



Meenakshi Sundararajan Engineering College

(An Autonomous Institution)

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



B.TECH INFORMATION TECHNOLOGY CURRICULUM AND SYLLABUS REGULATIONS 2024 CHOICE BASED CREDIT SYSTEM

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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 IJET Society for the cause of education. The society's main objective is to provide quality education and it has been ensured since 1951.

The IJET 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 IJET 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 & Guidance on Different Career Pathways
3. Higher Education – Awareness Sessions on various Geographical Locations
4. University Fairs
5. Training / Coaching Programs for different Competitive Exams
6. Repository / Text Books for various Competitive Exams

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

OFFICE OF STUDENTS AFFAIRS

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

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

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

COLLEGE COUNSELING SERVICES

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

Individual Counseling: One-on-one sessions with RCI registered counselors or psychologists to address personal issues such as stress, anxiety, depression, relationship problems, and any other psychological concerns.

Group Counseling: Support groups where students with similar issues can share experiences and strategies for coping in a safe and supportive environment.

Crisis Intervention: Immediate support for students in distress, trauma response, and any emergency psychological concerns.

TRAINING AND PLACEMENT CELL

Meenakshi Sundararajan Engineering College training and placement cell is committed to providing exceptional placement opportunities for its students. The Placement Cell takes meticulous efforts to ensure that students are recruited by top-notch companies in the industry.

The training pathway is established starting from the first semester with 180 Hours of Placement training which includes Communications Skills, Aptitude Training, Specialised Programming, Guidance on Certifications, Projects, Competitions, Grooming, Etiquette, Group Discussion and Mock Interviews.

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

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

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

DEPARTMENT OF PHYSICAL EDUCATION

Our college campus boasts an array of sports facilities, including

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

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

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

DEPARTMENT OF SAFETY AND SECURITY

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

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

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

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

MEENAKSHI SUNDARARAJAN INNOVATION AND INCUBATION CENTRE (MSIIC)

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

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

MSEC STUDENTS CLUBS

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





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Vision of the department	Mission of the department
<p>Produce technically savvy students, encourage innovative skills and inculcate moral and professional values.</p>	<p>Mission 1: To enrich and enhance the knowledge of the faculty and students through constant interaction with stakeholders. Mission 2: To apply the concept of information technology through innovative idea for research and developments. Mission 3: To mould the students with ethical and moral values.</p>
<p>PROGRAM OUTCOMES (POs) and PROGRAM SPECIFIC OUTCOME (PSOs)</p>	
PO1	<p>Engineering Knowledge:Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to solve complex engineering problems.</p>
PO2	<p>Problem Analysis:Identify, formulate, review research literature, and analyze complex engineering problems to reach substantiated conclusions with consideration for sustainable development.</p>
PO3	<p>Design/Development of Solutions:Design creative solutions for complex engineering problems and develop systems/components/processes that meet specified needs while considering public health, safety, life-cycle cost, culture, society, environment, and sustainability.</p>
PO4	<p>Conduct Investigations of Complex Problems:Plan and carry out investigations of complex engineering problems, including design of experiments, modeling, data analysis & interpretation to provide valid conclusions.</p>
PO5	<p>Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools — including prediction and modelling — recognizing their limitations to solve complex problems.</p>
PO6	<p>The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for impact on sustainability, economy, health, safety, legal and cultural contexts.</p>
PO7	<p>Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion, and adhere to national & international laws and standards.</p>
PO8	<p>Individual and Collaborative Team work:Function effectively as an individual and as a member or leader in diverse and multidisciplinary teams.</p>
PO9	<p>Communication:Communicate effectively and inclusively within the engineering community and society — including comprehension and writing of reports, documentation, and delivery of presentations.</p>
PO10	<p>Project Management & Finance:Apply knowledge of engineering management principles and economic decision-making to one’s own work, within teams, and to manage projects in multidisciplinary environments.</p>
PO11	<p>Life-Long Learning:Recognize the need for, and have the preparation and ability for independent/Life-long learning, adaptability to new and emerging technologies, and critical thinking in the broadest context of technological change.</p>
PSO1	<p>Have proficiency in programming skills to design, develop and apply appropriate techniques, to solve complex engineering problems.</p>
PSO2	<p>Have knowledge to build, automate and manage business solutions using cutting edge technologies.</p>
PSO3	<p>Have excitement towards research in applied computer technologies.</p>



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PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: Demonstrate technical competence with analytical and critical thinking to understand and meet the diversified requirements of industry, academia and research.

PEO2: Exhibit technical leadership, team skills and entrepreneurship skills to provide business solutions to real world problems.

PEO3: Work in multi-disciplinary industries with social and environmental responsibility.

PEO4: Work ethics and adaptability to address complex engineering and social problems.

PEO5: Pursue lifelong learning, use cutting edge technologies and involve in applied research to design optimal solutions.



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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 (TCP)								
6	U24CS101	Programming in C	ESC	90	2	0	4	4
7	U24CE102	Engineering Graphics and Computer Applications	ESC	75	3	0	2	4
PRACTICAL								
8	U24ME101	Engineering Practices Laboratory	ESC	60	0	0	4	2
9	U24TP110	Communication Skills Lab I	HSMC	30	0	0	2	1
10	U24ED111	Design Thinking - Building Innovation & Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				465	17	1	13	24.5



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SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TC P	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 Lab - II	HSMC	30	0	0	2	1
10	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
TOTAL				435	17	1	10	23



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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	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
5	U24CS301	Foundations of Data Science	PCC	75	3	0	2	4
6	U24EC310	Digital Principles and Computer Organization	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	U24RM312	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	U24CS404	Design and Analysis of Algorithms	PCC	45	3	0	0	3
5	U24MC413	Indological studies	MC [#]	30	0	0	2	0
THEORY CUM PRACTICAL								
6	U24IT401	Artificial Intelligence and Machine learning	PCC	75	3	0	2	4
PRACTICAL								
7	U24CS406	Operating Systems Laboratory	PCC	45	0	0	3	1.5
8	U24CS407	Database Management Systems Laboratory	PCC	45	0	0	3	1.5
9	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
10	U24ED411	Idea & Simulation Lab	EDIC	15	0	0	1	0.5
11	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				495	15	1	16	22

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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	U24IT501	Computational Theory and Compiler Design	PCC	60	3	1	0	4
2		Open Elective-I	OEC	45	3	0	0	3
THEORY CUM PRACTICAL								
3	U24IT502	Computer Networks	PCC	75	3	0	2	4
4	U24IT503	Web Technologies	PCC	75	3	0	2	4
5		Professional Elective I	PEC	60	2	0	2	3
6		Professional Elective II	PEC	60	2	0	2	3
PRACTICAL								
7	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
8	U24IT502	Summer Internship*	EEC					1
9	U24RM512	Domain specific Experiments/Methodology/Algorithms	RMC	15	0	0	1	0.5
10	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
11	U24MC513	Fitness for Life-Yoga, Food nutrition	MC#	30	0	0	2	0
TOTAL				480	17	0	15	24

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

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SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24IT601	Full Stack Web Development	PCC	45	3	0	0	3
2	U24MC613	Integrated Disaster Management	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
3	U24CS601	Object Oriented Software Engineering	PCC	75	3	0	2	4
4	U24IT603	Embedded Systems and IOT	PCC	75	3	0	2	4
5		Professional Elective III	PEC	60	2	0	2	3
6		Professional Elective IV	PEC	60	2	0	2	3
PRACTICAL								
8	U24IT602	Full Stack Web Development Laboratory	PCC	45	3	0	0	1.5
9	U24RM612	Ethics Data Collection, Analysis and Interpretation	RMC	30	0	0	2	1
10	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1
11	U24ED611	Business Management - Go To Market & Start-up Journey	EDIC	15	0	0	1	0.5
TOTAL				480	14	0	16	21

#Mandatory Course is a Non-credit Course.



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SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24IT701	Wireless Networks	PCC	45	3	0	0	3
2		Open Elective - II	OEC	45	3	0	0	3
3		Open Elective - III	OEC	45	3	0	0	3
4	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
5	U24MC713	Constitution of India	MC [#]	30	2	0	0	0
THEORY CUM PRACTICAL								
6		Professional Elective V	PEC	60	2	0	2	3
7		Professional Elective VI	PEC	60	2	0	2	3
PRACTICAL								
8	U24IT702	Summer Internship*	EEC					1.0
9	U24RM712	Technical Writing and Research	RMC	15	0	0	1	0.5
TOTAL				300	14	0	6	19.5

***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.**



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SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
PRACTICAL								
1	U24IT801	Project Work	EEC	240	0	0	16	8
TOTAL				240	0	0	16	8
OVERALL TOTAL								165



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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	Interpersonalskills Laboratory	HSMC	30	0	0	2	1
2	U24TP210	Professional Communication Laboratory	HSMC	30	0	0	2	1
3	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
4	U24TP410	Criticaland Creative Thinking Skills	EEC	30	0	0	2	1
5	U24TP510	Analyticaland Logical Thinking Skills	EEC	30	0	0	2	1
6	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1



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RMC – Research Methodology Courses

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

PROFESSIONAL ELECTIVES

Vertical 1: Data Science & Visualization

S. No	COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
1	U24CSP11	Exploratory Data Analysis	60	2	0	2	3
2	U24CSP12	Recommender Systems	45	3	0	0	3
3	U24CSP13	Deep Learning	60	2	0	2	3
4	U24CSP14	Text and Speech Analysis	60	2	0	2	3
5	U24CSP15	Business Analytics	60	2	0	2	3
6	U24CSP16	Big Data Analytics	60	2	0	2	3



