioustypesandcharacteristicsofgraphs.
CO4	Be aware of the counting principles.
CO5	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields

TEXTBOOKS	
1.	Kenneth H. Rosen, —Discrete Mathematics and its Applications ll, Tata Mc Graw Hill Pub. Co. Ltd., SeventhEdition,SpecialIndianEdition,NewDelhi,2012.
2.	TremblayJ.P. andManohar R,—DiscreteMathematicalStructureswithApplicationstoComputer Sciencell,TataMcGrawHillPub.Co.Ltd,ThirtiethReprint,NewDelhi,2011.
3.	Veerarajan.T,"DiscreteMathematics",25thEdition,TataMcgrawHillEducation, privateLimited,2016.
REFERENCES	
1.	1.Ralph.P.Grimaldi,—DiscreteandCombinatorialMathematics:AnAppliedIntroduction,Pearson Education, Fifth Edition, New Delhi, 2014
2.	2.SeymourLipschutzandMarkLipson,"DiscreteMathematics",Schaum'sOutlines,TataMcGrawHill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3.	3.ThomasKoshy,"DiscreteMathematicswithApplications",ElsevierPublications,Boston,2004.

CO/PO,PSOMapping

(3/2/1indicatesthestrengthofcorrelation)3-Strong2-Medium,1-WeakProgrammeOutcomes(POs)and ProgrammeSpecificOutcomesPSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	FUNDAMENTALSOFDATASCIENCE 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 eco systems
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 there search 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 - describingvariability–interquartilerange–variabilityforqualitativeandrankeddata - 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 OFVARIANCE	**9**

T- test for one sample–sampling distribution of 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– weightedresampling.RegressionusingStatsModels–multipleregression– 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, the student will be able to	
CO1	Explainthedataanalyticspipeline
CO2	Describeandvisualizedata
CO3	Performstatisticalinferencesfromdata
CO4	Analyzethevarianceinthedata
CO5	Buildmodelsforpredictiveanalytics

TEXTBOOKS	
1	David Cielen, Arno D.B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.(first two chapters for Unit I).
2	RobertS.WitteandJohnS.Witte,“Statistics”,EleventhEdition,Wiley Publications, 2017.
3	JakeVanderPlas,“PythonDataScienceHandbook”,O’Reilly,2016.

REFERENCES	
1	AllenB.Downey,“ThinkStats:ExploratoryDataAnalysisinPython”,GreenTea Press, 2014.
2	Sanjeev J. Wagh, Manisha S.Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”,CRCPress,2022.
3	ChiragShah,“AHands-OnIntroductiontoDataScience”,CambridgeUniversity Press,2020.
4	Vineet Raina, Srinath Krishnamurthy, “Building an Effective Data Science Practice: A Frame work to Boot strap and Manage a Successful Data Science Practice”, A press, 2021

CO/PO,PSO Mapping
(3/2/1 indicates the strength of correlation)3-Strong2-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	1	1	2	1	-	-	-	-	3	1	3	2	3	3	1
CO2	1	1	2	2	2	-	-	-	2	2	3	2	3	1	1
CO3	1	1	3	1	1	-	-	-	2	3	1	1	2	3	1
CO4	2	3	1	3	1	-	-	-	3	3	3	3	3	2	2
CO5	2	1	1	1	2	-	-	-	3	3	1	3	2	2	1
AVG	1	1	2	2	2	-	-	-	3	2	2	2	3	2	1

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 Stats Models
10	Weighted Resampling and Regression Diagnostics: Improving Model Reliability

U24AD302	OOPS AND DATA STRUCTURES	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.

Practical:

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.

Practical:

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.

Practical:

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.

Practical:

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 **Practical:** 11. Implement Minimum Spanning Trees 12. 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	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	-	-	2	1	-	2	2	1	-
CO2	3	3	3	1	3	1	-	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	1	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)

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U24AD304	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.

Practical:

DatabaseDevelopmentLifecycle:

1. ProblemdefinitionandRequirementanalysisscopeandConstraints
2. DatabasedesignusingConceptualmodelling(ER-EER)–top-downapproachMappingconceptualto relational database and validate using Normalization

UNIT2RELATIONALMODELANDSQL — 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

Practical:

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

Practical:

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 - ConcurrencyControl:Lockbasedprotocols-Deadlockhandling-Timestampbasedprotocols(CBS)-Error Recovery: Failure classification, deferred update, immediate update, Shadow paging

Practical:

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 toODB 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 **Practical:** 12. Object features of SQL Convert ER design to tables 13. Implementation of hospital management system 14. Implementation of Normalization Approach	
TOTALPERIODS	**45+30**

COURSE OUTCOMES	
At the end of the course, student will be able to	
CO1	Understand the database development lifecycle 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	To by Teorey, Sam Light stone, 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.

