Meenakshi Sundararajan Engineering College

(An Autonomous Institution)

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

B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM AND SYLLABUS REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

Powered by

Meenakshi Sundararajan Career Development Cell

Achievers Excellence Program

Meenakshi Sundararajan Innovation and Incubation Centre

MSEC JAPANESE CLUB

Institutions' Innovation Council

Societal Beneficial Innovation

MATLAB Enabled Campus

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

Meenakshi Sundararajan Engineering College

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

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

The IIET Society has the following to its credit :-

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

The society currently has the following institutions :-

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

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

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

MSEC's Hallmark of Quality

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

Vision of the Institute

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

Mission of the Institute

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

To achieve this, the college ensures

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

We offer following courses:

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

DEPARTMENT OF HUMANITIES AND SCIENCE

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

DEPARTMENT OF CIVIL ENGINEERING

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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

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

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

DEPARTMENT OF INFORMATION TECHNOLOGY

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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

INTERNAL QUALITY ASSURANCE CELL (IQAC)

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

Through IQAC, the institute strive to:

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

CONTROLLER OF EXAMINATION

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

MEENAKSHI SUNDARARAJAN RESEARCH CENTRE(MSRC)

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

THE MEENAKSHI SUNDARARAJAN CAREER DEVELOPMENT COMMITTEE (MSCDC)

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

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

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

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

OFFICE OF STUDENTS AFFAIRS

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

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

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

COLLEGE COUNSELING SERVICES

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

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

TRAINING AND PLACEMENT CELL

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

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

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

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

DEPARTMENT OF PHYSICAL EDUCATION

Our college campus boasts an array of sports facilities, including

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

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

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

DEPARTMENT OF SAFETY AND SECURITY

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

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

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

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

MEENAKSHI SUNDARARAJAN INNOVATION AND INCUBATION CENTRE (MSIIC)

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

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

MSEC STUDENTS CLUBS

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

Meenakshi Sundararajan Engineering College
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Department : Computer Science and Engineering, R2024, CBCS

Vision of the department	Mission of the department
To achieve academic excellence in Computer Science and Engineering by imparting quality education, encouraging research activities and innovation, inculcating ethical values and preparing the students to face industrial demands, societal needs and technical challenges.	• To provide quality education in theory and application of Computer Science and Engineering • To inculcate analytical thinking and innovation within students to become technically competent professionals. • To prepare students to excel in competitive and challenging careers. • To generate socially responsible citizens with ethical values to face industrial and societal challenges. • To promote research in the emerging areas of technology convergence.

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	Exhibit design and programming skills to build and automate business solutions using cutting edge technologies.
PSO2	Strong theoretical foundation leading to excellence and excitement towards research, innovation and entrepreneurship to provide elegant solutions to complex problems.
PSO3	Ability to work effectively with various engineering fields as a team to design, build and develop system applications

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Curriculum for I to VIII semesters

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
	U24IP101	Induction Program- Universal Human values	VAC	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	தமிழர் மரபு / 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 skills Laboratory - I	HSMC	30	0	0	2	1
10	U24ED111	Design Thinking - Building Innovation and Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				**465**	**17**	**1**	**13**	**24.5**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
	U24IP201	Value Added Course – II (Biology for Engineers)	VAC	30				
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 தொழில் நுட்பமும்/ 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 skills Laboratory - 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**	**10**	**23**

SEMESTER III

SL. 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	U24CS302	Data Structures	PCC	45	3	0	0	3
3	U24CS303	Object Oriented Programming	PCC	45	3	0	0	3
4	U24MC313	Foreign Language (Japanese / French / German)	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5	U24CS301	Foundations of Data Science	PCC	75	3	0	2	4
6	U24CS306	Digital Logic Design	ESC	75	3	0	2	4
PRACTICAL								
7	U24CS304	Data Structures Laboratory	PCC	45	0	0	3	1.5
8	U24CS305	Object Oriented Programming 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				**480**	**17**	**1**	**14**	**23**

#Mandatory Course is a Non-credit Course.

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SEMESTER IV

SL. 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	U24CS401	Operating Systems	PCC	45	3	0	0	3
3	U24CS402	Database Management Systems	PCC	45	3	0	0	3
4	U24CS403	Computer Organization and Computer Architecture	PCC	45	3	0	0	3
5	U24CS404	Design and Analysis of Algorithms	PCC	45	3	0	0	3
6	U24CS405	Artificial Intelligence	PCC	45	3	0	0	3
7	U24MC413	Indological studies	MC#	30	2	0	0	0
PRACTICAL								
8	U24CS406	Operating Systems Laboratory	PCC	45	0	0	3	1.5
9	U24CS407	Database Management Systems Laboratory	PCC	45	0	0	3	1.5
10	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
11	U24ED411	Idea & Simulation Lab	EDIC	15	0	0	1	0.5
12	U24RM414	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				**480**	**18**	**1**	**10**	**24**

#Mandatory Course is a Non-credit Course

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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	U24CS501	Computer Networks	PCC	45	3	0	0	3
2	U24CS503	Theory of Computation	PCC	45	2	1	0	3
3		Professional Elective I	PEC					3
4		Professional Elective II	PEC					3
5		Professional Elective III	PEC					3
6		Open Elective I	OEC					3
7	U24MC513	Fitness for Life-Yoga, Food nutrition	MC#	30	2	0	0	0
PRACTICAL								
8	U24CS502	Network Laboratory	PCC	45	0	0	3	1.5
9	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
10	U24ME507	Summer Internship*	EEC					1
11	U24RM514	Domain Specific Experiments/ Methodology/ Algorithms	RMC	30	0	0	2	1
12	U24ED511	Prototype & Market Valuation	EDIC	15	0	0	1	0.5
TOTAL								**23**

***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 Course.

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1		Open Elective II	OEC					3
2		Professional Elective IV	PEC					3
3		Professional Elective V	PEC					3
4	U24CS603	Embedded Systems & IOT	PCC	45	3	0	0	3
5	U24MC613	Integrated Disaster Management	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
6	U24CS602	Compiler Design	PCC	75	3	0	2	4
7	U24CS601	Object Oriented Software Engineering	PCC	75	3	0	2	4
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	Business Management - Go To Market & Start-up Journey	EDIC	15	0	0	1	0.5
TOTAL								**22**

#Mandatory Course is a Non-credit Course.

Meenakshi Sundararajan Engineering College
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Department : Computer Science and Engineering, R2024, CBCS

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		**30**				
THEORY								
1		Professional Elective VI	PEC					3
2	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
3		Open Elective III	OEC					3
4	U24CS702	Distributed Systems	PCC	45	3	0	0	3
5	U24MC713	Constitution of India	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
6	U24CS701	Cryptography and Cyber Security	PCC	75	3	0	2	4
PRACTICAL								
7	U24CS704	Summer Internship*	EEC					1
8	U24RM714	Data Collection, Analysis And Interpretation	RMC	15	0	0	1	0.5
TOTAL								**17.5**

***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	U24CS801	Project Work	EEC	240	0	0	16	8
TOTAL				240	0	0	16	**8**
OVERALL TOTAL								**165**

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	0	0	0	0	3	0	11
2	BSC	12	11	4	0	0	0	0	0	27
3	ESC	8	7.5	4	0	0	0	0	0	19.5
4	PCC	0	0	13	22	7.5	11	7	0	60.5
5	PEC	0	0	0	0	9	6	3	0	18
6	OEC	0	0	0	0	3	3	3	0	9
7	EEC	0	0	1	1	2	1	1	8	14
8	MC	0	0	√	√	√	√	0	0	0
9	EDIC	0.5	0.5	0.5	0.5	0.5	0.5	0	0	3
10	RMC	0	0	0.5	0.5	1	0.5	0.5	0	3
Total		24.5	23	23	24	23	22	17.5	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

EDIC – Entrepreneurial Development and Innovation Courses (EDIC)								
SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24ED111	Design Thinking - Building Innovation and Solutioning Mindset	EDIC	15	0	0	1	0.5
2	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
3	U24ED311	Innovation tool kits	EDIC	15	0	0	1	0.5
4	U24ED411	Idea & simulation lab	EDIC	15	0	0	1	0.5
5	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
6	U24ED611	Business Management - Go To Market & Startup Journey	EDIC	15	0	0	1	0.5

Placement Training by EduTech								
SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24TP110	Communication Skills Laboratory - I	HSMC	30	0	0	2	1
2	U24TP210	Communication Skills Laboratory - II	HSMC	30	0	0	2	1
3	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
4	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
5	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
6	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1

RMC – Research Methodology Courses								
SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24RM312	Introduction To Problem Solving	RMC	15	0	0	1	0.5
2	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
3	U24RM512	Domain Specific Experiments/ Methodology/ Algorithms	RMC	30	0	0	2	1
4	U24RM612	Technical Writing And Research Ethics	RMC	15	0	0	1	0.5
5	U24RM712	Data Collection, Analysis And Interpretation	RMC	15	0	0	1	0.5

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	0	0	0	0	3	0	11
2	BSC	12	11	4	0	0	0	0	0	27
3	ESC	8	7.5	4	0	0	0	0	0	19.5
4	PCC	0	0	13	22	7.5	11	7	0	60.5
5	PEC	0	0	0	0	9	6	3	0	18
6	OEC	0	0	0	0	3	3	3	0	9
7	EEC	0	0	1	1	2	1	1	8	14
8	MC	0	0	√	√	√	√	0	0	0
9	EDIC	0.5	0.5	0.5	0.5	0.5	0.5	0	0	3
10	RMC	0	0	0.5	0.5	1	0.5	0.5	0	3
Total		24.5	23	23	24	23	22	17.5	8	**165**

HSMC - Humanities, Social Sciences and Management Courses
BSC - Basic Sciences Courses
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MC - Mandatory Courses / Non-Credit
EDIC - Entrepreneurial Development and Innovation Courses (EDIC)
RMC - Research Methodology Courses

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	

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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**

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 right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To write definitions, descriptions, narrations and essays on various topics
CO5	To expand vocabulary and technical language competency

TEXT BOOKS
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 AyshaViswamohan, 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	-

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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 , First Edition , 2017.