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VERTICAL 2: FULL STACK DEVELOPMENT							
S.No	COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
1	U24ITP21	Software Testing and Automation	60	2	0	2	3
2	U24IT22	Web Application Security	45	3	0	0	3
3	U24ITP23	DevOps	60	2	0	2	3
4	U24CSP24	UI & UX Design	60	2	0	2	3
5	U24ITP25	Application Development	60	2	0	2	3
6	U24ITP26	Health Care Analytics	45	3	0	0	3

VERTICAL 3: CLOUD COMPUTING DATA CENTER TECHNOLOGIES							
S.No	COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
1	U24CSP31	Cloud Computing	60	2	0	2	3
2	U24CSP32	Virtualization	60	2	0	2	3
3	U24CSP33	Cloud Services Management	45	3	0	0	3
4	U24CSP34	Storage Technologies	45	3	0	0	3
5	U24CSP35	Security & Privacy in Cloud	60	2	0	2	3
6	U24ITP36	Data Warehousing and Mining	45	3	0	0	3

VERTICAL 4: CYBER SECURITY & FORENSICS							
S.No	COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
1	U24CSP41	Ethical Hacking	60	2	0	2	3
2	U24CSP42	Digital & Mobile Forensics	60	2	0	2	3
3	U24CSP43	Information Security	45	3	0	0	3
4	U24CSP44	Modern Cryptography	45	3	0	0	3
5	U24 ITP45	Network Security	60	2	0	2	3
6	U24CSP46	Cryptocurrency & Blockchain Technologies	45	3	0	0	3



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VERTICAL 5: CREATIVE MEDIA

COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
U24PIT51	Game Design and Development	60	2	0	2	3
U24PIT52	Multimedia and Animation	60	2	0	2	3
U24PIT53	Video Creation and Visual Effects	60	2	0	2	3
U24PIT54	Metaverse Technologies	45	3	0	0	3
U24PIT55	Augmented Reality	60	2	0	2	3
U24PIT56	Virtual Reality	60	2	0	2	3

VERTICAL 6: Next-Gen AI

COURSE CODE	COURSE TITLE	TOTAL CONTACT PERIODS	L	T	P	CREDITS
U24ITP61	Robotic Process Automation	60	2	0	2	3
U24ITP62	Cognitive science	45	3	0	0	3
U24ITP63	Ethics And AI	60	2	0	2	3
U24ITP64	Quantum Computing	60	2	0	2	3
U24ITP65	Generative AI	45	3	0	0	3
U24ITP66	Explainable AI & Agentic AI	45	3	0	0	3



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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	3	0	11
2	BSC	10	11	4	0	0	0	0	0	25
3	ESC	10	7.5	4	0	0	0	0	0	21.5
4	PCC	0	0	13	20	12	12.5	3	0	60.5
5	PEC	0	0	0	0	6	6	6	0	18
6	OEC	0	0	0	0	3	-	6		9
7	EEC	0	0	1	1	2	1	1	8	14
8	MC			√	√	√	√			0
9	EDIC	0.5	0.5	0.5	0.5	0.5	0.5	-		3
10	RMC			0.5	0.5	0.5	1	0.5		3
Total		24.5	23	23	22	24	21	19.5	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



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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 (TCP)								
6	U24CS101	Programming in C	ESC	90	2	0	4	4
7	U24CE102	Engineering Graphics and Computer Applications	ESC	75	3	0	2	4
PRACTICAL								
8	U24ME101	Engineering Practices Laboratory	ESC	60	0	0	4	2
9	U24TP110	Communication Skills Lab I	HSMC	30	0	0	2	1
10	U24ED111	Design Thinking - Building Innovation & Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				465	17	1	13	24.5

#Mandatory Course is a Non-credit.



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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	Demonstrate communicative competence in academic and professional contexts.				
2	Develop the basic reading and writing skills of first year engineering and technology students.				
3	Apply key grammar concepts in reading and writing tasks.				
4	Produce effective language for professional contexts.				
5	Construct clear, concise, and coherent language for a variety of contexts.				
UNIT 1 EFFECTIVE READING AND WRITING COMMUNICATION		6			
Reading: Comprehension of short technical texts – Skimming and scanning Writing: Precis Writing, Email Writing Grammar: Tenses, Question types: Wh/ Yes or No Vocabulary development: Root words – Prefixes & Suffixes, Standard Abbreviations & Acronyms					
UNIT 2 NARRATION AND SUMMATION		6			
Reading: Reading biographies, travelogues, newspaper reports Writing: Paraphrasing, Formal and informal Letter Grammar: Prepositions, Subject-verb Agreement Vocabulary development: One-word substitution					
UNIT 3 LANGUAGE DEVELOPMENT		6			
Reading: Reading reviews, advertisements Writing: Writing Instructions, Report writing (Industrial report, Survey report & Accident report) Grammar: Discourse Markers, Degrees of comparison Vocabulary development: Compound nouns, Homophones and homonyms.					
UNIT 4 RECOMMENDATIONS AND TRANSCODING		6			
Reading: Non-verbal communication (tables, pie charts etc.) Writing: Writing recommendations, Transferring information (chart, graph etc.) Grammar: Error corrections Vocabulary development: Fixed and semi fixed expressions					
UNIT 5 LANGUAGE FOR WORKPLACE		6			
Reading: Reading Editorial columns Writing: Writing minutes of meeting Grammar: Simple, compound and complex sentences Vocabulary development: Verbal analogies					
TOTAL PERIODS		30			



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Course Outcomes														
At the end of the course, the student will be able to														
CO1	Use appropriate words in a professional context													
CO2	Gain understanding of basic grammatical structures and use them in the right context.													
CO3	Read and infer the denotative and connotative meanings of technical texts													
CO4	Write definitions, descriptions, narrations and essays on various topics													
CO5	Expand and vocabulary and technical language competency.													
TEXT BOOKS														
1.English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)														
2.English for Science & Technology Cambridge University Press, 2021.														
3.English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jovani, Department of English, Anna University.														
REFERENCES														
1.Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.														
2.A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.														
3.English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN: 0070264244.														
4.Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.														
5.Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.														
CO-PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	0	-	1	3	3	1	2	-	-	-
CO2	-	-	-	-	1	-	1	2	3	2	2	-	-	-
CO3	-	-	-	-	0	-	1	1	2	1	1	-	-	-
CO4	-	-	-	-	1	-	2	3	3	3	2	-	-	-
CO5	-	-	-	-	1	-	2	2	3	3	2	-	-	-
AVG	-	-	-	-	0.6	-	1.4	2.2	2.8	2.0	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	



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Course Outcomes														
At the end of the course, the student will be able to														
CO1	Use the matrix algebra methods for solving practical problems													
CO2	Apply differential calculus tools in solving various application problems.													
CO3	Able to use differential calculus ideas on several variable functions.													
CO4	Apply different methods of integration in solving practical problems.													
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems													
TEXT BOOKS														
1. Veerarajan.T, "Engineering Mathematics,for semester I and II", Updated second Edition,Tata Mcgraw Hill Education , private Limited ,2019.														
2.Grewal B.S and Grewel J.S ."Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2020														
3. Engineering Mathematics: First year.Calculus and analytical geometry,volume 2, M.K.Venketaraman,,National Publishing company,1965.														
4. Won Y. Yang, Young K. Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho lm, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.														
REFERENCES														
1.Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, NewDelhi,2016 .														
.2.Kandasamy.P.,Thilagavathy.K and Gunavathy.K., "Engineering Mathematics For first Year BB.E/B.Tech,Seventh Edition 2008 S.Chand and Co.,New Delhi.														
3.Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics, Semester-I", ninth Edition, Laxmi Publications Pvt. Ltd, 2016														
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	3	1	-	-	-	-	-	-	-	1	-	-
AVG	3	2.6	2.6	1	1	-	-	-	-	-	-	1	-	-



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U24PH102	PHYSICS FOR INFORMATION SCIENCE I	L	T	P	C
		3	0	0	3
Course Objectives					
1	To comprehend and identify different crystal structures and their imperfections.				
2	To explain the elastic properties of materials and understand their significance.				
3	To develop knowledge about the sound waves				
4	To develop an understanding of quantum mechanical phenomena and their applications.				
5	To explain the origin of laser action, production of laser, fibre optics and their applications.				
UNIT 1 CRYSTAL PHYSICS				9	
Single crystalline, polycrystalline and amorphous materials– single crystals -Seven type of crystal system- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures ,Crystal growth-Bridgmann technique,Czochralski technique.					
UNIT 2 PROPERTIES OF MATTER				9	
Properties of matter: Elasticity- Hooke’s law - Relationship between three moduli of elasticity– stress - strain diagram– Poisson’s ratio –Factors affecting elasticity– Torsional stress & deformations – Twisting couple – Torsion pendulum- theory and experiment– bending of beams -bending moment– uniform and nonuniform bending: theory and experiment.					
UNIT 3 ULTRASONICS				9	
Ultrasonics: Production of ultrasonics by Magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays.Applications of ultrasonic waves: SONAR.					
UNIT 4 QUANTUM PHYSICS				9	
Black body radiation – Planck’s theory (derivation) – Deduction of Wien’s displacement law and Rayleigh – Jeans’ Law from Planck’s theory – Compton Effect. Theory and Experiential verification - Schrödinger’s wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states.					
UNIT 5 PHOTONIC AND FIBRE OPTICS				9	
Photonics: Spontaneous and stimulated emission- Population inversion -Einstein’s A and B coefficients – Conditions for Laser action - Types of lasers – Nd YAG and CO2 lasers. Laser applications: Laser welding ,laser marking,surface texturing.Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Losses in fibers - attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- pressure and displacement.					
TOTAL PERIODS				45	