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CO/PO,PSOMapping

(3/2/1indicatesthestrengthofcorrelation)3-Strong2-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	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:
4	Personal Finance Management (PFM) Application:
3	Order Fulfillment & Tracking System:
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

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U24EC310	DIGITALPRINCIPLESANDCOMPUTER 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**

CombinationalCircuits–KarnaughMap-MinimizationTechniques:MinimizationofBoolean expressions using Boolean laws, Karnaugh map Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder – Magnitude Comparator – Decoder – Encoder – Multiplexers- De multiplexers

Practical:

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

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

IntroductiontoSequentialCircuits–Flip-Flops–operationandexcitationtables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation -Registers– Counters.

Practical:

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.

Practical:

6.SimulatorbasedstudyofComputerArchitecture

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

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

Practical:

7. Arithmeticoperationsusing8085
8. ALUoperationsusing8085
9. Interfacingoperationsusing8085

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.

TOTALPERIODS — **45+30**

COURSE OUTCOMES	
At the end of the course, 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 Flip flops
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

TEXTBOOKS

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 Mc Graw - 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.“Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.

6.Vincent P.Heuring, Harry F.Jordan, “Computer System Architecture”, 2nd Edition, Pearson Education, 2005.

7.John P Hayes, “Computer Architecture and Organization ”, 3rdedition, Mc Graw Hill, 2002.

CO-PO,PSOMapping

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

	PO 1	PO 2	PO3	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
COURSEOBJECTIVES					
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				
LISTOFEXPERIMENTS					
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:UsingJupyterNotebook.,Python,Numpy,Scipy,Matplotlib,Pandas, statmodels, seaborn, plotly, bokeh					
TOTALPERIODS					**45**

COURSE OUTCOMES	
At the end of the Course, 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
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 Vander Plas, “Python Data Science Handbook”, O’ Reilly, 2016.
REFERENCES	
1	AllenB.Downey,“ThinkStats:ExploratoryDataAnalysisinPython”,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**	**PO 12**	**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
AVG	2	2	1	2	2	-	-	-	2	2	2	2	2	2	1

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SEMESTER IV								
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**TCP**	**PERIODS PER WEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24MA401	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
THEORY CUM PRACTICAL								
5	A24AD403	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	U24RM414	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				**480**	**17**	**1**	**14**	**23**

[#]**Mandatory Course is a Non-credit**

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U24MA401	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 transformation - 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**
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.	

UNIT5 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.
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.

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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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	-	-
AVG	3	2	2	1	1	0	0	0	1	0	0	1	1	0	0

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U24AD401	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objective: 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 Depth First Search-Hill Climbing Algorithm-Genetic Algorithm

UNIT 3: GAME PLAYING AND CSP	**9**

Game Theory-optimal decisions in games-alpha-beta search- monte-carlo tree search -Constraint satisfaction problems-constraint propagation -backtracking search for CSP-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-AII applications -Language Models Information Retrieval-Information Extraction

TOTAL PERIODS	**45**

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COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Design and implement search strategies
CO2	Implement game playing and CSP techniques
CO3	Develop logical reasoning systems
CO4	Develop probabilistic reasoning systems
CO5	Implement Naive Bayes Model
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
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'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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

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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 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 – Multi Layer Perceptron- Back propagation– 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**

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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.
CO6	Apply ML techniques to various real time applications.
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
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.

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	2	2	2	1	2	1	1	2	2	2	1	2	2	1	1
CO2	3	3	2	2	2	2	1	2	2	2	1	2	1	1	1
CO3	2	2	2	2	2	1	1	2	2	2	1	2	1	1	1
CO4	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
CO5	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
CO6	3	3	3	2	3	2	1	2	2	2	1	2	3	2	2
AVG	2	2	2	2	3	1	1	2	2	2	1	2	2	2	1

Meenakshi Sundararajan Engineering College

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

Department: Artificial Intelligence and Data Science, R2024, CBCS

	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.

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24AD403	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

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

1	Analyze 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	Analyze 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	Analyze 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 – Examples of IPC Systems.