REFERENCES

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

2.Kandasamy.P.,Thilagavathy.K and Gunavathy.K.,"Engineering Mathematics For First Year B.E/B.Tech,Seventh Edition 2008 S.Chand and Co., New Delhi.

3.Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics, Semester-I”, ninth Edition, Laxmi Publications Pvt. Ltd, 2016.

4. Engineering Mathematics: First year. Calculus and Analytical Geometry, Volume, M.K.Venketaraman, National Publishing company,1965.

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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	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	0.6	0.2	-	-	-	-	-	-	-	1	-	-

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

Course Objectives

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

UNIT 1 Crystal Physics	**9**
Single crystalline, polycrystalline and amorphous materials– single crystals -Seven type of crystal system- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures ,Crystal growth-Bridgmann technique, Czochralski technique.	
UNIT 2 Properties of Matter	**9**
Properties of matter: Elasticity- Hooke's law - Relationship between three moduli of elasticity– stress -strain diagram– Poisson's ratio –Factors affecting elasticity– Torsional stress & deformations – Twisting couple – Torsion pendulum- theory and experiment– bending of beams -bending moment–uniform and nonuniform bending: theory and experiment.	
UNIT 3 Ultrasonics	**9**
Ultrasonics: Production of ultrasonics by Magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays. Applications of ultrasonic waves: SONAR.	
UNIT 4 Quantum Physics	**9**
Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect. Theory and Experiential verification - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states.	
UNIT 5 Photonic and Fibre Optics	**9**
Photonics: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients – Conditions for Laser action - Types of lasers – Nd YAG and CO2 lasers. Laser applications: Laser welding, laser marking, surface texturing. Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) –Losses in fibers - attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- pressure and displacement.	
TOTAL PERIODS	**45**

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.

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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	-	-	-	-	-

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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 – External conditioning (Ion exchange, zeolite) – Internal conditioning (Carbonate, phosphate, calgon, sodiumaluminate 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 Evoparation 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-Infra red 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-Photophysical processes Internal conversion-Intersystem crossing-Fluorescence and Phosphorescence-Chemiluminescence and Photosensitization.

TOTAL PERIODS — **45**

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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	Interpret 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

REFERENCES

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.

2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

3. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

4.Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body, Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013

5.Guang-Zhong Yang, Body Sensor Networks, Springer, 2006

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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

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

Department: Computer Science and Engineering, R2024, CBCS

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

அலகு I மொழி மற்றும் இலக்கியம் UNIT I LANGUAGE AND LITERATURE	3

இந்திய மொழிக் குடும்பங்கள் – 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 TAMILS**	**3**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas	
அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	
TOTAL PERIODS	**15**

TEXT BOOK CUM REFERENCE BOOKS

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

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

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

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

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

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

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

8.Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
9.Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Meenakshi Sundararajan Engineering College

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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.

Practicals:

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.

Practicals:

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.

Practicals:

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

Practicals:

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.

Practicals:

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

TOTAL PERIODS	**90**

Course Outcomes

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

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

TEXT BOOKS

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education,2015.

2. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016

REFERENCES

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.

2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020

3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.

4.. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.

5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**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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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 simulations, 2D/3D transformations and their applications in engineering graphics.

UNIT 1 PLANE CURVES , PROJECTION OF POINTS AND STRAIGHT LINES	**6+9**
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method. Orthographic projection- principles- Principal planes-First angle projection-projection of points and straight lines inclined to both the principal planes	
UNIT 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 graphics, Introduction to Blender and Sketch, basic operations and commands, creating 2D drawings and 3D models: 2D Geometric transformations -2D viewing – Line, Polygon clipping, 3D Viewing – 3D Object representations – 3D Transformations	
TOTAL PERIODS	**75**

Course Outcomes

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

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

TEXT BOOKS
1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House,53 Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015
4. 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	3	-	3
AVG	3	1	2	-	2	-	-	-	-	3	-	2	2	-	2

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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
	Self-Study
1	List examples of sheet metal fabricated component used in house
2	Application of shaft
3	List examples of welded components commonly used in a house
4	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

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: Computer Science and Engineering, R2024, CBCS

U24TP110	COMMUNICATION SKILLS LABORATORY 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 and speaking activities that are relevant to authentic contexts.

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

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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: Computer Science and Engineering, 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)

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	2	-	1	1	1	-	-	-	2			
CO2	2	1	1	-	1	-	1	-	-	-	2	2			
CO3	2	1	1	2	-	-	-	1	-	-	-	2			
CO4	-	1	1	2	2	-	-	-	-	-	-	2			
CO5	-	1	1	2	3	1	-	-	1	1	2	2			
AVG	2	1	1	2	2	1	1	1	1	1	2	2			

U24IP201	BIOLOGY FOR ENGINEERS	
Course Objectives		
1	To familiarize the students with the basic biological concepts and their engineering applications.	
2	To motivate the students to develop an interdisciplinary application with a vision of biological engineering.	
Module I: CELL - BASIC UNIT OF LIFE & BIOMOLECULES		**8+2**
Introduction. Structure and functions of a cell. Biomolecules: Properties & functions of Carbohydrates, Nucleic acids, proteins, lipids. Enzymes: Enzymes and their applications in industry		
Module II: BIOLOGICAL BLUEPRINT OF COMPUTING		**8+2**
Eye as a Camera system- Image recognition. Heart as a pump system - Network flow, load balancing, and data transfer processes. Autonomic nervous system: Network management and data transfer processes Kidney as a filtration system -Data filtering and caching in computer systems.		
Module III: BIOENGINEERING		**8+2**
Examples of Biomimicry: Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train),Humpback Whale(Wind Turbine Blades). **Application in Bioinformatics:** DNA Sequence Analysis and Pattern Matching, Drug Discovery using Machine Learning, Personalized Medicine Algorithms, Image Analysis in Histopathology, RNA Sequencing Data Analysis.		

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Department: Computer Science and Engineering, 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 engage learners in meaningful language activities to improve their reading and writing skills.
3	To enhance learners' vocabulary with a focus on technical terms and enabling them to communicate more effectively in both technical and professional contexts.
4	To master key grammar concepts and apply those concepts to produce clear and correct written communication
5	To help learners understand the purpose, audience, contexts of different types of writing.

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**

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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

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

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.

2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi

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

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

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

CO-PO, 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: Computer Science and Engineering, 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 HOURS	**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 , 1st Edition , 2017.

REFERENCES

1.Gupta. S.C. and Kapoor. V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand &Sons, New Delhi, 12th Edition, 2020.

2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning,New Delhi, 8th Edition, 2014.

3.Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition,Elsevier, 2014.

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

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

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

	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	-	-

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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.

UNIT 3 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).

UNIT 4 OPTICAL PROPERTIES OF MATERIALS

Classification of optical materials – Absorption emission and scattering of light in metals, insulators and semiconductors (quanlitative) – 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 nanotechnology, Wiley, 2003

5.Principles of Electronic Materials and Devices, S.O.Kasap, McGraw Hill Education, 2017.

6.Fundamentals of Nano electronics, 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	-	-	-

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Department: Computer Science and Engineering, R2024, CBCS

U24TA201	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	L	T	P	C
		1	0	0	1

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்:	**3**
சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியிடுகள்	
அலகு II வடிவமைப்பு மற்றும் கட்டிடக் தொழில்நுட்பம்:	**3**
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் 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	
அலகு III உற்பத்தித் தொழில் நுட்பம் :	**3**
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்	
அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:	**3**
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் 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	
அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் :	**3**
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இனையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்	
TOTAL HR	**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 of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
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.

U24TA201	**TAMILS AND TECHNOLOGY**	**L**	**T**	**P**	**C**
		1	0	0	1
UNIT I WEAVING AND CERAMIC TECHNOLOGY			**3**		
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.					
UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY			**3**		
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.					
UNIT III MANUFACTURING TECHNOLOGY			**3**		
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.					
UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY			**3**		
Dam, Tank, ponds, Sluice, Significance of 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 SCIENTIFIC TAMIL & TAMIL COMPUTING			**3**		
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.					
	TOTAL HR		**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
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9. Keeladi - ‘Sangam City C ivilization on the banks of river Vaigai’ (Jointly Published by:Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
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.

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, 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.

Practicals:

1.Implement a python program to print an Electricity Bill (for domestic usage.)

2.Implement a Python program to exchange the values of two variables (using simple statements and expressions)

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

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

Practicals:

1.Implement a Python program to print a Number series & Number Patterns.(using Iterative loops).

2.Implement a Python program to find Factorial and largest number in a list (using Functions).

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.

Practicals:

1.Implement a Python program using Lists & Tuples. (operations of list & tuples - Book Catalogue)

2.Implement a Python program using Sets, Dictionaries. (operations of Sets - Product Categories , operations on Dictionaries - Product Categories)

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

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

Practicals: 1.Implement a Python program to perform file operations (copy from one file to another, word count, longest word). 2.Implement a Python program to handle Exceptions.(voter's age validity).	
UNIT 5 LIBRARIES,PACKAGES	**9+9**
Python libraries - NumPy-Array manipulations, numeric ranges, Slicing, indexing, Searching, Sorting and splitting, Pandas - Data Analysis, Data-frame, Data selection, group-by, Series, sorting, searching, and statistics, dask (pandas wrapper), Matplotlib- Data visualization, Line plot, Style properties, multi line plot, scatter plot. **Practicals:** 1.Implement a Python program to create a weather data chart using Python Standard Libraries (pandas, numpy. Matplotlib, scipy) .	
TOTAL 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 Edition, O'Reilly Publishers, 2016.