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Course Outcomes														
At the end of the course, the student will be able to														
CO1	Analyze crystal structures and the influence of imperfections on their properties.													
CO2	Demonstrate and explain the general concepts of elastic properties of materials.													
CO3	Analyze the applications of ultrasonics to engineering and medical disciplines.													
CO4	The quantum concepts and its use to explain black body radiation, Compton effect and wave equation for matter waves.													
CO5	Elucidate the principle and working of lasers and their applications in the field of industry, medicine and telecommunication													
TEXT BOOKS														
1. Gaur R K, Gupta S L, “Engineering Physics”, Dhanpat Rai Publishers, 2012.														
2. Serway R A, Jewett J W, “Physics for Scientists and Engineers”, Cengage Learning, 2010														
REFERENCES														
1.Halliday D, Resnick R, Walker J, “Principles of Physics”, Wiley, 2015.														
2.Tipler P A, Mosca G, “Physics for Scientists and Engineers with Modern Physics”, WH Freeman,2007														
3.Avadhanulu M N, Kshirsagar P G, “A Textbook of Engineering Physics”, S Chand & Co Ltd, Ninth Revised Edition, 2012.														
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-		-	-	-	-	-	-	1	-	-	-
CO4	3	2	-		-	-	-	-	-	-	1	-	-	-
CO5	3	2	-	2	-	-	-	-	-	-	2	-	-	-
AVG	3	2	-	2	-	-	-	-	-	-	1	-	-	-



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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 – Application - External conditioning (Ion Exchange, zeolite) – Internal conditioning (Carbonate, phosphate, calgon, sodium aluminate conditioning) — Brackish water treatment - Reverse osmosis.					
UNIT 2 POLYMER CHEMISTRY				9	
Polymers and Polymerization: definition, classification - types of polymerization: addition and condensation–mechanism of addition polymerization (cationic, anionic, free radical and coordination polymerization)- Moulding of polymers into articles-injection-Properties: Glass Transition temperature.- Thermoplastic and thermosetting polymers-conducting polymers-definition,types and applications.					
UNIT 3 ENERGY STORAGE DEVICES AND NANOMATERIALS				9	
Batteries – Types of batteries – Characteristics-Definition of Electricity storage density and power discharge rate--Principle,working and applications of lead-acid battery, Ni–Cd and lithium ion batteries – Fuel cell. Nanomaterials-Classification-Properties and uses-. Synthesis–Top down method(ball milling), Bottom up methods –Laser Evaporation method -chemical vapour deposition, - Applications of nanomaterials - Application - A Case Study – Medicine,Agriculture,Industry and Electronics.					
UNIT 4 PHASE RULE AND SPECTROSCOPY				9	
Phase rule - Introduction, definition of terms - phase, components and degree of freedom - phase diagram-one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system Introduction-importance of spectroscopy-types of spectroscopy-Spectrum-Electromagnetic radiation-Electromagnetic spectrum-Absorption of Electromagnetic radiation-Types of energy present in molecules- Molecular spectra-Energy level diagram-Ultraviolet (UV) and visible spectroscopy-Infrared spectroscopy.					
UNIT 5 SENSORS AND PHOTOCHEMISTRY				9	
Sensors, types of sensors. Chemical Sensors – characteristics and elements - Carbon dioxide, glucose detector, Mosquito, and Pregnancy test. Electrochemical sensors – potentiometric sensors, amperometric sensors, polarization techniques - Working Principles and Applications. Integrated and Smart sensors, Definitions and applications of various smart sensors-types- , Humidity sensor, UV sensor and Ultra Sonic Sensors. Introduction-Photochemical reaction-Laws of photochemistry-Grothus-Draper law-Stark-Einstein law and Lambert-Beer Law-Photo physical processes Internal Conversion-Intersystem crossing-					



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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	Interpolate the properties and applications of important polymers.													
CO3	Describe the preparation and applications of nano materials and illustrate the methods of harnessing energy from non-conventional energy sources.													
CO4	Utilize the thorough knowledge on phase rule to form a system and various applications of spectroscopy.													
CO5	Acquire the knowledge on sensors along with photochemistry to develop an interdisciplinary approach among the students which is essential for the software engineers.													
TEXT BOOKS														
1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company(P) Ltd, New Delhi, 2018.														
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.														
3. S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.														
4.Zhang and Yuan-Ting, Wearable Medical Sensors and Systems, Springer, 2013														
5. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications, Pan Stanford Publishing Pte. Ltd, Singapore, 2012														
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	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	1	-	-	-	-
CO2	3	3	1	2	1	-	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	1	-	-	-	-	-	-	-
CO4	2	2	3	2	2	2	2	-	-	1	-	-	-	-
CO5	2	2	3	3	3	2	2	-	1	1	1	-	-	-
AVG	2.6	2.4	2	2	1.8	1.2	1	-	0.2	0.6	0.2	-	-	-



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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			
<p>இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செல்விலக்கியங்கள் - சங்க இலக்கியத்தின்சமய சார்பற்ற தன்மை -சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் - சமணப் பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு</p> <p>Language Families in India - Dravidian Languages – Tamil as a Classical 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</p>					
அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE		3			
<p>நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்பைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புற தெய்வங்கள் - குமரிமுனையில் திருவள்ளூவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு</p> <p>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</p>					
அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் UNIT III FOLK AND MARTIAL ARTS		3			
<p>தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்</p> <p>Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.</p>					
அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் UNIT IV THINAI CONCEPT OF TAMILS		3			



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<p>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</p>		
<p>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</p>		
<p>அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE</p>	<p>3</p>	
<p>இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ் புத்தகங்களின் அச்சு வரலாறு</p>		
<p>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.</p>		
<p>TOTAL PERIODS</p>		<p>15</p>
<p>TEXT BOOK CUM REFERENCE BOOKS</p>		
<p>1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)</p>		
<p>2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)</p>		
<p>3. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).</p>		
<p>4. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)</p>		
<p>5. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</p>		
<p>6. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).</p>		
<p>7. 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)</p>		
<p>8. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</p>		
<p>9. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</p>		
<p>10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.</p>		



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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.					
Practical:					
1. Algorithm, pseudocode, flowcharts for simple scientific and statistical problems					
2. I/O statements, operators, expressions and decision-making constructs(if, if-else, break, continue)					
3. C Programming using Simple statements and expressions.					
4. Create Looping statements- for, while, do-while.					
UNIT 2 ARRAYS AND STRINGS				6+12	
Arrays: Introduction – Declaration of Arrays – Storing Values in Array – Accessing elements of the Array– Calculating the length of the Array – Operations on Array – one dimensional arrays – Two dimensional Arrays – String: Declaring, Initializing, Printing and reading strings, String input and output functions, String handling functions, Arrays of strings.					
Practical:					
5. Create simple programs for one dimensional and two dimensional arrays.					
6. Practice all string handling functions.					
UNIT 3 FUNCTION AND STORAGE CLASS				6+12	
Library functions: Math functions, other miscellaneous functions such as getchar(), putchar(), malloc(), calloc(). User defined functions - function definition, functions declaration, function call, scope of variables - local variables, global variables. Function parameters: Parameter passing- call by value & call by reference, function return values, Passing arguments to Functions. Recursive functions. Storage classes-auto, register, static, extern, scope rules.					
Practical:					
7. Implementation of C Program using user defined functions (Pass by value and Pass by reference).					
8. Implementation of Recursion Function.					
UNIT 4 STRUCTURES AND POINTERS				6+12	
Basics of structures-structure data types, type definition, accessing structures, Structure operations, Complex structures-nested structures, structures containing arrays, Array of structures, Structures and Functions, Unions. Pointers: Understanding Computer Memory –Memory Management-Dynamic memory Allocation-Memory leaks- Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers– Generic Pointers - Passing Arguments to Functions using Pointer – Pointer and Arrays –Use of pointers in self- referential structures, notion of linked list					
Practical:					
9. C Programming using Pointers.					
10. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.					



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UNIT 5 MACROS AND FILE PROCESSING												6+12		
Preprocessor Directives: Introduction to preprocessor directives in Simple macros using `#define`, conditional macros using `#ifdef`, `#ifndef`, `#endif`, `#else`, and `#elif`. Files: Introduction to Files – Opening a file – Reading Data from Files – Writing Data to Files – Detecting the End-of-file – Closing a file – Sequential access File-Random Access Files – Binary Files – Command line arguments.														
Practical:														
11. Programming using macros and storage classes Implementation of Command line Arguments like argc,argv														
12. Files- reading and writing, file operations, random access														
13. 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	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	2	2	2	-	-	-	1	-	1	-	2	1	2
CO4	2	2	2	2	1	1	-	1	1	1	1	2	-	2
CO5	2	2	2	2	1	1	-	1	1	1	1	2	1	2
AVG	2	2	2	2	1	1	-	1	1	1	1	2	1	2



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U24CE102	ENGINEERING GRAPHICS AND COMPUTER APPLICATION	L	T	P	C
		3	0	2	4
Course Objectives					
CO1	To learn the construction of engineering curves and projection techniques for constructing conic curves, points, and lines.				
CO2	To understand the techniques for projecting and visualizing surfaces and solids in various orientations.				
CO3	To determine the true shape of sectioned solids and develop their lateral surfaces.				
CO4	To develop skills in 3D projection and perspective projection techniques for simple solids.				
CO5	To introduce CAD, simulations, 2D/3D transformations, VR/AR technologies, 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 graphic, Introduction to Blender and Sketch, basic operations and commands, creating 2D drawings and 3D models: 2D Geometric transformations -2D viewing – Line, Polygon clipping, 3D Viewing – 3D Object representations – 3D Transformations.					
TOTAL PERIODS				75	
Course Outcomes					
At the end of the course, the student will be able to					
CO1	Construct engineering curves and apply projection techniques for conic curves, points, and lines.				
CO2	Effectively project and visualize surfaces and solids in various orientations.				
CO3	Determine true shapes and develop lateral surfaces of sectioned solids.				