Practical:

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 – Peterson's Solution – Hardware Support for Synchronization – Mutex Locks – Semaphores – Monitors – Liveness – Basic Concepts of CPU Scheduling– Scheduling Criteria – Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue – Thread Scheduling –Real-Time CPU Scheduling.

Practical:

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 – System model – 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 – FileSystem Operations – Directory Implementation – Allocation Methods – Free-Space Management – Recovery – File-System Internals – File-System Mounting – File Sharing – Virtual File Systems – Remote File Systems.

Practical:

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. **Practical:** 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 – Kerne I/O Subsystem – Transforming I/O Requests to Hardware Operations – STREAMS – I/O Performance – Case study: Linux Vs Windows: Design principles – Process management – Scheduling – Memory management – File systems and Introduction to Mobile Operating System: Android. **Practical:** 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

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Department: Artificial Intelligence and Data Science, R2024, CBCS

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	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.

Meenakshi Sundararajan Engineering College

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Department: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE, R2024, CBCS

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.

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

TEXT BOOKS

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.

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	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	1	1	1	_	1	3	2	3	2
CO2	3	3	3	3	3	2	1	1	1	_	1	3	2	2	3
CO3	3	3	3	3	3	2	1	1	1	_	1	3	2	2	2
CO4	2	2	2	2	3	2	1	1	1	-	1	3	3	3	2
CO5	2	2	2	2	3	2	1	1	1	1	1	3	3	3	2
AVG	2	2	2	2	3	2	1	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

Meenakshi Sundararajan Engineering College

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Department: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE, R2024, CBCS

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

COURSE OBJECTIVES	
1	To implement game playing techniques
2	To implement CSP techniques
3	To develop systems with logical reasoning
4	To develop systems with probabilistic reasoning
5	To design and implement search strategies
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 Algorthm
12	Implementation of Map Coloring Algorthm
13	Implementation of Backtracking Using Csp
14	Implementation of Propositional Model Checking Algorithm
15	Implementation of Bayesian Networks
16	Mini Project

COURSE OUTCOMES	
At the end of the course, the student will be able to	
CO1	Design and implement search strategies
CO2	Implement game playing and CSP techniques
CO3	Develop logical reasoning systems
CO4	Develop probabilistic reasoning systems
CO5	Implement Naive Bayes Model

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
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/

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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	PO 12	PSO 1	PSO 2	PSO 3
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CO2	3	3	2	2	2	2	1	2	2	2	1	2	1	1	1
CO3	2	2	2	2	2	1	1	2	2	2	1	2	1	1	1
CO4	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
CO5	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
AVG	2	2	2	2	3	1	1	2	2	2	1	2	2	2	1

Meenakshi Sundararajan Engineering College

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Department: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE, R2024, CBCS

24AD406	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

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 Back propagation 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.
CO6	Apply ML techniques to various real time applications.

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
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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.

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	2	2	2	1	2	1	1	2	2	2	1	2	2	1	1
CO2	3	3	2	2	2	2	1	2	2	2	1	2	1	1	1
CO3	2	2	2	2	2	1	1	2	2	2	1	2	1	1	1
CO4	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
CO5	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
CO6	3	3	3	2	3	2	1	2	2	2	1	2	3	2	2
AVG	2	2	2	2	3	1	1	2	2	2	1	2	2	2	1

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Department:ArtificialIntelligenceandDataScience,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 COME PRACTICAL								
3	U24AD502	Big Data Analytics	PCC	75	3	0	2	4
4		Professional Elective I	PCC	60	2	0	2	3
5		Professional Elective II	PCC	60	2	0	2	3
6		Professional Elective III	PCC	60	2	0	2	3
PRACTICAL								
7	U24AD503	Deep Learning Lab	PCC	60	0	0	4	2
8	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
9	U24AD504	Summer Internship*	EEC					1
10	U24RM514	Domain Specific Experiments/Methodology/ Algorithms	RMC	30	0	0	2	1
11	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
12	U24MC513	Fitness for Life-Yoga, Food Nutrition	MC#	30	0	0	2	0
TOTAL				510	15	0	19	24.5

***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.

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

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

UNIT1 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 2 INTRODUCTION OF DEEP NEURAL NETWORKS	**9**

Multilayer perceptron - Gradient Descent (GD) – Back propagation - Vanishing and Exploding GD problem – Optimization Methods: Stochastic GD: Momentum based GD &Nesterov Accelerated GD, Ada Grad, RMS Prop, Adam – Bias Variance trade off - Regularization – Dropout.