2.Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021

2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion

3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling

4.Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.

5.Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

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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	-	-	-	-	-	-	-	-	-	-	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

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

UNIT3 PRINCIPLES OF SUSTAINABLE GREEN CHEMISTRY — **6**

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

UNIT 4 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.

UNIT 5 GOOD HEALTH AND WELL BEING - WATER-SOIL-AIR	**6**
Ground water contamination and contamination of water bodies. The role of chemistry in developing appropriate technological solutions for water treatment using Electrodialysis, Forward osmosis and advanced oxidation using photocatalysis and waste water treatment. Reclamation of soil. Current air pollution situation and trends. Factors responsible for air pollution. Air pollution assessment, monitoring and mitigation.	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the ability to face the current challenges across globe with the aid of chemistry.
CO2	Identify the climatic challenges and to contribute for sustainable transformation.
CO3	Understand the safe design of products with the principles of green chemistry.
CO4	Understand to analyze the energy challenges for sustainable resource management.
CO5	Integrate chemistry with environmental science and public health.

TEXT BOOKS

1.Anubha Kaushik and C.P.Kaushik “Perspectives in Environmental Studies”,6thEdition,NewAge International Publishers, 2018.

2.BennyJoseph,‘Environmental Science and Engineering’,TataMcGraw-Hill,NewDelhi,2016.

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

4.Allen,D.T.andShonnard,D.R.,SustainabilityEngineering:Concepts,DesignandCaseStudies, Prentice Hall.

5.Bradley.A.S;Adebayo,A.O.,Maria,P.Engineering applications in sustainable design and development, Cengage learning.

6.Environment Impact Assessment Guidelines, Notification of Government of India, 2006

7.Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1. M.Karpagam,Geetha Jaikumar,”Green Management Theory and Applications”, ANE Publishers, First Edition, 2010

2. Matlack,A.S. Introduction to green chemistry, Marcel Dekker: New York,2001.

3. Anastas, P.T:Warner,J.C.Green chemistry:Theory and practice,Oxford univ press:oxford,1998.

4. Fankte, Peter,et al. “Exposure and toxicity characterization of chemical emissions and chemical in products: Global recommendations and implementation in USEtox” The international journal of life cycle assessment,26.5(2021):899- 915.

5. Rajagopalan. R, ‘Environmental Studies-From Crisis to Cure’,Oxford University Press, 2005.

6. Erach Bharucha “Textbook of Environmental Studies for Undergraduate Courses” Orient Black swan Pvt. Ltd. 2013.

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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	-	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	-	-	-

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U24EC202	BASICS OF ELECTRICAL AND ELECTRONIC 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 and 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 opamp 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	

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	3	3	2	3	1	1	1	1	2	1	1	2	2	1	2
CO2	3	2	2	2	1	1	1	1	2	1	1	2	2	1	2
CO3	3	2	2	2	1	1	1	1	2	1	1	2	2	1	2
CO4	3	2	2	2	1	1	1	1	2	1	1	2	2	1	2
CO5	3	2	1	2	1	1	1	1	2	1	1	2	2	1	2
AVG	3	2.2	1.8	2	1	1	1	1	2	1	1	2	2	1	2

Meenakshi Sundararajan Engineering College

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

Department: Computer Science and Engineering, R2024, CBCS

U24TP210	COMMUNICATION SKILLS LABORATORY 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**

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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 Black Swan, 2013	
4.Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015	
5.Interact English Lab Manual for Undergraduate Students, Orient Black Swan: Hyderabad, 2016	
6 E. Suresh Kumar et al. Communication for Professional Success. Orient Black swan: Hyderabad, 2015	
7.Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014	
8.S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.	

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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	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	-

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

Course Objectives

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

LIST OF EXPERIMENTS

PHYSICS LABORATORY

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

CHEMISTRY LABORATORY

1	Estimation of mixture of acids by conductometric titration
2	Estimation of iron by potentiometric titration
3	Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
4	Determination of alkalinity in a water sample
5	Estimation of hardness of water by EDTA method
6	Estimation of hydrochloric acid by pHmetric method
7	Determination of chloride content of water sample by Argentometric method

8	Determination of viscosity of a polymer using ostwald's viscometer	
9	Estimation of iron content using spectrophotometer.	
	TOTAL PERIODS	**60**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Gain knowledge about torque and rigidity modulus of a material and understand the principles of simple harmonic motion and bending of beams
	Estimate the strength of given mixture of acids using conductance measurements under the principle of conductometric titration and Estimate the strength of given iron using EMF measurements with the help of potentiometer and have a knowledge on redox reaction.
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 travelling in liquid medium & comprehend the light accepting power of given optical fibre and its transmission
	Employ complexometric titrations to estimate total hardness of a water sample and determine the amount of chloride present in water using Argentometric method.

TEXT BOOKS

1. Mechanics Part I and Part II, Narayanamoorthy National Publishing Company, 2001.

2. Optics -Dr.Murugesan, S Chand Publication.

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)

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

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Department: Computer Science and Engineering, 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 — **2**

- 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 — **2**

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

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

- Before You Begin: Identify An Opportunity – Scope Your Project – Draft Your Design Brief – Make Your

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

UNIT 5 REAL WORLD CASE STUDIES AND EXAMPLES	**7**

- 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			
AVG	2	3	3	3	1	3	2	1	3	3	3	3			

Meenakshi Sundararajan Engineering College

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U24MA302	DISCRETE MATHEMATICS	L	T	P	C
		3	1	-	4

Course Objectives

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

UNIT 1 LOGIC AND PROOFS — **9+3**

Propositional Logic – Propositional Equivalences – Normal Forms - Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

UNIT 2 COMBINATORICS — **9+3**

Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations -Generating Functions - Solving Linear Recurrence Relations Using Generating Functions– Inclusion – Exclusion – Principle and Its Applications.

UNIT 3 GRAPHS — **9+3**

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

UNIT 4 ALGEBRAIC STRUCTURES — **9+3**

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

UNIT 5 LATTICES AND BOOLEAN ALGEBRA — **9+3**

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

TOTAL: 60

At the end of the course, the student will be able to	
CO1	Apply of propositions, predicates and flow of logical proofs
CO2	Understanding the knowledge of induction ,counting principles and to solve recurrence relation.
CO3	Understanding the knowledge of various types and characteristics of graphs.
CO4	Be aware of the counting principles.
CO5	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields

TEXT BOOKS	
1.Kenneth H. Rosen, —Discrete Mathematics and its Applications‖, Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2012.	
2.Tremblay J.P. and Manohar R, —Discrete Mathematical Structures with Applications to Computer Science‖, Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.	
3.Veerarajan.T,"Discrete Mathematics", 25th Edition,Tata Mcgraw Hill Education , private Limited ,2016.	
REFERENCES	
1.Ralph. P. Grimaldi, —Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education, Fifth Edition, New Delhi, 2014	
2.Seymour Lipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.	
3.Thomas Koshy," Discrete Mathematics with Applications ", Elsevier Publications, Boston, 2004.	

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

	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	-	-	-	-	-	-	1	-	-	1	-	1

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U24CS302	DATA STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives

To Build a real-time project (Data Structure Simulator) like Smart Library Management System that integrates various data structures by

1	Defining the Scope by learning the concepts of ADTs.
2	Implementing Data Structures by exploring linear data structures and non-linear data structures.
3	Sharing and Collaborating- If required

UNIT1	LISTS	9

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists

UNIT2	STACKS AND QUEUES	9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions-Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

UNIT3	TREES	9

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT4	MULTIWAY SEARCH TREES AND GRAPHS	9

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

UNIT5	SEARCHING, SORTING AND HASHING TECHNIQUES	9

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –. Quick Sort - Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing.

TOTAL: 45

At the end of the course, the student will be able to	
CO1	Understand linear and non-linear data structures' concept
CO2	Implement linear and non–linear data structure operations.
CO3	Apply appropriate linear/non–linear data structure operations for solving a given problem.

CO4	Apply appropriate graph algorithms for graph applications.
CO5	Analyze the various searching and sorting algorithms.

TEXT BOOKS

Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.

Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

Ellis Horowitz and Sartaj Sahni, Anderson Freed “Fundamentals of Data Structures in C”, University Press, 2008.

REFERENCES

Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.

Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.

Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006

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

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

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U24CS304	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	3	1.5

Course Objectives	
1	To understand and implement the concepts of ADTs.
2	To implement linear data structures – lists, stacks, and queues.
3	To implement non-linear data structures – trees and graphs.
4	To implement sorting, searching and hashing algorithms.
5	To implement User Interface with any programming language.
List of Experiments - (C Programming)	
1	Array implementation of Stack, Queue and Circular Queue ADTs
2	Implementation of Singly Linked List
3	Implementation of Polynomial Manipulation using Linked list
4	Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
5	Implementation of Binary Search Trees
6	Implementation of Heaps using Priority Queues
7	Implementation of Dijkstra's Algorithm
8	Implementation of Insertion Sort
9	Implementation of MergeSort
10	**Mini Project** Build a lightweight System with core Data structure concepts
	TOTAL:45

Mini Projects (Teams)

1. File system simulator using Tree
2. Dynamic Task scheduling system
3. Stock Management system

At the end of the course, the student will be able to	
CO1	Implement Linear data structure algorithms.
CO2	Implement applications using Stacks and Linked lists
CO3	Implement Binary Search tree and AVL tree operations.
CO4	Implement graph algorithms.
CO5	Analyze the various searching and sorting algorithms.

TEXT BOOKS

Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.

Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

Ellis Horowitz and Sartaj Sahni, Anderson Freed "Fundamentals of Data Structures in C", University Press, 2008.

REFERENCES

Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.

Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.

Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006

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

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

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS303	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

Develop a real-world application like University Course Management System by

1	Understanding Object Oriented Programming concepts and basics of Java programming language
2	Understanding the principles of packages, inheritance and interfaces
3	Learning java application with threads and generics classes
4	Defining exceptions and use I/O streams
5	Designing and building Graphical User Interface Application using JAVAFX

UNIT 1 INTRODUCTION TO OOP AND JAVA	**9**

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

UNIT 2 INHERITANCE, PACKAGES AND INTERFACES	**9**

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT 3 EXCEPTION HANDLING AND MULTITHREADING	9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication, suspending – Resuming, and Stopping Threads –Multithreading.

UNIT 4 I/O, GENERICS, STRING HANDLING	**9**

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT 5 JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS	**9**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls:Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls –ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus– Basics – Menu – Menu bars – MenuItem.

	TOTAL: 45

Meenakshi Sundararajan Engineering College

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

Department: Computer Science and Engineering, R2024, CBCS

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Apply the concepts of classes and objects to solve simple problems
CO2	Develop programs using inheritance, packages and interfaces
CO3	Make use of exception handling mechanisms and multithreaded model to solve real world problems
CO4	Build Java applications with I/O packages, string classes, Collections and generics concepts
CO5	Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications
TEXT BOOKS	
1.Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2019	
2.Herbert Schildt, “Introducing JavaFX 8 Programming”, 1 st Edition, McGraw Hill Education, New Delhi, 2015	
REFERENCES	
1.Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 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	1	1	3	1	3	-	-	-	3	2	2	2	3	1	2
CO2	2	1	3	2	1	-	-	-	2	1	1	3	3	3	2
CO3	3	3	1	2	2	-	-	-	3	2	1	2	3	1	3
CO4	3	1	2	2	2	-	-	-	1	2	1	3	3	1	1
CO5	1	1	2	3	2	-	-	-	3	2	1	2	3	3	3
AVG	2	1	2	2	2	-	-	-	2	2	1	2	3	2	2

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS305	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

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

	List of Experiments
1	Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2	Develop stack and queue data structures using classes and objects.
3	Develop a java application with an Employee class with Emp_name, Emp_id, Address,Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
5	Write a Java Program to create an interface named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
6	Implement exception handling and creation of user defined exceptions.
7	Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8	Write a program to perform file operations.
9	Develop applications to demonstrate the features of generics classes.
10	**Mini Project**
	Develop applications using OOPS concepts,JavaFX controls, layouts and menus.
	Total : 45 Periods

Mini Projects (Teams)

Movie Ticket Booking System
Contact Management Application
File Organizer Utility

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	Design and develop java programs using object oriented programming concepts
CO2	Develop simple applications using object oriented concepts such as package, exceptions
CO3	Implement multithreading, and generics concepts
CO4	Create GUIs and event driven programming applications for real world problems
CO5	Implement and deploy web applications using Java
TEXT BOOKS	
1	Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2019
2	Herbert Schildt, “Introducing JavaFX 8 Programming”, 1st Edition, McGraw Hill Education, New Delhi, 2015
REFERENCES	
1	Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 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	1	2	1	-	-	-	-	1	2	2	2	1	2	3
CO2	2	1	3	1	-	-	-	-	2	3	3	2	1	3	1
CO3	2	2	1	2	1	-	-	-	1	2	1	3	2	3	2
CO4	2	2	1	3	-	-	-	-	3	1	1	1	2	1	2
CO5	1	3	3	1	3	-	-	-	1	1	1	1	2	1	2
AVG	2	2	2	2	2	-	-	-	2	2	2	2	2	2	2

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS306	DIGITAL LOGIC DESIGN	L	T	P	C
		3	0	2	4

Course Objectives

Design digital circuits for various applications like digital clock, digital lock, traffic light controller etc. by

1	Analyzing and designing combinational circuits
2	Analyzing and designing synchronous and asynchronous sequential circuits
3	Understanding Programmable Logic Devices
4	Understanding Verilog code for combinational and sequential circuits

UNIT 1 BOOLEAN ALGEBRA AND LOGIC GATES

Number Systems — Arithmetic Operations — Binary Codes- Boolean Algebra and Logic Gates — Theorems and Properties of Boolean Algebra — Boolean Functions — Canonical and Standard Forms — Simplification of Boolean Functions using Karnaugh Map — Logic Gates — NAND and NOR Implementations.

Practical:

1. To implement and verify Boolean functions using basic logic gates
2. To simplify a 3-variable Boolean function using Karnaugh Map and implement it using only NAND gates.

UNIT 2 COMBINATIONAL LOGIC

Combinational Circuits — Analysis and Design Procedures — Binary Adder-Subtractor — Decimal Adder — Binary Multiplier — Magnitude Comparator — Decoders — Encoders — Multiplexers — Introduction to Verilog — Verilog Models of Combinational circuits.

Practical:

3. To design and implement a binary adder-subtractor using full adders and verify its operation.
4. To design and simulate a 4-bit magnitude comparator using Verilog and verify its functionality.

UNIT 3 SYNCHRONOUS SEQUENTIAL LOGIC

Sequential Circuits — Storage Elements: Latches , Flip-Flops — Analysis of Clocked Sequential Circuits — State Reduction and Assignment — Design Procedure — Registers and Counters — Verilog Models of Sequential Circuits.

Practical:

5. To design and implement a 4-bit synchronous up-counter using flip-flops and verify its operation.
6. To design and simulate a 4-bit shift register using and verify its functionality.

UNIT 4 ASYNCHRONOUS SEQUENTIAL LOGIC

Analysis and Design of Asynchronous Sequential Circuits — Reduction of State and Flow Tables — Race-free State Assignment — Hazards.

Practical:

7. To design and analyze a 2-bit asynchronous counter using flip-flops and observe the race conditions and hazards.
8. To design a simple asynchronous sequential circuit, reduce its state and flow tables, and perform a race-free state assignment.

UNIT 5	**MEMORY AND PROGRAMMABLE LOGIC**
RAM — Memory Decoding — Error Detection and Correction — ROM — Programmable Logic Array — Programmable Array Logic — Sequential Programmable Devices. **Practical:** 9. To design a basic RAM (Random Access Memory) system and implement error detection using a parity bit. 10. Mini Project	
	TOTAL 75

PROJECTS(Team)

- **Digital Lock System**: A security system unlocking upon entering a correct binary code, combining combinational logic with user input interfaces.
- **Digital Clock**: A timekeeping device displaying hours, minutes, and seconds, combining counters and display interfacing.
- **Digital Calculator**: A basic calculator performing arithmetic operations, reinforcing combinational logic concepts.
- **Traffic Light Controller**: A system managing traffic signals, illustrating sequential logic and FSMs.

Course Outcomes	
At the end of the course, the student will be able to	
CO1	To design digital circuits using simplified Boolean functions
CO2	To analyze and design combinational circuits
CO3	To analyze and design synchronous sequential circuits
CO4	To analyze and design asynchronous sequential circuits
CO5	To understand Programmable Logic Devices
TEXT BOOKS	
1	M. Morris R. Mano, Michael D. Ciletti, —Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog‖, 6th Edition, Pearson Education, 2017.
REFERENCES	
1	G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2	John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3	Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4	Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003.

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

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CO2	3	1	1	2	2	-	-	-	3	2	1	1	3	1	2
CO3	3	3	2	1	2	-	-	-	3	3	1	2	2	2	2
CO4	1	2	2	3	2	-	-	-	3	1	3	1	1	2	1
CO5	2	2	1	1	3	-	-	-	1	2	2	3	1	3	3
AVG	2.4	1.8	1.8	1.6	2	-	-	-	2.2	2.2	2	2	1.8	1.8	2.2

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS301	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	2	4

Course Objectives

Developing applications like sentiment analysis, stock market prediction and Fraud Detection using publicly available dataset

1	To understand the data science fundamentals and process.
2	To learn to describe the data for the data science process.
3	To learn to describe the relationship between data
4	To present and interpret data using visualization libraries in Python
5	To understand the applications of data science

UNIT1 INTRODUCTION TO DATA SCIENCE

Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – Model Building – presenting findings and building applications

Practical:

1. Working with Numpy arrays - Computation on arrays
2. Working with Pandas dataframes - Data indexing and selection – operating on data – missing data
3. Reading data from text files, Excel and the web

UNIT2 DESCRIBING DATA

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

Practical :

1. Descriptive and statistical analytics on Diabetes data set.

UNIT3 DESCRIBING RELATIONSHIP

Correlation –Scatter plots, Correlation coefficient for quantitative data, Computational formula for correlation coefficient, Regression – Regression Line, Least Squares Regression Line, Interpretation of r2 – Multiple Regression Equations

Practical:

1. Perform Linear regression modeling on Diabetes data set.

UNIT4 DATA VISUALIZATION

Visualization with Matplotlib – 2D and 3D plots - Line plot, Scatter plot, Density plot, Contour plots, Histograms

Practical :

1. Use the Diabetes datasets to explore the various plotting functions

UNIT5 APPLICATIONS OF DATA SCIENCE

Case study - Data science in Health care, Financial Services, Agriculture and Media

Practical:

Implementation of a data science projects like sentiment analysis, stock market prediction and Fraud Detection

TOTAL 60 HOURS

Projects (Teams)
• Sentiment analysis • Stock market prediction • Fraud Detection • Cricket Score Analysis • Weather Prediction

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Define the data science process
CO2	Learn the different types of data description for data science process
CO3	Gain knowledge on relationships between data
CO4	Use Data Visualization techniques to explore data
CO5	Use Python-based toolkits to create data science applications.
TEXT BOOKS	
1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4	Chirag Shah, A Hands-on Introduction to Data Science, Cambridge University Press,UK, 2020
REFERENCES	
1	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014
2	Grus, Joel, Data science from scratch: first principles with python. O'Reilly Media,2019.
3	https://www.coursesidekick.com/statistics/study-guides/introstats1
4	Wes McKinney, Python for Data Analysis, 3rd Edition, O’ Reilly, 2022

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

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

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

COURSE OBJECTIVES

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

UNIT 1 VECTOR SPACES — **9 +3**

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

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

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

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

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

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

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

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

TOTAL: 60 PERIODS

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	1.Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi, 4 th Edition, 2004.
2	2.Grewal. B.S. and Grewal. J.S., “Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
3	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.