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CO4	Apply 3D and perspective projection techniques to model simple solids in various views.
CO5	Understand the role of simulations in engineering graphics and perform geometric transformations

TEXT BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53 Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015
4. Introduction to Blender 3.0: Learn Organic and Architectural Modeling, Lighting, Materials, Painting, Rendering and Compositing with Blender Gianpiero Moioli Apress, Year : 2022

REFERENCES

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

CO/PO, PSO Mapping

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

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



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U24ME201	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives					
The main learning objective of this course is to provide hands on training to the students in:					
1	Draw pipe line plan; layout and connect various pipe fittings used in common household plumbing work				
2	To make wood joints commonly used in household wood.				
3	To make various electrical connections in typical household electrical wiring installations.				
4	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.				
5	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.				
GROUP – A (CIVIL & ELECTRICAL)					
PART I CIVIL ENGINEERING PRACTICES 15					
LIST OF EXPERIMENTS IN PLUMBING WORK					
1	a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.				
	b) Preparing plumbing line sketches.				
	c) Laying pipe connection to the suction side of a pump				
	d) Laying pipe connection to the delivery side of a pump.				
	e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.				
LIST OF EXPERIMENTS IN WOOD WORK					
2	a) Sawing,				
	b) Planing and				
	c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.				
Wood Work Study					
3	a) Studying joints in door panels and wooden furniture				
	b) Studying common industrial trusses using models.				
PART II ELECTRICAL ENGINEERING PRACTICES 15					
LIST OF EXPERIMENTS					
4	a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket				
5	b) Staircase wiring				
6	c) Fluorescent Lamp wiring with introduction to CFL and LED types.				
7	d) Energy meter wiring and related calculations/ calibration				
8	e) Study of Iron Box wiring and assembly				
	f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)				
	g) Study of emergency lamp wiring/Water heater				



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GROUP – B (MECHANICAL AND ELECTRONICS)		
PART III MECHANICAL ENGINEERING PRACTICES 16		
LIST OF EXPERIMENTS IN WELDING WORK		
9	a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.	
	b) Practicing gas welding.	
LIST OF EXPERIMENTS IN BASIC MACHINING WORK		
10	a) (simple)Turning.	
	b) (simple)Drilling.	
	c) (simple)Tapping.	
LIST OF EXPERIMENTS IN ASSEMBLY WORK		
11	a) Assembling a centrifugal pump.	
	b) Assembling a household mixer.	
	c) Assembling an airconditioner.	
LIST OF EXPERIMENTS IN SHEET METAL WORK		
12	a) Making of a square tray	
LIST OF EXPERIMENTS IN FOUNDRY WORK		
13	a) Demonstrating basic foundry operations.	
PART IV ELECTRONIC ENGINEERING PRACTICES		15
LIST OF EXPERIMENTS IN SOLDERING WORK		
14	a) Soldering simple electronic circuits and checking continuity.	
LIST OF EXPERIMENTS IN ELECTRONIC ASSEMBLY AND TESTING WORK		
15	a) Assembling and testing electronic components on a small PCB	
LIST OF EXPERIMENTS IN ELECTRONIC EQUIPMENT STUDY		
16	a)Study an elements of smart phone	
17	b)Assembly and dismantle of LED TV	
18	c)Assembly and dismantle of computer/ laptop	
		TOTAL
		60
COURSE OUTCOMES:		
	Upon completion of this course, the students will be able to:	
1	To practice and experience the plumping work	
2	To gain practical experience in carpentry by crafting a variety of joints.	
3	To acquire knowledge in the methodology and techniques of wiring for electrical connections.	
4	To gain knowledge in welding, sheet metal fabrication, and lathe operations.	
5	To learn about electronic components, equipment, and their functions—such as resistors, color coding, measuring AC signal parameters, gates, circuits, and more.	



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CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	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



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U24TP110	COMMUNICATION SKILLS LAB I	L	T	P	C
		0	0	2	1
Course Objectives					
1	Demonstrate communicative competence in academic and professional contexts.				
2	Apply language skills effectively in academic and workplace contexts.				
3	Apply appropriate listening strategies to comprehend different types of audio materials such as lectures, discussions, and videos.				
4	Express opinions effectively by using language across various media.				
5	Demonstrate English language proficiency through participation in listening and speaking activities relevant to authentic contexts.				
UNIT 1				6	
Listening: Listening as a key skill- its importance -Listening for general information-specific details - Introduction to classmates – Audio / video (formal & informal) Speaking: Making telephone Calls, Introducing a friend, Making polite requests, polite offers and replying to polite requests - Understanding basic instructions for filling out a bank application					
UNIT II				6	
Listening: Listen to a process information Speaking: Small talk on general topics and current scenario					
UNIT III				6	
Listening: Listen to event narration and stories Speaking: Picture description- describing locations in workplaces					
UNIT IV				6	
Listening: Listening to discussions and debates Speaking: Role Play					
UNIT V				6	
Listening: Listening/watching documentaries Speaking: Formal and informal talk -making predictions- talking about a given topic-giving opinions					
TOTAL PERIODS				30	

Course Outcomes	
At the end of the course, the student will be able	
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)



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ASSESSMENT PATTERN .

End Semester Listening & Speaking activity will be conducted.

TEXT BOOKS

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.

2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES

1. Bhatnagar, Nitin and Mamta Bhatnagar. 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	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	0	1	2	3	2	2	-	-	-
CO2	-	-	-	-	-	1	1	2	3	3	2	-	-	-
CO3	-	-	-	-	-	1	2	1	1	1	2	-	-	-
CO4	-	-	-	-	-	-	1	2	3	2	2	-	-	-
CO5	-	-	-	-	-	1	2	2	2	2	2	-	-	-
AVG	-	-	-	-	-	0.6	1.4	1.8	2.4	2.0	2	-	-	-



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Department: Information Technology, 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	
<ul style="list-style-type: none"> • 5 Hours: 60 Students * 5 Minutes Each – Team of Three Students (15 Minutes Per Team) – Collaborative Work To Research & Present 20 Case Studies: <ul style="list-style-type: none"> ○ 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)					



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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	PSO1	PSO2	PSO3
CO1	1	1	2	-	2	1	1	2	2	1	2	-	3	1
CO2	1	2	2	-	2	1	-	2	2	1	2	3	1	-
CO3	-	1	3	1	2	1	-	2	2	1	2	1	-	1
CO4	-	2	3	2	3	-	-	2	2	1	2	2	2	1
CO5	-	2	3	2	3	1	-	2	3	2	2	2	2	1
AVG	1	1.6	2.6	1.6	2.4	1	1	2	2.2	1.2	2	2	2	1



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U24ITV01	BIOLOGY FOR IT ENGINEERS	
Course Objectives		
1	To understand biological concepts from an engineering perspective	
2	To motivate technology application for biological and life science challenges	
3	To develop competency in bioengineering techniques, biomedical imaging, sensors, signal processing, and AI/ML methods for healthcare, bioinformatics, and drug discovery applications.	
Module I : NEED TO STUDY BIOLOGY & CELL - BASIC UNIT OF LIFE		10
Role of Biology in Next Generation Technology Development – Levels of Structural Organization in the Human Body, Sensory Systems: Vision, Hearing, Taste, Smell, and Touch, Cell Structure – Cell Potential – Action Potential- Artificial Intelligence for disease diagnosis Practicals: Disease Prediction Using Classifiers		
Module II: ADAPTATION OF ANATOMICAL PRINCIPLES FOR BIOENGINEERING DESIGN		10
Life Science Studies Significance – Bio Inspired Inventions –Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as a purification system. Kidney as a filtration system Artificial Neural Networks Practicals: Image Processing Using Neural Networks .		
Module III: BIOENGINEERING		10
Sensors and Transducers, Biomedical Imaging Techniques (MRI, CT, X-ray, Ultrasound), Signal Acquisition and Processing, Design of Medical Devices. Artificial Intelligence in Drug Discovery Practicals: DNA Sequence Analysis and Pattern Matching, Drug Discovery using Machine Learning, Personalized Medicine Algorithms		
Course Outcomes		
At the end of the course, the student will be able to		
CO1	Understanding fundamental biological concepts, cell structure, sensory systems, and physiological mechanisms from an engineering	
CO2	Analyze and interpret biological systems to adapt their anatomical and functional principles for bio-inspired engineering design.	
CO3	Apply bioengineering techniques, biomedical imaging methods, sensors, and AI-based computational tools to solve problems in healthcare and life-science domains.	
TEXT BOOKS		
1.T. Johnson, <i>Biology for Engineers</i> , Tata McGraw Hill.		
2.Arun K. Sharma & N. Swarup, <i>Elements of Biotechnology</i> , Prentice Hall India.		
3.C. R. Kothari, <i>Introduction to Biomedical Engineering</i> , New Age Publications.		
4.S. M. DeDar & R. Plonsey, <i>Bioelectric Phenomena</i> , McGraw-Hill.		
REFERENCES		
1.James M. Gere, <i>The Science of Biology</i> , Cengage.		