UNIT 3 CONVOLUTIONAL NEURAL NETWORKS	**9**

Motivation – Architectural Overview –Pooling – Parameter sharing - Regularization –Advanced Convolution Techniques- Strided -- Tiled -- Transposed and dilated convolutions; Popular CNN Architectures: Res Net, Alex Net, VGG Net - Transfer learning –Image classification using Transfer learning

UNIT 4 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 5 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**

Meenakshi Sundararajan Engineering College

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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, YoshuaBengio 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.	EthemAlpaydin,"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**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
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	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
AVG	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3

Meenakshi Sundararajan Engineering College

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Department: Artificial Intelligence and Data Science, R2024, CBCS

	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.

Practical:

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.

Practical:

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.

Practical:

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.

Practical:

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.

Practical:

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, AnandRajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Third Edition, Cambridge University Press, New Delhi
2.	ArshdeepBagha and Vijay Madisetti, “Big Data Science & Analytics - A Hands-on Approach”, New Delhi, 2016.
3.	VigneshPrajapati, “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 SimhadriGovindappa (2024)

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	3	3	3	3	1	1	1	2	1	2	2	3	3	3
CO2	3	3	3	3	3	1	1	1	2	1	2	2	3	3	3
CO3	3	3	3	3	3	1	1	1	2	1	2	2	3	3	3
CO4	3	3	3	3	3	1	1	1	2	1	2	2	3	3	3
CO5	3	3	3	3	3	1	1	1	2	1	2	2	3	3	3
AVG	3	3	3	3	3	1	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

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U24AD503	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	
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, YoshuaBengio 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.	EthemAlpaydin,"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

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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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
AVG	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3

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SEMESTER VI								
SL. NO.	**COURSE CODE**	**COURSETITLE**	**CATEGORY**	**TCP**	**PERIODS PERWEEK**			**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	U24EC610	Embedded Systems and IOT	PCC	75	3	0	2	4
5	U24AD602	Network Essentials	PCC	75	3	0	2	4
6		Professional Elective IV	PEC	60	2	0	2	3
7		Professional Elective V	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				**450**	**18**	**1**	**12**	**23**

#Mandatory Course is a Non-credit.

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U24CS503	THEORYOF COMPUTATION	L	T	P	C
		3	1	0	4

COURSEOBJECTIVES

1	Understand the classification of languages according to the Chomsky hierarchy.
2	Learn about finite automata and proveits 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

UNIT1 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 Push down 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 – ExtensionstoTuringMachines–RestrictedTuringMachineTwo–wayInfiniteTape,EquivalenceofOne Way Infinite Tape and Two– way Infinite Tape Turing Machines – Multi Tape Turing Machines, Non–deterministic Turing Machine.

UNIT5 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.

TOTALPERIODS:	**45**

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COURSE OUTCOMES	
At the end of the course, the student 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	JohnEHopcroft,RajeevMotwani,andJefferyDUllman,"IntroductiontoAutomataTheory, LanguagesandComputations",PearsonEducation,3rdEdition,2009.
2	JohnEHopcroftandJefferyDUllman,"IntroductiontoAutomataTheory,Languages andComputations",NarosaPublishingHouse,2002.
REFERENCES	
1	H.R.LewisandC.H.Papadimitriou,"ElementsofthetheoryofComputation",SecondEdition, Pearson Education, 2003.
2	J.Martin,"IntroductiontoLanguagesandtheTheoryofComputation",ThirdEdition,TataMcGraw Hill, 2003.
3	MichealSipser,"IntroductionoftheTheoryandComputation",ThomsonBrokecole,1997.

CO/PO,PSOMapping

(3/2/1indicatesthestrengthofcorrelation)3-Strong2-Medium,1-WeakProgrammeOutcomes(POs)andProgrammeSpecificOutcomesPSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	1	1	-	-	-	-	-	1	0	3	1
CO2	2	3	3	3	3	2	-	-	-	-	-	1	0	3	1
CO3	2	3	3	3	3	2	-	-	-	-	-	1	0	3	1
CO4	2	3	3	3	3	2	-	-	-	-	-	1	0	3	1
CO5	3	3	3	3	2	2	-	-	-	-	-	1	2	3	3
AVG	2	2.6	2.8	2.6	2.4	1.8	-	-	-	-	-	1	0.4	3	1.4

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24EC610	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