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	-	-	-	1	-	-	1	1	-	-

U24CS401	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Develop a simplified OS kernel simulator that demonstrates process scheduling, memory management, and file system navigation by

1	Learning the basic concepts and functions of operating systems (OS).
2	Understanding the mechanisms of OS to handle processes and threads and their communication
3	Studying the basic components of scheduling mechanisms and Deadlocks.
4	Understanding File management strategies in contemporary OS.
5	Learning the Memory and Storage management in operating systems

UNIT 1 INTRODUCTION TO OPERATING SYSTEMS — **9**

Introduction to OS – Operating System Operations – Operating System Services – User and Operating System Interface – System Calls – Operating System Structures – Process Concept – Process Scheduling – Context Switch – Operations on Processes.

UNIT 2 PROCESS SYNCHRONIZATION AND THREADS — **10**

Inter-process Communication – IPC in Shared Memory Systems – IPC in Message Passing Systems – Examples of IPC Systems -Multicore Programming – Multithreading Models – Thread Libraries – Threading Issues – The Critical Section Problem – Peterson's Solution – Hardware Support for Synchronization – Mutex Locks – Semaphores – Monitors – Liveness.

UNIT 3 SCHEDULING AND DEADLOCKS — **9**

Basic Concepts of CPU Scheduling– Scheduling Criteria – Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue – Thread Scheduling –Real-Time CPU Scheduling, Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention –Deadlock Avoidance – Deadlock detection – Recovery from deadlock.

UNIT 4 FILE SYSTEM — **9**

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.
File-System Interface - I/O Systems – I/O Hardware,Application I/O interface, Kernel I/O subsystem.

UNIT 5 MEMORY AND STORAGE MANAGEMENT — **9**

Main Memory -Swapping-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. Mass-Storage Structure: Disk Structure - Disk Scheduling Algorithms and Management

TOTAL: 45 PERIODS

At the end of the course, the student will be able to	
CO1	Analyze various scheduling algorithms and process synchronization
CO2	Study and implementation of various CPU scheduling algorithms and process synchronization techniques”
CO3	Exploration of deadlock handling mechanisms, and different file management systems
CO4	Explain the functionality of file systems, I/O systems, and Virtualization
CO5	Compare iOS and Android Operating Systems.

TEXT BOOKS	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley and Sons Inc., 2018.
2	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition,2022 New Delhi.
3	NPTEL course on “Operating System fundamental “https://archive.nptel.ac.in/courses/106/105/106105214/

REFERENCES	
1	William Stallings, “Operating Systems – Internals and Design Principles”, 9thEdition, Pearson, 2018
2	Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
3	D. M. Dhamdhere, “Operating Systems: A Concept–based Approach”, Third Edition. Tata McGraw–Hill, 2017.
4	https://pdos.csail.mit.edu/6.828/2014/xv6/book–rev8.pdf
5	The xv6 source code: git clone git://pdos.csail.mit.edu/xv6/xv6.git

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS406	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES	
1	To implement various CPU scheduling algorithms.
2	To implement Deadlock Avoidance and Deadlock Detection Algorithms
3	To implement Page Replacement Algorithms
4	To implement various memory allocation methods.
5	To be familiar with File Organization and File Allocation Strategies
LIST OF EXPERIMENTS : All experiments can be done in Windows / Linux	
1	Basic UNIX Commands, System calls – ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc
2	Basic Shell script
3	Process control system calls - demonstration of fork, exec, wait fork(), exec(), getpid(),opendir(), readdir()
4	Write C program to implement Thread management
5	Implementation of CPU scheduling Policy
6	Write C program to avoid Deadlock using Banker's Algorithm
7	Implement the paging Technique using C program
8	Write C programs to Implement the various File Organization Techniques
9	Implement the following File Allocation Strategies using C programs a. Sequential b. Indexed c. Linked
10	Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit
11	Write C programs to implement the various Page Replacement Algorithms
12	Mini Project
	TOTAL:45 Periods

At the end of the course, the student will be able to	
CO1	To implement various CPU scheduling algorithms.
CO2	To implement Deadlock Avoidance and Deadlock Detection Algorithms
CO3	To implement Page Replacement Algorithms
CO4	To implement various memory allocation methods.
CO5	To implement File Organization and File Allocation Strategies
TEXT BOOKS	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”ǁ, 10th Edition, John Wiley and Sons Inc., 2018.
2	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES	
1	Ramaz Elmasri, A. Gil Carrick, David Levine, " Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3	Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

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	1	1	-	-	-	1	3	3	3	2	1	3
CO2	3	1	1	2	2	-	-	-	3	2	1	1	3	1	2
CO3	3	3	2	1	2	-	-	-	3	3	1	2	2	2	2
CO4	1	2	2	3	2	-	-	-	3	1	3	1	1	2	1
CO5	2	2	1	1	3	-	-	-	1	2	2	3	1	3	3
AVG	2.4	1.8	1.8	1.6	2	-	-	-	2.2	2.2	2	2	1.8	1.8	2.2

Meenakshi Sundararajan Engineering College

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

Department: Computer Science and Engineering, R2024, CBCS

U24CS402	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES	
1	Understand conceptual modeling tools like ER diagrams and design database schemas
2	Learn relational models using relational algebra/ SQL
3	Learn to normalize the relations in RDBMS to avoid redundancy and anomalies.
4	Understand concurrent transactions and their consequences, and analyze the use of triggers, functions, and procedures in a realistic database application.
5	Understand database storage structures and access techniques

UNIT 1 INTRODUCTION TO DATABASE SYSTEMS	**9**
Introduction to Databases– File System Vs Database System – Data Models – Schemas and Instances – DBMS Architecture – Centralized – Client Server – Database Applications– ER Models – ER to Relational Mapping	

UNIT 2 RELATIONAL MODELS	**10**
Relational Model – Constraints – Keys – Dependencies – Relational Algebra – Unary, Binary, Set and Extended Relational Algebra operations – SQL– Data Definition – Data Manipulation and Retrieval Queries – Nested Queries – Joins – Views– Cursors – Procedures – Functions – Triggers – Embedded and Dynamic SQL	

UNIT 3 RELATIONAL DATABASE DESIGN	**7**
Database Design – Functional Dependencies – Normalization – 1 NF – 2 NF – 3 NF – BCNF – Multivalued Dependency (4 NF) – Join Dependency (PJNF) .	

UNIT 4 TRANSACTIONS AND RECOVERY	**10**
Transaction processing concepts – Need for concurrency control and recovery– ACID Properties – Recoverability – Serializability – Concurrency Control – Two phase locking Techniques – Timestamp based protocol – Graph based protocol – Deadlock handling – Log based recovery – Two Phase Commit Protocol	

UNIT 5 QUERY PROCESSING AND ADVANCED DATABASES	**9**
Indexing and Hashing Techniques – Query Processing and Optimization – Sorting and Joins – Database Tuning – Introduction to Spatial and Temporal Databases – OO Databases – NoSQL	
	TOTAL: 45 PERIODS

At the end of the course, the student will be able to	
CO1	Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model
CO2	Formulate solutions to a broad range of query problems using relational algebra/ SQL
CO3	Apply normalization theory to normalize the relations in RDBMS to avoid redundancy and anomalies.
CO4	Manage concurrent transactions and their consequences, and analyze the use of triggers, functions, and procedures in a realistic database application.
CO5	Understand database storage structures and access techniques

TEXT BOOKS	
1	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020
2	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017
REFERENCES	
1	C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2	Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2014.
3	Andreas Meier, Michael Kaufmann, “SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management”, 1st Edition 2019.
4	Narain Gehani and Melliyal Annamalai, “The Database Book: Principles and Practice Using the Oracle Database System”, Universities Press, 2012.
5	Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education- 2000.
6	Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, Thompson Learning Course Technology- Fifth edition, 2003.

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	3	1	–	2	–	1	3	3	3	2
CO2	3	3	3	3	3	3	1	–	2	–	1	2	3	3	2
CO3	3	3	3	3	2	3	–	–	3	–	1	3	3	3	2
CO4	3	3	3	3	3	3	–	–	1	–	1	2	3	3	2
CO5	3	3	3	2	3	3	–	–	2	–	1	3	3	3	2
AVG	3	3	3	2.8	2.8	3	1	–	2	–	1	2.6	3	3	2

U24CS407	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

Develop front end tool for GUI based application development like EMart Grocery Shop,

1	To learn and implement important commands in SQL.
2	To learn the usage of nested and joint queries.
3	To understand functions, procedures and procedural extensions of databases.
4	To understand design and implementation of typical database applications.
5	To be familiar with the use of a front end tool for GUI based application development.

.LIST OF EXPERIMENTS

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

TOTAL:45

At the end of the course, the student will be able to	
CO1	Create databases with different types of key constraints.
CO2	Construct simple and complex SQL queries using DML and DCL commands.
CO3	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO4	Create an XML database and validate with meta-data (XML schema).
CO5	Create and manipulate data using the NOSQL database.