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2. John Enderle & Joseph Bronzino, *Biomedical Engineering*, Academic Press.

3. Philip Nelson, *Biological Physics: Energy, Information, and Life*, W. H. Freeman.

CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	2	1	1	1	1	1	2	1	1
CO2	3	2	2	2	1	2	1	1	1	1	1	2	1	-
CO3	3	2	2	2	1	2	1	1	1	1	1	2	1	1
AVG	3	2	2	2	1	2	1	1	1	1	1	2	1	1



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U24EN201	PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2
Course Objectives					
1	Demonstrate understanding of reading and writing skills through meaningful language activities.				
2	Apply technical vocabulary to communicate effectively in technical and professional contexts.				
3	Apply key grammar concepts to produce clear, accurate, and effective written communication.				
4	Evaluate writing examples based on purpose, audience, and context.				
5	Apply knowledge of job applications and interviews to prepare for internships and placements.				
UNIT 1 APPLIED LANGUAGE SKILLS				6	
Reading: Reading user manuals, brochures, posters, pamphlets Writing: Review Writing (Book Review and Movie Review) Grammar: Tenses, Prepositional phrases Vocabulary Development: Technical vocabulary (synonyms and antonyms)					
UNIT 2 PRACTICAL WRITING AND GRAMMAR SKILLS				6	
Reading: Reading longer technical texts Writing: Writing response to a complaint letter Grammar: Active and passive voice, Infinitives and Gerunds Vocabulary Development: Sequence words, Misspelled words					
UNIT 3 PROFESSIONAL WRITING AND ANALYTICAL READING				6	
Reading: Case Studies, Excerpts from literary texts, news reports etc. Writing: Letter to the Editor, Checklists Grammar: If Conditionals, Articles Vocabulary Development: Collocation, Cause and effect expression					
UNIT 4 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														
1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna university, (2020 edition)														
2. English for Science & Technology Cambridge University Press, 2021.														
3. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jovani, 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	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	-	1	2	3	2	2	-	-	-
CO2	-	-	-	-	1	-	1	3	3	2	2	-	-	-
CO3	-	-	-	-	1	-	1	1	3	2	2	-	-	-
CO4	-	-	-	-	1	1	2	3	3	3	2	-	-	-
CO5	-	-	-	-	1	1	2	2	3	3	3	-	-	-
AVG	-	-	-	-	1.0	0.4	1.4	2.2	3	2.4	2.2	-	-	-



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Department: Information Technology, R2024, CBCS

U24MA202	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4
Course Objectives					
1	This course aims at providing the required skill to apply the statistical tools in engineering problems.				
2	To introduce the basic concepts of probability and random variables.				
3	To introduce the basic concepts of two dimensional random variables.				
4	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.				
5	To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.				
UNIT 1 PROBABILITY AND RANDOM VARIABLES		9+3			
Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.					
UNIT 2 TWO- DIMENSIONAL RANDOM VARIABLES		9+3			
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).					
UNIT 3 TESTING OF HYPOTHESIS		9+3			
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.					
UNIT 4 DESIGN OF EXPERIMENTS		9+3			
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - Two square factorial design.					
UNIT 5 STATISTICAL QUALITY CONTROL		9+3			
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.					
TOTAL PERIODS		60			



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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 Im, ""Engineering Mathematics with MATLAB"" CRC Press Publishers , I st Edition , 2017."														
REFERENCES														
1.Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.														
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.														
3.Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.														
4.Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.														
5.Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.														
CO-PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	1	1	-	-
CO2	3	3	2	1	-	-	-	-	-	-	1	1	-	-
CO3	3	3	2	1	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	1	-	-	-	-	-	-	1	1	-	-
CO5	3	3	2	1	-	-	-	-	-	-	1	1	-	-
AVG	3	3	2	1	-	-	-	-	-	-	1	1	-	-



Meenakshi Sundararajan Engineering College

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Department: Information Technology, R2024, CBCS

U24PH202	PHYSICS FOR INFORMATION SCIENCE II	L	T	P	C
		3	0	0	3
Course Objectives					
1	To understand the electrical properties of materials including free electron theory, applications.				
2	To enable the students to gain knowledge in semiconductor physics				
3	To instill knowledge on magnetic properties of materials.				
4	To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications				
5	To inculcate an idea of significance of nano structures, quantum confinement, ensuing nano device applications and quantum computing.				
UNIT1 ELECTRICAL PROPERTIES OF MATERIALS					9
Conductors – Classical free electron theory of metals – Expression for Electrical and Thermal conductivity – Wiedemann – Franz law – Lorentz number – Success and failures of classical theory – Quantum theory – electron 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.					
UNIT2 SEMICONDUCTOR PHYSICS					9
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 coefficient -Experiment.					
UNIT3 MAGNETIC PROPERTIES OF MATERIALS					9
Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses– Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).					
UNIT4 OPTICAL PROPERTIES OF MATERIALS					9
Classification of optical materials – Absorption emission and scattering of light in metals, insulators and semiconductors (qualitative) – Carrier generation and recombination - photocurrent in a P-N diode – Principle and working of solar cell - LED – Organic LED – Laser diodes - Photo diode – Determination of V- I Characteristics -Photoconductors - Optical data storage techniques.					
UNIT 5 PHYSICS OF NANOMATERIALS					9
Nano materials –Preparations, Properties, Applications, -Density of states in quantum well, quantum wire and quantum dot structures – Quantum confinement-Quantum well and Quantum dot lasers- CNOT gate-- Quantum Confined Stark effect.- Tunneling-resonant tunneling diode – Coulomb blockade-Single electron phenomena-single electron transistor.					
Total Periods: 45					



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Course Outcomes														
At the end of the course, the student will be able to														
CO1	gain knowledge on classical and quantum electron theories, and energy band structures.													
CO2	acquire knowledge on basics of semiconductor physics and its applications in various devices.													
CO3	get knowledge on magnetic properties of materials and their applications in data storage.													
CO4	have the necessary understanding on the functioning of optical materials for optoelectronics.													
CO5	Understand quantum mechanics of nanostructures and their application to Nano electronics.													
TEXT BOOKS														
1. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007														
2. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.														
3. Progress in Nanoscale and Low-Dimensional Materials and Devices, Hilmi Unlu and Norman J M. Horing, Springer Link, 2022.														
4. R.F. Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006														
REFERENCES														
1. Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.														
2. Y.B. Band and Y. Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.														
3. Yoshinobu Aoyagi and Kotaro Kajikawa, Optical Properties of Advanced Materials, Springer, 2013.														
4. Charles P. Poole Jr., Frank J. Owens, Introduction to nano technology, Wiley, 2003														
5. Principles of Electronic Materials and Devices, S.O. Kasap, McGraw Hill Education, 2017.														
6. Fundamentals of Nanoelectronics, G.W. Hanson, Pearson Education, 2009.														
7. Optoelectronics. Pearson Education, J. Wilson and J.F.B. Hawkes, 2018														
CO-PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2					-	-	-	-	-	-	-	-
CO2	2	2	2				-	-	-	-	-	-	-	-
CO3	2	-		1	2	1	1	-	-	-	-	-	-	-
CO4	2	-	2	1	3		1	-	-	-	-	-	-	-
CO5	2	2	2	1	2	1	2	-	-	-	-	-	-	-
AV G	2	2	2	1	2	1	1.3	-	-	-	-	-	-	-



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U24TA201	தமிழரும் தொழில் நுட்பமும் / TAMILS AND TECHNOLOGY	L	T	P	C
		0	0	0	1
Course Objectives					
அலகு I: நெசவு மற்றும் பானைத் தொழில்நுட்பம் UNIT I: WEAVING AND CERAMIC TECHNOLOGY		3			
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு மற்றும் சிவப்பு பானைகள் (BRW) – பானைகளில் கீறல் குறியீடுகள் Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries					
அலகு II : வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் UNIT II : DESIGN AND CONSTRUCTION TECHNOLOGY		3			
சங்க காலத்தில் வீடு மற்றும் கட்டிட வடிவமைப்பு – சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தின் கட்டிடப் பொருட்கள் மற்றும் நடுகற்கள் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரத்தின் சிற்பங்கள் மற்றும் கோவில்கள் – சோழர் காலப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் கால கோவில்கள் – வகை ஆய்வு (மதுரை மீனாட்சி அம்மன் ஆலயம்) – திருமலை நாயக்கர் மஹால் – செட்டிநாடு வீடுகள் – பிரிட்டிஷ் காலத்தில் மதராசில் இந்தோ-சராசெனிக் கட்டிடக் கலை Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.					
அலகு III : உற்பத்தித் தொழில் நுட்பம் UNIT III : MANUFACTURING TECHNOLOGY		3			
கப்பல் கட்டும் கலை – உலோகவியல் ஆய்வுகள் – இரும்புத் தொழிற்சாலை – இரும்பு உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணியுருவாக்கத் தொழிற்சாலைகள் – கல் மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் / எலும்பு மணிகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள் Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and 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					
அலகு IV : வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் UNIT IV : AGRICULTURE AND IRRIGATION TECHNOLOGY		3			
அணை, ஏரி, குளங்கள், மதகு – சோழர் காலக் குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடைப் பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகங்கள் Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society					



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அலகு V: அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் UNIT V: SCIENTIFIC TAMIL & TAMIL COMPUTING	3
அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்னூலாக்கம் செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் மெய்நிகர் கல்விக்கழகம் – தமிழ் மின்னூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	
TOTAL PERIODS	15
TEXT BOOKS	
1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)	
2. கணினித் தமிழ் – முனைவர் இல. சுந்தர் (விகடன் பிரசுரம்)	
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)	
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)	
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)	
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.	
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).	
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)	
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)	
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)	
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)	
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book	