UNIT18-BIT EMBEDDED PROCESSOR — **9+6**

8-BitMicrocontroller-Architecture-InstructionSetandProgramming-ProgrammingParallel Ports-Timers and serial Port-Interrupt Handling

Practical:

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

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

Practical:

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

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

MemoryAndI/ODevicesInterfacing-ProgrammingEmbeddedSystemsinC-NeedFor RTOS-Multiple Tasks and Processes-Context Switching-Priority Based Scheduling Policies

Practical:

6.ExploredifferentcommunicationmethodswithIoTdevices(Zigbee,GSM,Bluetooth)

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

IoTCommunicationModelsandAPIs-IoTCommunicationProtocols-Bluetooth-WiFi– ZigBee-GPS-GSMmodules-OpenPlatform (likeRaspberryPi)-Architecture-Programming Interfacing-AccessingGPIOPins-SendingandReceivingSignalsUsingGPIOPins- Connecting to the Cloud.

Practical:

7. Introduction to Raspberry PI platform and python programming
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Set up 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. Practical: 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 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—The 8051 Micro controller and Embedded Systems ǁ,Pearson Education,Second Edition,2014
2	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro,—IoTFundamentals:NetworkingTechnologies,Protocols,andUse Cases for the Internet of Things ǁ,CISCOPress,2017.
3	Dieter Uckelmann; Mark Harrison; Florian Michahelles,“ Architecting the Internet of Things”, Springer2011.

REFERENCES	
1	Michael J. Pont, — EmbeddedCǁ,PearsonEducation,2007.
2	Wayne Wolf, — Computers as Components: Principles of Embedded Computer System Design ǁ, Elsevier, 2006.
3	Andrew N Sloss, D.Symes, C.Wright, — Arm System Developer's Guideǁ, Morgan Kauffman/Elsevier,2006.
4	Arshdeep Bahga, Vijay Madisetti, — Internet of Things – A hands – on approach ǁ, Universities Press,2015

CO/PO, PSO Mapping

(3/2/1indicatesthestrengthofcorrelation)3-Strong2-Medium,1-Weak

Programme Outcomes(POs)and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	-	-	-	-	1	2	3	3	2	1	3
CO2	2	1	3	2	2	-	-	-	1	2	2	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	2	3	2	2	1
CO5	2	3	3	2	2	-	-	-	1	3	3	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

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Department: Artificial Intelligence and Data Science, R2024, CBCS

U24AD602	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 tcp dump, netstat, ipconfig, ns look up and trace route.
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)

Practical:

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

UNIT4TRANSPORTLAYER **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

Practical:

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

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

TOTALPERIODS: 45+30

COURSE OUTCOMES	
At the end of the course, 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 sub netting 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	LarryL.Peterson,BruceS.Davie,“ComputerNetworks:ASystemsApproach”,SixthEdition, MorganKaufmannPublishersInc.,2022.
REFERENCES	
1	WilliamStallings,“DataandComputerCommunications”,TenthEdition,PearsonEducation,2017.
2	Ying-DarLin,Ren-HungHwang,FredBaker,“ComputerNetworks:AnOpen-SourceApproach”, McGrawHill,2012.
3	AndrewSTanenbaum,NickFeamsterandDavidJWetherall,“ComputerNetworks”,SixthEdition, PearsonEducation,2022.

CO-PO,PSOMapping

(3/2/1indicatesthestrengthofcorrelation)3-Strong2-Medium,1-WeakProgrammeOutcomes(POs)andProgrammeSpecificOutcomesPSOs'

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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	Simulateagatewaythatconvertsdatabetweentwodifferentprotocolsornetworktypes.
2	Multiplexing / Demultiplexing Demo: Build as implement 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.

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SEMESTER VII								
SL. NO.	**COURSE CODE**	**COURSETITLE**	**CATEGORY**	**TCP**	**PERIODS PERWEEK**			**CREDITS**
					L	**T**	**P**	
		VAC		30				
THEORY								
1	U24AD701	Information Security	PCC	45	3	0	0	3
2	U24MG701	Engineering Economics and Financial Management	HSMC	45	3	0	0	3
3		Open Elective – III	OEC	45	3	0	0	3
4		Open Elective – IV	OEC	45	3	0	0	3
5		Constitution of India	MC #	30	2	0	0	0
THEORY CUM PRACTICAL								
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

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U24AD701	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

Course Objectives

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 the students' knowledge on digital signature, email security and 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)

UNIT3 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

UNIT4 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.

UNIT5 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**

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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, DebdeepMukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 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	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	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

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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