TEXT BOOKS	
1	Database Management Systems, Raghu RamaKrishnan, Johannes Gehrke, Tata Mc Graw Hill, 3rd Edition, 2002
2	Database System Concepts, Silberschatz, Korth, McGraw Hill, V edition, 2005

REFERENCES	
1	Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition, 2006
2	Fundamentals of Database Systems, Elmasri Navathe, Pearson Education, 2017
3	Introduction to Database Systems, C.J. Date, Pearson Education, 2006
4	Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD, 2008
5	Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI, 2016
6	Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition, 2011

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

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

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS403	COMPUTER ORGANIZATION AND COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Design a PlayStation console architecture for high-performance gaming

1	By understanding the computer architecture concepts related to design of processors, memory management and I/O system.
2	By exploring the GPU computing architecture and developing an environment for creating high performance GPU-accelerated applications using CUDA programming.
3	By gaining knowledge on modern processor architecture to design the best processor/computing system.

UNIT 1 PROCESSOR ARCHITECTURE AND INSTRUCTION SETS — **9**

Basic Computer Organization and Design, Instruction Set principles, x86 and x64 architecture & instruction sets, 32 bit and 64-bit ARM architecture & instruction sets.

UNIT 2 PROCESSOR DESIGN — **9**

Designing a Data path for a Simple Processor, DLX Pipeline, Super Pipelining, Super scalar processor Task parallelism, data parallelism, and bit-level parallelism, Instruction level parallelism (ILP) Speculative Execution, Side channel attack (Spectre and Meltdown).

UNIT 3 MEMORY UNIT AND I/O ORGANIZATION — **9**

Memory Hierarchy, Non-volatile memory technologies, advanced I/O protocols, and memory, Cache Architectures, Levels in Cache, Improving Cache Performance, Memory Prefetch, Connecting I/O Devices to the Processor.

UNIT 4 GPU ARCHITECTURE — **9**

GPU Vs CPU architecture, GPU Architecture Basics, NVIDIA's CUDA Toolkit, AMD's RDNA, Ampere, Ada Lovelace and Hopper architectures, CUDA Programming

UNIT 5 MODERN COMPUTER ARCHITECTURE — **9**

Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebos,Wafer Scale Computing, Accelerators (FPGA, ASIC), RISC-V Architecture and Instruction Set, Complex Instruction Set Architecture (CISC) , RISC vs. CISC.

TOTAL: 45 PERIODS

At the end of the course, the student will be able to	
CO1	Analyze the processor architecture and instruction sets of x86/x64 and ARM architecture.
CO2	Design a data path for a simple processor and compare the various techniques related to simultaneous execution of multiple instructions from a program
CO3	Organize the computer memory to speed up the performance and facilitate the transfer of data between the computer's central processing unit and the external devices

CO4	Analyze the GPU computing architecture and develop applications to run on NVIDIA GPUs using the CUDA programming environment.
CO5	Analyze the modern processor architectures and instruction sets and implement a RISC-V processor in a low-cost FPGA board

TEXT BOOKS

1	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill,Third Reprint, 2015.
2	David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/ software interface, MorganKaufmann,6th edition, 2022

REFERENCES

1	Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition,2022

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Projects (Team)

1	Build a simple image filter for instagram using CUDA programming
2	Exploring side channel attack based on cache timing(Spectre and Meltdown).
3	Build a GEM5 simulator tool that demonstrates prototyping and evaluating new hardware features .
4	Design a mobile app to benchmark ARM processor performance with simple metrics.
5	Simulate a 5-stage pipelined RISC processor with basic hazard detection.
6	Create a Raspberry Pi based smart home controller integrating simple sensor inputs and outputs.

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U24CS404	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Understand the foundation of algorithms
2	Understand the asymptotic performance of algorithms.
3	Apply important algorithmic design paradigms and methods of analysis.
4	Demonstrate familiarity with string matching algorithms.
5	Prove the hardness and to find alternatives for such problems

UNIT 1 FUNDAMENTALS	**6**

Introduction – Asymptotic Notations – Recurrences – Substitution Method – Recurrence Tree Method – Master Method – Probabilistic Analysis and Randomized Algorithms .

UNIT 2 DIVIDE & CONQUER STRATEGY	**13**

Maximum Subarray – Strassen's Matrix Multiplication – Analysis of Quick Sort, Merge Sort – Quick Sort Randomized Version – Sorting in Linear Time – Lower Bounds for Sorting – Selection in Expected Linear Time – Selection in Worst case Linear Time.

UNIT 3 DYNAMIC PROGRAMMING AND GREEDY STRATEGIES	**8**

Elements of Dynamic Programming – Rod cutting – Matrix Chain Multiplication – Longest Common Subsequence – Elements of Greedy Strategy – Huffman Code .

UNIT 4 DESIGN STRATEGIES AND STRING MATCHING	**8**

Backtracking: N– Queens – Branch & Bound: Travelling Salesperson – String Matching: Naïve, KMP

UNIT 5 COMPLEXITY ANALYSIS	**10**

NP– Completeness – Polynomial Time Verification – Theory of Reducibility – Circuit Satisfiability –– NP Complete Problems: Vertex Cover, Traveling Salesman Problems – Approximation Algorithms – Approximation Algorithms to Vertex .

TOTAL: 45 PERIODS

At the end of the course, the student will be able to	
CO1	Have a strong foundation for algorithm study.
CO2	Analyze the asymptotic performance of algorithms.
CO3	Apply important algorithmic design paradigms and methods of analysis.
CO4	Demonstrate and analyze the string matching algorithms.
CO5	Prove the hardness and to find alternatives for such problems

TEXT BOOKS	
1	Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, Prentice Hall of India, 2009.
2	Ellis Horowitz, Sartaj Sahni and Senguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2008.
REFERENCES	
1	Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Eastern Economy Edition, 1996.
2	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, fourth edition, Pearson, 2014.
3	Dasgupta S, Papadimitriou H C and Vazirani U V , Algorithms, 2006.
4	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson, Education India, 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	3	2	2	–	3	–	–	–	–	–	–	3	3	3	3
CO2	3	3	3	3	3	–	–	–	–	–	–	3	3	3	3
CO3	3	3	3	3	3	1	–	–	–	–	–	3	3	3	3
CO4	3	3	3	3	3	1	–	–	–	–	–	3	3	3	3
CO5	3	3	2	3	3	1	–	–	–	–	–	3	3	3	3
AVG	3	2.8	2.6	3	3	1	–	–	–	–	–	3	3	3	3

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS405	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To Create an Intelligent System

1	By Learning the basic AI approaches and problem solving agents
2	By understanding Game Theory and CSP
3	By analysing logical Reasoning
4	By applying probabilistic reasoning and 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	**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	**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	**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	**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: 45 PERIODS

PRODUCT BASED PROJECTS (Teams)

- **AI-Powered Language Translation App** - Create an application that translates spoken or written language in real-time..
- **AI-Based Financial Advisor** -Create A virtual assistant that provides financial advice based on user spending habits and financial goals.
- **Smart Traffic Management System -** Create an AI-driven system that optimizes traffic flow and reduces congestion.
- **AI-Based Health Monitoring System** - Create A system that monitors vital health parameters and predicts potential health issues.

- **AI-Powered Personalized Learning Assistant** - Create an adaptive learning platform that personalizes educational content based on individual student performance and learning styles.

At the end of the course, the student will be able to	
CO1	Explain intelligent agent frameworks
CO2	Apply problem solving techniques
CO3	Apply game playing and CSP techniques
CO4	Perform logical reasoning
CO5	Perform probabilistic reasoning and Language processing
TEXT BOOKS	
1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
REFERENCES	
1	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007
2	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4	Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5	http://nptel.ac.in/

CO/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

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS503	THEORY OF COMPUTATION	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES

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

UNIT 1 REGULAR LANGUAGES — **9**

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

UNIT 2 CONTEXT FREE LANGUAGES — **9**

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

UNIT 3 PUSH DOWN AUTOMATA — **9**

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

UNIT 4 TURING MACHINES — **9**

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

UNIT 5 UNDECIDABILITY — **9**

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

TOTAL: 45 PERIODS

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
TEXT BOOKS	
1	John E Hopcroft, Rajeev Motwani, and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition, 2009.
2	John E Hopcroft and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations", Narosa Publishing House, 2002.
REFERENCES	
1	H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education, 2003.
2	J. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill, 2003.
3	Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	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

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS501	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

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**

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)

UNIT 2 NETWORK LAYER — **9**

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

UNIT 3 ROUTING PROTOCOLS — **9**

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

UNIT 4 TRANSPORT LAYER — **9**

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

UNIT 5 INTRODUCTION/ APPLICATION LAYER — **9**

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

TOTAL: 45 PERIODS

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

TEXT BOOKS	
1	James F. Kurose, Keith W. Ross, “Computer Networking: A Top– Down Approach”, Eighth Edition, Pearson Education, 2022.
2	Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2021.
REFERENCES	
1	William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2017.
2	Ying– Dar Lin, Ren– Hung Hwang, Fred Baker, " Computer Networks: An Open Source Approach", 1st Edition, McGraw Hill, 2011

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	1	-	1	-	-	1	3	1	1
CO2	3	3	3	2	1	1	1	-	-	-	-	2	3	3	1
CO3	3	3	3	3	2	1	1	-	3	-	-	2	3	3	3
CO4	3	3	3	3	2	1	1	-	3	-	-	2	3	3	3
CO5	3	3	3	2	1	1	1	-	-	-	-	-	3	2	2
AVG	3	3	3	2.4	1.4	1	1	-	2.3	-	-	1.75	3	2.4	1.8