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U24EC202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives					
1	To introduce the basics of electric circuits and analysis.				
2	To impart knowledge in the basics of working principles and application of electrical machines.				
3	To introduce analog devices and their characteristics.				
4	To educate on the fundamental concepts of digital electronics.				
5	To introduce the functional elements and working of measuring instruments.				
UNIT I ELECTRICAL CIRCUITS		9			
DC Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchoff’s Laws – Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state). Introduction to AC Circuits : sinusoidal Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Simple problems in series RLC circuits. Introduction to three phase circuits:(star- delta conversion)..					
UNIT II ELECTRICAL MACHINES		9			
DC generator- Construction and Working principle, types, EMF equation. DC motor - Working Principle, types, Torque Equation. Applications. Single phase Transformer- construction, working principle and applications. Three Phase and Single phase Induction Motor- construction and working principle. Special Machines- Servo Motor and BLDC motor.					
UNIT III ANALOG ELECTRONICS		9			
Overview of Semiconductor Materials: Silicon & Germanium – PN Junction Diode -- Characteristics Applications – zener Diode -- Characteristics Applications –Bipolar Junction Transistor- JFET-- configurations -- I-V Characteristics and Applications, Rectifier and Inverters. applications of Operational amplifiers, Ideal 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).					



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UNIT V MEASUREMENTS AND INSTRUMENTATION											9			
Functional elements of an instrument, Standards and calibration, overview of Moving Coil and Moving Iron meters (Ammeters and voltmeters), DSO, Block diagram of Data acquisition systems. Electrical Safety – Fuses and Earthing.														
TOTAL PERIODS: 45														
Course Outcomes														
At the end of the course, the student will be able to														
CO1	Compute the electric circuit parameters for simple problems.													
CO2	Explain the working principle and applications of electrical machines .													
CO3	Analyze the characteristics of analog electronic devices.													
CO4	Explain the basic concepts of digital electronics .													
CO5	Explain the operating principles of measuring instruments.													
TEXT BOOKS														
1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020														
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.														
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008														
4. James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.														
5. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015														
REFERENCES														
1. Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill 2. Education, 2019.														
2. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.														
3. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.														
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.														
5. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010.														
CO-PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	1	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	1	-	-	-	-	-	-
CO5	2	2	1	-	-	-	-	1	-	-	-	-	-	-
AVG	2	1.8	1	-	-	-	-	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.				
UNIT1 ROLE OF CHEMISTRY - CURRENT CHALLENGES FOR SUSTAINABLE DEVELOPMENT					6
Role of chemistry in addressing the challenges for sustainable development and solving global issues. Nexus among biosphere environment, human and animal health. . Introduction to bio-diversity-threats and conservation of bio-diversity Millenium development goals (MDG) and sustainable development goals(SDG), clean development mechanism(CDM).					
UNIT2 SUSTAINABLE ENVIRONMENTAL CHEMISTRY					6
Climate change – green house effect - global warming - sea level rise - intrusion and inundation, , ozone layer depletion, El Niño and La Niña – 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, cypermethrin, Pyrethrin, silica gel, rotenone- synthesis properties and practical applications. -reduction of toxicity, improved recycling and improved product performance.					
UNIT4 SUSTAINABLE ENERGY					6
Present energy challenges and the possible energy solutions - Solar energy- Solar panels- Solar water heater- solar heat collector and applications- Wind energy- Types – production - advantages and disadvantages- applications. Nuclear energy – production - advantages and disadvantages- applications. Geothermal energy – Production and applications – Bio fuels.					
UNIT5 GOOD HEALTH AND WELL BEING -WATER-SOIL-AIR					6
Ground water contamination and contamination of water bodies. The role of chemistry in developing appropriate technological solutions for water treatment using Electrodialysis, Forward osmosis and advanced oxidation using photocatalysis and waste water treatment. Reclamation of soil. Current air pollution situation and trends. Factors responsible for air pollution. Air pollution assessment, monitoring and mitigation.					
TOTAL PERIODS					30



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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", 6th Edition, New Age International Publishers, 2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D.T. and Shonnard, D.R., Sustainability Engineering: Concepts, Design and Case Studies, 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,PSOMapping

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

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



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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: 3. Implement a Python program to print a Number series & Number Patterns. (using Iterative loops). 4. Implement a Python program to find Factorial and largest number in a list (using Functions). 5. 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.					



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Practicals: 6.Implement a Python program using Lists & Tuples. (operations of list & tuples - Book Catalogue) 7.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: 8.Implement a Python program to perform file operations (copy from one file to another, word c ount, longest word). 9.Implement a Python program to handle Exceptions.(voter’s age validity).	
UNIT 5 LIBRARIES,PACKAGES	9+9
Python libraries - NumPy -Array manipulations, numeric ranges, Slicing, indexing, Searching, Sorting, and splitting, Pandas - Data Analysis, Data-frame, Data selection, group-by, Series, sorting, searching, and statistics, dask (pandas wrapper), Matplotlib- Data visualization, Line plot, Style properties, multi-line plot, scatter plot. Practical: 10.Implement a Python program to create a weather data chart using Python Standard Libraries (pandas, numpy. Matplotlib, SciPy)	
TOTAL PERIODS	90

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Develop and execute simple Python programs
CO2	Learn to handle strings and funtions 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	



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

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

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

CO-PO, PSO Mapping

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	1	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	1	2	-	2
CO3	2	3	2		3	-	-	1	-	-	1	2	1	2
CO4	2	2		3	3	-	-	-	1	-	2	2	-	2
CO5	1	2		2	3	-	-	1	1	-	3	2	1	2
AVG	2.2	2.4	2	2	2.6	-	-	1	1	-	1.6	2	1	2



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Department: Information Technology, R2024, CBCS

U24BS01	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives					
1	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on bending of beams, application of laser,. The course will also train the learner to observe good lab practices, record readings and analyse and interpret the results.				
2	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on water treatment, electrochemistry, lubricants, composites and nanomaterials using simple chemical methods. The course will also train the learner to observe good lab practices, record readings and graphically represent the results, as well as analyse and interpret the influence of reaction conditions on the results.				
LIST OF EXPERIMENTS					
PHYSICS LABORATORY					
1	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular objects				
2	Simple harmonic oscillations of cantilever				
3	Uniform bending – Determination of Young’s modulus				
4	Laser- Determination of the wave length of the laser using grating				
5	Ultrasonic Interferometer-Determination of compressibility of given liquid				
6	a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.				
7	Non-uniform bending - Determination of Young’s modulus				
CHEMISTRY LABORATORY					
1	Estimation of mixture of acids by conductometric titration				
2	Estimation of iron by potentiometric titration				
3	conductometric titration of barium chloride against sodium sulphate (precipitation titration)				
4	Determination of alkalinity in a water sample				
5	Estimation of hardness of water by EDTA method				
6	Estimation of hydrochloric acid by pHmetric method				
7	Determination of chloride content of water sample by Argentometric method				
8	Determination of viscosity of a polymer using ostwald’s viscometer				
9	Estimation of iron content using spectrophotometer				
TOTAL PERIODS					60



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U24TP210	COMMUNICATION SKILLS LAB II	L	T	P	C
		0	0	2	1
Course Objectives					
1	Demonstrate understanding of spoken English in various contexts and participate in effective discussions in professional settings..				
2	Demonstrate effective speaking and presentation skills.				
3	Identify appropriate group discussion skills and apply them to participate in effective professional discussions.				
4	Analyze issues and ideas to demonstrate critical thinking skills.				
5	Apply communication strategies in real-life and workplace contexts through participation in mock interviews.				
UNIT I					6
Listening: Listening to voicemail & messages, Audio texts, for writing short answers					
Speaking: Conversation between the interlocutor and each candidate					
UNIT II					6
Listening: Listening to podcasts, anecdotes and identifying topics, context etc.					
Speaking: Presentation on any given topic (Non - Technical)					
UNIT III					6
Listening: One extended conversation or monologue - interview, discussion, lectures and educational videos					
Speaking: Group Discussion.					
UNIT IV					6
Listening: Listening to presentation and 5 min informal talk					
Speaking: Presentation on any given topic (Technical)					
UNIT V					6
Listening: Listening to interview skills					
Speaking: Mock interview					
TOTAL PERIODS					30
Course Outcomes					
At the end of the course, the student will be able to					
CO1	Understand accurately and respond to a variety of spoken content to showcase their ability to capture both main ideas and supporting details.				
CO2	Enhance the students to make effective presentations.				
CO3	Speak effectively in group discussions held in a formal/semi-formal contexts.				
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				



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

CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	2	2	3	2	2	-	-	-
CO2	-	-	-	-	-	1	1	2	2	2	2	-	-	-
CO3	-	-	-	-	1	1	2	3	2	3	2	-	-	-
CO4	-	-	-	2	1	2	2	2	2	2	2	-	-	-
CO5	-	-	-	-	1	1	2	2	3	2	2	-	-	-
AVG	-	-	-	0.4	0.6	1.2	1.8	2.2	2.4	2.2	2	-	-	-