Meenakshi Sundararajan Engineering College

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

Department: Computer Science and Engineering, R2024, CBCS

U24CS502	NETWORKS LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES	
Design applications using the networking principles	
1	Learn application layer and transport layer protocols required to implement various network applications.
2	Identify better routes by applying appropriate intra AS protocols and inter AS protocols.
3	Understand the address management techniques and configure IPv6 protocols.
4	Understand the working of LAN technology and MAC layer protocols.
5	Learn about type of medium and frequency range for data transmission
LIST OF EXPERIMENTS	
1	Practice different network commands available in Windows and Linux Operating Systems and troubleshoot the network.
2	Configure the network devices such as Router, Switch, Hub, Bridge and Repeater.
3	Analyzing the Network traffic using Packet Analyzer (Wireshark) and understanding the various protocol headers.
4	Configure IPv4 and IPv6 addressing for a network using static and dynamic approaches (SLAAC and DHCP).
5	Configure Dynamic Routing mechanism using RIP and OSPF protocols. Simulate TCP congestion control mechanism using NS2/NS3/OPNET
6	Configure Dynamic Routing mechanism using RIP and OSPF protocols.
7	Simulate TCP congestion control mechanism using NS2/NS3/OPNET.
8	Performance analysis of Network using NS2/NS3/OPNET (Delay, Bandwidth etc.)
9	Develop client/server-based applications using TCP and UDP sockets.
10	Implement the functionality of Ping and traceroute commands using raw sockets
11	Mini Project - Interdisciplinary
	TOTAL:45
Projects (Teams)	
1. Chat Application 2. Packet Sniffer 3. Simple Web Server	

At the end of the course, the student will be able to	
CO1	Identify the appropriate application layer and transport layer protocols required to implement various network applications.
CO2	Identify better routes by applying appropriate intra AS protocols and inter AS protocols.
CO3	Apply effective address management techniques and configure IPv6 protocols.
CO4	Select the appropriate LAN technology and MAC layer protocols.
CO5	Select the type of medium and frequency range for data transmission
TEXT BOOKS	
1	James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down and Approach”, Eighth Edition, Pearson Education, 2022.
2	Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2022
REFERENCES	
1	William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2017
2	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open-Source Approach”, McGraw Hill, 2012
3	Andrew S Tanenbaum, Nick Feamster and David J Wetherall, “Computer Networks”, Sixth Edition, Pearson Education, 2022.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	1	2	1	-	-	2	-	1	3	3	3	3
CO2	2	3	2	3	1	-	-	-	-	-	1	3	3	3	3
CO3	2	3	3	3	1	-	-	-	2	-	-	3	3	3	3
CO4	2	3	3	3	1	-	-	-	1	-	1	3	3	3	3
CO5	2	2	2	3	1	2	-	-	2	-	2	3	3	3	3
AVG	2	2.6	2.6	2.6	1.2	1.5	-	-	1.4	-	1.2	3	3	3	3

U24CS603	EMBEDDED SYSTEMS & IOT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To design embedded systems for IoT applications

1	Learn about microcontrollers for assembly language programming and design simple Embedded applications.
2	Understand the architectures, Communication models and IoT infrastructure Protocols
3	Learn about application protocols for the target IOT use case
4	Understand the working of IoT applications using Arduino/Raspberry Pi/open platform and Test and experiment different sensors.
5	Learn to apply IoT in real– time scenario and explore deployment platforms for IoT applications.

UNIT 1 EMBEDDED PROGRAMMING — **9**

8051 microcontroller architecture, instruction set, addressing modes, assembly language programming. Introduction to Embedded Systems – Programming Embedded Systems in C –Multiple Tasks and Processes

UNIT 2 IOT ARCHITECTURE AND CONNECTIVITY — **10**

Introduction to IoT – Enabling Technologies, IOT architectures, functional stack, IOT data management and compute stack, IoT devices, Sensors, actuators– Design & functional blocks of IoT – Control Units – Communication modules – Bluetooth – Zigbee – WiFi – GPS – GSM modules – Infrastructure Protocols – IEEE 802.15.4, IEEE 802.11ah, Zigbee

UNIT 3 IOT NETWORK LAYER AND APPLICATION PROTOCOLS — **9**

IP as the IOT network layer, Optimizing IP for IOT – 6LoWPAN adaptation, Header Compression, Fragmentation, RPL. Application protocols – SCADA

UNIT 4 IOT PROGRAMMING — **9**

Introduction to Raspberry Pi – Integration of Sensors and Actuators– Architecture– Programming– Interfacing – Reading from Sensors–

UNIT 5 IOT SECURITY AND CASE STUDIES — **8**

Securing IOT – modbus, DNP3, IoT Applications – Home Automation – Smart Cities – Smart Healthcare

TOTAL: 45 PERIODS

Product Based Projects (Teams)

Design an embedded system for the IoT applications

- Smart Door Lock System
- IoT Fire Detection System
- Smart Dustbin
- Smart Temperature Monitor
- Home Automation Using NodeMCU

At the end of the course, the student will be able to	
CO1	Use microcontrollers for assembly language programming and design simple Embedded applications.
CO2	Understand the architectures, Communication models and IoT infrastructure Protocols to design IoT solutions.
CO3	Analyze and suggest application protocols for the target IOT use case
CO4	Develop IoT applications using Arduino/Raspberry Pi/open platform and Test and experiment different sensors.
CO5	Analyze applications of IoT in real– time scenario and explore deployment platforms for IoT applications.
TEXT BOOKS	
1	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems using Assembly and C”, Pearson Education, Second Edition, 2014
2	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press, 2017
REFERENCES	
1	Muhammad Azhar Iqbal, Sajjad Hussain, Huanlai Xing, Muhammad Ali Imran, Enabling the Internet of Things, Fundamentals, Design and Applications, Wiley, 2021.
2	Michael J. Pont, “Embedded C”, Pearson Education, 2007.
3	Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands– on Approach”, VPT, 2014.
4	Adrian McEwen, Hakim Cassimally “Designing the Internet of Things”, John Wiley & Sons, 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	3	3	3	2	2	-	-	2	-	-	1	3	2	2
CO2	3	3	3	3	2	2	-	-	1	-	-	1	3	2	2
CO3	3	3	3	3	1	1	-	-	1	-	-	1	3	2	2
CO4	3	3	3	3	3	1	-	-	3	-	-	1	3	2	2
CO5	3	3	3	3	3	1	1	-	3	-	-	1	3	2	2
AVG	3	3	3	3	2.2	1.6	1	-	2	-	–	1	3	2	2

U24CS601	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1	To understand Software Engineering Lifecycle Models
2	To Perform software requirements analysis
3	To gain knowledge of the System Analysis and Design concepts using UML
4	To understand software testing and maintenance approaches
5	To work on project management scheduling using DevOp

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT — **9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION — **9**

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram- CASE TOOLS.

UNIT III SOFTWARE DESIGN — **9**

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client Server - Tiered - Pipe and filter- User interface design-Case Study.

UNIT IV SOFTWARE TESTING AND MAINTENANCE — **9**

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking-Case Study

UNIT V PROJECT MANAGEMENT — **9**

Software Project Management- Software Configuration Management - Project Scheduling- DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline:Overall Architecture Building and Testing-Deployment- Tools- Case Study

PRACTICAL EXERCISES: 30 PERIODS

LIST OF EXPERIMENTS:

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using

UML Sequence and Collaboration Diagrams 6. Draw relevant State Chart and Activity Diagrams for the same system. 7. Implement the system as per the detailed design 8. Test the software system for all the scenarios identified as per the usecase diagram 9. Improve the reusability and maintainability of the software system by applying appropriate design patterns. 10. Implement the modified system and test it for various scenarios.
Product based Projects (Teams)
• Passport Automation System • Library Management System • e-Book Management System • Learning Management System
TOTAL: 75 PERIODS

At the end of the course, the student will be able to	
CO1	Compare various Software Development Lifecycle Models
CO2	Evaluate project management approaches as well as cost and schedule estimation strategies.
CO3	Perform formal analysis on specifications
CO4	Use UML diagrams for analysis and design.
CO5	.Architect and design using architectural styles and design patterns, and test the system
TEXT BOOKS	
1	Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: Using UML, Patterns and Java”, Third Edition, Pearson Education, 2009.
2	Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, Mc Graw-Hill International Edition, 2014.
REFERENCES	
1	Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
2	Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
3	Len Bass, Ingo Weber and Liming Zhu, “DevOps: A Software Architect‘s Perspective”, Pearson Education, 2016
4	Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
5	Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 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	2	1	2	2	–	–	–	–	1	1	2	2	2	1
CO2	2	3	2	3	2	–	–	–	2	2	3	2	3	2	1
CO3	2	3	2	1	1	–	–	–	2	2	3	2	2	3	1

CO4	2	3	2	2	3	–	–	–	2	2	3	2	2	3	1
CO5	2	3	1	2	2	–	–	–	–	–	–	1	3	2	2
AVG	2	2.8	1.6	2	2	–	–	–	2	1.75	2.5	1.8	2.4	2.4	1.2

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS602	COMPILER DESIGN	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1	Develop a compiler for a sample programming language focusing on performance metrics like execution speed and overall efficiency
2	To learn lexical analysis and parsing techniques
3	To learn the process associated with type checking and runtime environments
4	To understand intermediate code generation
5	To learn to implement code generator and optimizer

UNIT 1 FRONT END OF COMPILERS — **10 + 10**

Language Processors – Structure of a Compiler – Lexical Analysis: Role of Lexical Analyzer – Specification of Tokens – Recognition of Tokens. Syntax Analysis: Introduction – Context Free Grammars – Using ambiguous Grammars–Top Down Parsing – Bottom–Recursive Descent parser – LL(1) Parser – Bottom Up Parsing –Shift Reduce Parser – SLR, CLR, LALR Parsers.

Lab Component:

1. Programs using LEX for tokenization.
2. Implementation of error recovery procedures using LEX.
3. Programs using YACC for parsing.
4. Programs for validating C– like constructs using YACC. (valid statements)

UNIT 2 TYPE CHECKING AND RUNTIME ENVIRONMENTS — **8 + 4**

Syntax Directed Definitions –Construction of Syntax Tress –Type Systems – Specification of a Simple Type Checker– Equivalence of Type Expressions –Type Conversations– Attribute Grammar for a Simple Type checking system–Runtime Environments: Storage Organization – Stack Allocation of space – Access to Nonlocal Data on the Stack – Storage allocation Strategies – Parameter Passing – Symbol Table

Lab Component:

1. Implementation of Symbol Table for a programming language like C.
2. Simple Type Checking System for basic data types in a programming language like C.

UNIT 3 INTERMEDIATE CODE GENERATION — **10 + 6**

Intermediate Representations– Syntax Tree, Three Address Code, Static Single Assignment(SSA) – Types and Declarations – Translations of Expressions — Control Flow – Backpatching – switch case statements – Intermediate code for procedures. Translation and Evaluation of expressions, flow of control and switch statements, Backpatching

Lab Component:

1. Implementation of three– address code generation for arithmetic expressions.
2. Three– address code generation for Switch– case statements.
3. Three– address code generation for arrays and Boolean expressions.

UNIT 4 CODE GENERATION — **9 + 4**

Issues in the Design of a Code generator – Target Language – Address of the target code – Simple Code Generator – Register Allocation and Assignment – Code Generation – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

Lab Component: 1. Generation of Simple target code from the three-address code. 2. Implementation of Register allocation using Graph Colouring.	
UNIT 5 CODE OPTIMIZATION	**8 + 6**
Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Peephole Optimization – Principal Sources of Optimization – Introduction to Data Flow Analysis – Partial Redundancy Elimination – Loops in Flow Graphs. **Lab Component:** 1. Implementation of peephole optimization to the generated code. 2. Integrating all the implemented features for a programming language like C.	
	TOTAL: 45 + 30

At the end of the course, the student will be able to	
CO1	Comprehensively explain the analysis phases of the compiler and develop scanners and parsers.
CO2	Manage type checking for a given language specification
CO3	Generate the intermediate representation of programs
CO4	Produce the target machine code using the runtime environment
CO5	Transform given code into an optimized code by applying various optimization techniques
TEXT BOOKS	
1	Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, updated 2nd Edition, Pearson Education, 2024.
2	Andrew W Appel, Modern Compiler Implementation in ML, Cambridge University Press, December 1997.
3	Kenneth C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1st Edition, 1997.
REFERENCES	
1	Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence Based Approach”, Morgan Kaufmann Publishers, 2001.
2	Steven S. Muchnick, “Advanced Compiler Design and Implementation”, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 1997.
3	Keith D Cooper, Linda Torczon, “Engineering a Compiler”, 3rd Edition, Morgan Kaufmann Publishers Elsevier Science, 2022.
4	John E Hopcroft and Jeffery D Ullman, "Introduction to Automata Theory, Languages and Computations”, Narosa Publishing House, 2002
5	Y. N. Srikant, Priti Shankar, The Compiler Design Handbook – Optimizations and Machine Code Generation, CRC Press, Second Edition, 2007.
6	Watson, Des, “A Practical Approach to Compiler Construction”, 1st edition, Springer- Verlog, 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	1	1	2	2	3	1	1	-	-	-	-	1	3	2	1

CO2	1	2	2	2	3	1	1	-	-	-	1	1	3	2	1
CO3	1	2	2	2	3	1	1	-	-	-	1	1	3	2	1
CO4	1	2	2	2	3	1	1	-	-	-	1	1	3	2	1
CO5	3	3	2	3	3	1	1	-	1	-	1	1	3	2	1
AVG	**1.4**	**2**	**2.6**	**2.2**	**2**	1	1	-	1	-	**1**	**1**	**3**	**2**	**1**

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS701	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C
		3	0	2	4

Course Objectives

Learn to mitigate the security breach launched in Student Database and to reduce cybercrimes

1	By learning the fundamental mathematical concepts related to security.
2	By understanding cryptographic algorithms for information security.
3	By analyzing the various types of data integrity and authentication schemes

UNIT 1 INTRODUCTION TO SECURITY — **9+6**

Computer Security Concepts, The OSI Security Architecture, Security Attacks Security Services and Mechanisms, A Model for Network Security, Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography, Foundations of modern cryptography: Perfect security, Information Theory, Product Cryptosystem Cryptanalysis.

Practical:

Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher iv) Vigenère cipher

UNIT 2 SYMMETRIC CIPHERS — **9+6**

Number theory, Algebraic Structures, Modular Arithmetic - Euclid‘s algorithm, Congruence and matrices Group, Rings, Fields, Finite Fields

SYMMETRIC KEY CIPHERS: SDES, Block Ciphers, DES, Strength of DES, Differential and linear cryptanalysis, Block cipher design principles, Block cipher mode of operation, Evaluation criteria for AES

Practical:

Apply DES algorithm for practical applications.

Apply AES algorithm for practical applications.

UNIT 3 ASYMMETRIC CRYPTOGRAPHY — **9+6**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY:

Primes, Primality Testing – Factorization, Euler’s totient function, Fermat’s and Euler’s Theorem Chinese Remainder Theorem – Exponentiation and Discrete Logarithms.

ASYMMETRIC KEY CIPHERS: RSA cryptosystem

Key distribution, Key management , Diffie Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography.

Practical:

Implement RSA Algorithm using HTML and JavaScript

Implement the Diffie-Hellman Key Exchange algorithm

UNIT 4 INTEGRITY AND AUTHENTICATION ALGORITHMS — **9+6**

Authentication requirement, Authentication function, MAC, Hash function, Security of hash function: HMAC, CMAC, SHA, Digital signature and authentication protocols, DSS, Schnorr Digital Signature Scheme, ElGamal cryptosystem, Entity Authentication: Biometrics, Passwords, challenge Response protocols, Authentication applications, Kerberos, X.509 Certificates

Practical: Calculate the message digest of a text using the SHA-1 algorithm.	
UNIT 5 CYBER CRIMES AND CYBER SECURITY	**9+6**
Cyber Crime and Information Security, classifications of Cyber Crimes, Tools and Methods, Password Cracking, Keyloggers, Spywares, SQL Injection, Network Access Control , Cloud Security Web Security, Wireless Security **Practical:** Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.	
TOTAL: 75 PERIODS	

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography
CO4	Apply the various Authentication schemes to simulate different applications
CO5	Analyze various cybercrimes and detect intrusion detection and security threats using penetration testing tools
TEXT BOOKS	
1	William Stallings, "Cryptography and Network Security - Principles and Practice", eighth Edition, Pearson Education, 2023
2	Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.
REFERENCES	
1	Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 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'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	-	-	-	1	-	-	1	2	3	3
CO2	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
CO3	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
CO4	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
CO5	3	2	3	2	3	-	-	-	3	-	-	2	3	2	3
AVG	3	2.6	2.6	2.6	2.8	-	-	-	2	-	-	1.2	2.8	2.8	3

Projects (Team)
• Create a security breach identifying the vulnerability and to mitigate the attack launched in Students' Database. • Launch attacks and identify the level of adversity to alleviate the attack in a Product database. • Cracking of Password in File Systems

Meenakshi Sundararajan Engineering College

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Department: Computer Science and Engineering, R2024, CBCS

U24CS702	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Understand the foundations and issues of distributed systems
2	Learn the various synchronization issues and global state for distributed systems
3	Demonstrate the mutual exclusion and deadlock detection in distributed systems
4	Demonstrate the agreement protocols and fault tolerance mechanisms in distributed systems
5	Describe the features of peer– to– peer and distributed shared memory systems

UNIT 1 INTRODUCTION AND A MODEL OF DISTRIBUTED COMPUTATIONS — **9**

Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message–passing systems versus shared memory systems –Primitives for distributed communication–Synchronous versus asynchronous executions –Design issues and challenges.
Distributed program – model of distributed executions —Global state –Cuts –Past and future cones of an event –Models of process communications.

UNIT 2 GROUP COMMUNICATION — **9**

Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) – Total order. Introduction –System model and definitions

UNIT 3 DEADLOCK DETECTION AND MUTUAL EXCLUSION IN DISTRIBUTED SYSTEMS — **9**

Introduction – Preliminaries – Lamport's algorithm – Ricart – Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification–Algorithms for the single resource model, the AND model and the OR model.

UNIT 4 FAILURE AND RECOVERY IN DISTRIBUTED SYSTEMS — **9**

Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery–Coordinated checkpointing algorithm –Algorithm for asynchronous checkpointing and recovery.
Problem definition – Overview of results – Agreement in a failure –free system – Agreement in synchronous systems with failures.

UNIT 5 PEER– TO– PEER COMPUTING AND DISTRIBUTED SHARED MEMORY — **9**

Introduction – Data indexing and overlays –Chord – Content addressable networks –Tapestry. Abstraction and advantages – Memory consistency models – Shared memory Mutual Exclusion.

TOTAL: 45 PERIODS

At the end of the course, the student will be able to	
CO1	Elucidate the foundations and issues of distributed systems
CO2	Point out the various synchronization issues and global state for distributed systems
CO3	Demonstrate the mutual exclusion and deadlock detection in distributed systems
CO4	Demonstrate the agreement protocols and fault tolerance mechanisms in distributed systems
CO5	Describe the features of peer– to– peer and distributed shared memory systems
TEXT BOOKS	
1	Ajay D. Kshemkalyani and Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2011.
2	. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, Second Edition, 2016.
REFERENCES	
1	George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2	Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3	Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems, McGraw Hill, 2001.
4	Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
5	Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufmann Publishers, USA, 2003

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	1	1	–	1	–	–	3	3	3	3
CO2	3	3	3	3	–	1	–	–	1	–	–	2	3	3	3
CO3	3	3	3	3	1	1	–	–	1	–	–	2	3	3	3
CO4	3	3	3	3	–	1	–	–	1	–	–	3	3	3	3
CO5	3	3	3	3	–	1	–	–	1	–	–	3	3	2	2
AVG	3	3	3	3	1.5	1	1	–	1	–	–	2.6	3	2.8	2.8