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U24ED211	DESIGN THINKING - DECODING INNOVATION OPPORTUNITY	L	T	P	C
		0	0	1	0.5
Course Objectives					
1	Understand and apply the five phases of the Stanford Design Thinking Framework (Empathize, Define, Ideate, Prototype, and Test) to identify user needs and create innovative solutions.				
2	Gain knowledge of the five stages of the IDEO Design Thinking Framework (Discover, Interpret, Ideate, Experiment, and Evolve) and explore how to iteratively refine solutions through a human-centered approach.				
3	Learn the application of Design Thinking tools such as visualization, journey mapping, value chain analysis, brainstorming, and rapid prototyping to generate and refine ideas that meet customer needs.				
4	Apply Design Thinking methodologies to identify opportunities for innovation, scope projects, conduct research, generate ideas, and create business case studies and prototypes for real-world problem-solving.				
5	Analyze and clarify innovation opportunities by understanding the problem, stakeholders, and solution context through frameworks like Doblin's Ten Types of Innovation and RACI, focusing on the 'Who', 'What', 'How', and 'Why' aspects of problem-solving.				
UNIT – 1: STANFORD DESIGN THINKING FRAMEWORK		3			
<ul style="list-style-type: none"> • How To `Empathize`? • How To `Define` • How To `Ideate`? • How To `Prototype`? • How To `Test`? 					
UNIT – 2: IDEO DESIGN THINKING FRAMEWORK		2			
<ul style="list-style-type: none"> • How To `Discover`? • How To `Interpret`? • How To `Ideate`? • How To `Experiment`? • How To `Evolve`? 					
UNIT – 3: DESIGN THINKING & DESIGN DOING		3			
<ul style="list-style-type: none"> • `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			
<ul style="list-style-type: none"> • Before You Begin: Identify An Opportunity – Scope Your Project – Draft Your Design Brief – Make Your Plans • `What Is` Focus: Do Your Research – Identify Insights – Establish Design Criteria • What If Focus: BrainStorm Ideas – Develop Concepts – Create Business Case Studies • `What Wows` Focus: Surface Key Assumptions – Make Prototypes • `What Works` Focus: Get Feedback From Stakeholders – Run Learning Launches – Design The On-Ramp 					
UNIT – 5: CLARIFYING PROBLEM STATEMENT & PRIORITIES BY IDENTIFYING & DECODING THE INNOVATION OPPORTUNITY		5			
<ul style="list-style-type: none"> • 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) 					



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



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	MC [#]	30	2	0	0	0
THEORY CUM PRACTICAL								
5	U24CS301	Foundations of Data Science	PCC	75	3	0	2	4
6	U24EC310	Digital Principles and Computer Organization	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	U24RM312	Introduction to Problem Solving	RMC	15	0	0	1	0.5
TOTAL				480	17	1	14	23



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



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

TEXT BOOKS
1.Kenneth H. Rosen, —Discrete Mathematics and its Applications, Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2012.
2.Tremblay J.P. and Manohar R, —Discrete Mathematical Structures with Applications to Computer Sciencell, Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.
3.Veerarajan.T,"Discrete Mathematics", 25th Edition,Tata Mcgraw Hill Education , private Limited ,2016.
4.Won Y. Yang, Young K.Choi,Jaekwon Kim,Man Cheol Kim, H.Jin Kim,Taeho Im, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.

REFERENCES
1.Ralph. P. Grimaldi, —Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education, Fifth Edition, New Delhi, 2014
2.Seymour Lipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3.Thomas Koshy," Discrete Mathematics with Applications ", Elsevier Publications, Boston, 2004.

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

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



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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	Understand the concepts of ADTs.				
2	Learn linear data structures – lists, stacks, and queues.				
3	Understand non-linear data structures – trees and graphs.				
4	Apply Tree and Graph structures.				
5	Understand sorting, searching and hashing algorithms.				
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					
UNIT 5 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



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Course Outcomes														
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														
1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.														
2.Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007														
3.Ellis Horowitz and Sartaj Sahni, Anderson Freed "Fundamentals of Data Structures in C", University Press, 2008.														
REFERENCES														
1.Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.														
2.Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.														
3.Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.														
4.Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006														
5.Yashavant Kanetkar, "Data Structures Through C", BPB press, 4th 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	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	1	1	1	1	2	1	3
CO2	3	3	2	1	2	-	-	1	1	1	1	2	2	2
CO3	3	3	3	2	2	-	-	1	1	1	2	2	1	2
CO4	3	3	2	2	3	1	-	1	1	1	2	2	3	1
CO5	3	3	2	2	2	-	-	1	1	1	2	2	2	3
AVG	3	2.8	2.2	1.6	2.2	1	-	1	1	1	1.6	2	1.8	2.2



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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 – Java Buzzwords – Overview of Java – 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



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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	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	3	2	2	2	3	1	2
CO2	3	3	2	2	2	-	-	2	1	1	3	3	3	2
CO3	3	3	2	2	2	-	-	3	2	1	2	3	1	3
CO4	3	3	2	2	2	-	-	1	2	1	3	3	1	1
CO5	3	3	2	3	2	-	-	3	2	1	2	3	3	3
AV G	3	3	2	2	2	-	-	2	2	1	2	3	2	2



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U24EC310	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	2	4
Course Objectives: Develop the ability to design basic digital systems and computer subsystems.					
1	Analyze and design combinational circuits.				
2	Analyze and design sequential circuits				
3	Understand the basic structure and operation of a digital computer.				
4	Study the design of data path and control unit for processor and to familiarize with the hazards.				
5	Understand the concept of various memories and I/O interfacing.				
UNIT I COMBINATIONAL LOGIC				9 + 12	
Combinational Circuits – Karnaugh Map - Minimization Techniques: Minimization of Boolean expressions using Boolean laws, Karnaugh Map Analysis and Design Procedures – Binary Adder –Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers- Demultiplexers					
Lab Components :					
1. Design and implementation of combinational circuits using gates for arbitrary functions.					
2. Implementation of binary adder/subtractor circuits.					
3. Implementation of encoder and decoder circuits.					
4. Implementation of functions using Multiplexers and Demultiplexers.					
UNIT II SYNCHRONOUS SEQUENTIAL LOGIC				9 + 9	
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.					
Lab Components :					
5.Design and Implementation of counters					
6.Design and Implementation of Registers					
UNIT III COMPUTER FUNDAMENTALS				9	
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.					
Lab Components :					
7.Simulator based study of Computer Architecture					
UNIT IV INSTRUCTION EXECUTION AND PROCESSOR				9+9	
Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control - Introduction to processors (8085) and basics of programming– Pipelining – Data Hazard – Control Hazards.					
Lab Components:					
8.Arithmetic operations using 8085					
9.ALU operations using 8085					
10.Interfacing operations using 8085					



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UNIT V MEMORY AND I/O SYSTEMS												9		
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA														
TOTAL HRS												45 + 30 = 75		
Course Outcomes														
At the end of the course, the student will be able to														
CO1	Design various combinational digital circuits using logic gates													
CO2	Design sequential circuits and analyze the design procedures													
CO3	State the fundamentals of computer systems and analyze the execution of an instruction													
CO4	Analyze different types of control design and identify hazards													
CO5	Identify the characteristics of various memory systems and I/O communication													
TEXT BOOKS														
1.M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.														
2.David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.														
REFERENCES														
1.Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.														
2.William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.														
3.M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.														
4.Charles H.Roth.“Fundamental sofLogic Design”, 6th Edition,Thomson Learning, 2013.														
5.Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, 2nd Edition, Pearson Education,2005.														
6.John P Hayes, “Computer Architecture and Organization”,3rd edition, McGraw Hill, 2002.														
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	1	1	2	1	2	2	1
CO2	2	2	1	2	2	-	-	1	1	1	2	2	2	2
CO3	2	1	-	1	1	-	-	2	1	1	2	2	3	1
CO4	2	2	1	2	2	1	1	1	2	1	3	2	2	3
CO5	3	2	2	1	2	-	-	1	1	2	2	3	3	2
AVG	2	2	1	1	2	1	1	1	1	1	2	2	2	2



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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					9+6
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					
Lab Components :					
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					9+6
Types of Data – Types of Variables - Describing Data with Tables and Graphs – Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores					
Lab Components :					
4. Descriptive and statistical analytics on Diabetes data set.					
UNIT3 DESCRIBING RELATIONSHIP					9+6
Correlation – Scatter plots, Correlation coefficient for quantitative data, Computational formula for correlation coefficient, Regression – Regression Line, Least Squares Regression Line, Interpretation of r^2 – Multiple Regression Equations					
Lab Components :					
5. Perform Linear regression modeling on Diabetes data set.					
UNIT4 DATA VISUALIZATION					9+6
Visualization with Matplotlib – 2D and 3D plots - Line plot, Scatter plot, Density plot, Contour plots, Histograms					
Lab Components :					
6. Use the Diabetes datasets to explore the various plotting functions					
UNIT 5 APPLICATIONS OF DATA SCIENCE					9+6
Case study - Data science in Health care, Financial Services, Agriculture and Media					
Lab Components :					
7. Implementation of a data science projects like sentiment analysis, stock market prediction and Fraud Detection					
					TOTAL :75 HOURS
Projects (Teams)					
● Sentiment analysis					
● Stock market prediction					
● Fraud Detection					
● Cricket Score Analysis					
● Weather Prediction					



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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	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	3	2	2	2	2	3	-
CO2	3	3	2	2	2	-	-	2	1	1	3	2	3	-
CO3	3	3	2	2	2	-	-	3	2	1	2	2	3	-
CO4	3	3	2	2	2	-	-	1	2	1	3	3	2	-
CO5	3	3	2	3	2	-	-	3	2	1	2	3	2	2
AVG	3	3	2	2	2	-	-	2	2	1	2	2.4	2.6	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					
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				
	Design the User Interface using tools like canvas / any open source visual elements and Add Animations (if required)				
	Choose Programming Language like JavaScript / any equivalent for creating interactive applications				
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					
1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.					
2.Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007					
3.Ellis Horowitz and Sartaj Sahni, Anderson Freed “Fundamentals of Data Structures in C”, University Press, 2008.					



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REFERENCES

- 1.Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
- 2.Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
- 3.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	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	2	1	2	2	2	2	3
CO2	3	3	1	1	-	-	-	1	1	1	3	1	2	2
CO3	3	3	3	1	-	-	-	1	1	2	3	3	3	3
CO4	3	3	3	1	-	-	-	1	2	3	3	2	1	2
CO5	3	2	1	1	2	-	-	3	3	3	1	3	1	3
AVG	2.8	2.6	2	1	2	-	-	2	2	2	2	2	2	3



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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 JavaFX controls, layouts and menus.				
					Total : 45 Periods



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Projects (Teams)														
Movie Ticket Booking System Contact Management Application File Organizer Utility														
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	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	1	2	2	2	1	2	3
CO2	3	3	2	2	2	-	-	2	3	3	2	1	3	1
CO3	3	3	2	2	2	-	-	1	2	1	3	2	3	2
CO4	3	3	2	2	2	-	-	3	1	1	1	2	1	2
CO5	3	3	2	3	2	-	-	1	1	1	1	2	1	2
AVG	3	3	2	2	2	-	-	2	2	2	2	2	2	2



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U24ED311	INNOVATION TOOLKITS	L	T	P	C
		0	0	1	0.5
Course Objectives					
1	To familiarize students with structured innovation and problem-solving toolkits used in industry and entrepreneurship.				
2	To apply analytical and creative tools to diagnose problems and generate solution directions.				
3	To develop competency in using digital, AI-based, and no-code tools for innovation support..				
4	To analyze complex challenges using systematic frameworks such as TRIZ, Root Cause Analysis, and Decision matrices.				
5	To select and justify appropriate innovation tools based on problem type, stakeholders, and constraints				
UNIT I – INNOVATION TOOLKIT FOUNDATIONS				1	
<ul style="list-style-type: none"> • Role of toolkits in innovation and entrepreneurship. • Difference between frameworks, methods, and tools. • Classification of tools: <ul style="list-style-type: none"> ○ Problem analysis tools ○ Idea generation tools ○ Decision-making tools ○ Digital innovation tools When and why to use each toolkit in the innovation lifecycle. 					
UNIT II – PROBLEM ANALYSIS & DIAGNOSTIC TOOLS				2	
<ul style="list-style-type: none"> • Root Cause Analysis (5 Whys, Fishbone Diagram). • Systems thinking tools. • Stakeholder Mapping and Empathy Maps (tool usage only). • Value Chain Analysis. • Problem framing using structured templates. 					
UNIT III – SYSTEMATIC INNOVATION & CREATIVE TOOLS				4	
<ul style="list-style-type: none"> • TRIZ principles and contradiction matrix. • Six Thinking Hats for parallel thinking. • Lateral thinking tools and forced association. • Tool comparison and selection. 					
UNIT IV – DIGITAL, AI & NO-CODE INNOVATION TOOLS				4	
Digital collaboration tools (Miro, Jamboard, Notion – overview). Visualization tools (Canva, Figma). No-code tools for simulation and concept modeling. Use of AI tools for: <ul style="list-style-type: none"> • Idea generation • Research support • Concept refinement • Ethical and responsible use of digital tools. 					
UNIT V – TOOL INTEGRATION & DECISION TOOLKITS				4	
<ul style="list-style-type: none"> • Decision matrices and prioritization tools (MoSCoW, ICE, RICE). • Risk assessment and feasibility tools. • Mapping problems to appropriate toolkits. • Developing an Innovation Toolkit Canvas. • Presentation of toolkit-driven solution strategy. 					
TOTAL PERIODS				15	



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Course Outcomes														
At the end of the course, students will be able to														
1	Explain different categories of innovation toolkits and their purpose.													
2	Apply diagnostic tools to analyze real-world problems.													
3	Use systematic innovation tools such as TRIZ and SCAMPER to explore solution directions													
4	Demonstrate the use of digital and AI tools for innovation support and visualization.													
5	Select and justify appropriate innovation toolkits to solve practical challenges													
TEXTBOOKS														
1	Hasso Plattner, Christoph Meinel, Larry Leifer, <i>Design Thinking: Understand – Improve – Apply (Understanding Innovation)</i> , Springer, 2011													
2	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Publications, 2009													
3	Don Norman, “The Design of Everyday Things”, Basic Books, 2013													
4	Tom Kelley, David Kelley, “Creative Confidence: Unleashing the Creative Potential Within Us All”, Currency, 2013													
REFERENCE BOOKS														
1	Hasso Plattner, Christoph Meinel, Larry Leifer, “Design Thinking: Understand – Improve – Apply (Understanding Innovation)”, Springer, 2011													
2	Jakob Schneider, Marc Stickdorn, “This Is Service Design Thinking: Basics, Tools, Cases”, John Wiley & Sons, 2011													
3	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001													
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO2	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO3	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO4	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO5	-	2	3	2	2	2	-	3	3	2	2	-	-	-
AVG	1	2	3	2	2	2	1	3	3	2	2	-	-	-



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U24RM312	INTRODUCTION TO PROBLEM SOLVING	L	T	P	C
		0	0	1	0.5
COURSE OBJECTIVES					
1	Develop an understanding of the types and characteristics of problems in research and real-life scenarios				
2	Enable students to explore creative and critical thinking strategies for solving complex problems				
3	Introduce engineering-oriented and methodical problem-solving techniques using logical and algorithmic thinking.				
4	Equip students to analyze, model, and evaluate real-world problems in diverse domains.				
5	Foster the ability to apply scientific inquiry and strategic design to derive optimized solutions				
UNIT1 Problem Solving				2	
Problem – types and characteristics, Problem vs research question, Curiosity and observation in research, Introduction to critical and analytical thinking, Literature Survey, Redefined Problem Statement					
UNIT2 The Art and Craft of Creative Problem Solving				3	
Understanding the nature of problems, Techniques for defining and analysing problems, Strategies for investigating problems, Tactics for solving problems, Creative thinking methods for generating solutions, Evaluating and implementing solutions effectively, The toolbox, Algebra, Combinatronics, Number Theory, Geometry, Calculus.					
UNIT3 Problem Solving for New Engineers				2	
Formulation, Myths of Discovery, Experimenting with Storytelling, Variation, Strategic Design, Randomness.					
UNIT4 Methodical Approach in Problem Solving				2	
Scientific methods and its applications in research, Algorithmic thinking, Step-wise problem decomposition, Heuristics and Optimization strategies, Comparative analysis of problem solving techniques					
UNIT5 Real-life Examples in Problem Solving techniques				6	
Problem solving examples in Healthcare, Education, Urban and Infrastructure, Business and Workplace related problems, Technology and Software, Agriculture and Environment, Engineering and Design, Society and Community problems					
					TOTAL: 15



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At the end of the course, the student will be able to														
CO1	Demonstrate critical, analytical, and observational skills to redefine a research problem													
CO2	Apply creative thinking and problem analysis techniques to generate and evaluate solutions.													
CO3	Use mathematical tools like algebra, number theory, and geometry to solve structured problems													
CO4	Adopt algorithmic, heuristic, and optimization strategies in scientific problem solving.													
CO5	Analyze and apply appropriate problem-solving approaches to real-life sector-specific problems.													
TEXT BOOKS														
1.	G. Polya, How to Solve It: A New Aspect of Mathematical Method, 2nd ed. Princeton, NJ, USA: Princeton University Press, 2014.													
2.	M. Buie, Problem Solving for New Engineers: What Every Engineering Manager Wants You to Know. Boca Raton, FL, USA: CRC Press, 2018.													
3.	A. Barker, How to Solve Almost Any Problem: The Creative Approach to Any Problem Solving. New York, NY, USA: Wiley, 2001.													
4.	P. Zeitz, The Art and Craft of Problem Solving, 3rd ed. Hoboken, NJ, USA: Wiley, 2016.													
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	2	-	-	-
CO3	3	3	3	-	2	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	3	2	2	-	2	2	2	-	-	-
AVG	3	2	2.75	2.5	2.25	2	2	-	2	2	2	-	-	-



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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	U24MA402	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	U24CS404	Design and Analysis of Algorithms	PCC	45	3	0	0	3
5	U24MC413	Indological studies	MC [#]	30	0	0	2	0
THEORY CUM PRACTICAL								
6	U24IT401	Artificial Intelligence and Machine learning	PCC	75	3	0	2	4
PRACTICAL								
7	U24CS406	Operating Systems Laboratory	PCC	45	0	0	3	1.5
8	U24CS407	Database Management Systems Laboratory	PCC	45	0	0	3	1.5
9	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
10	U24ED411	Idea & Simulation Lab	EDIC	15	0	0	1	0.5
11	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
TOTAL				495	15	1	16	22



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U24MA402	LINEAR ALGEBRA AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4
COURSE OBJECTIVES					
1	To introduce the basic notions of vector spaces which will then be used to solve related problems.				
2	To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.				
3	To introduce the basic concepts of solving algebraic and transcendental equations.				
4	To introduce the interpolation operators and numerical techniques of interpolation in various intervals, numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.				
5	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.				
UNIT 1 VECTOR SPACES					9 +3
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.					
UNIT 2 LINEAR TRANSFORMATION AND INNER PRODUCT SPACES					9 +3
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.					
UNIT 3 SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS					9 +3
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method.					
UNIT 4 INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION					9 +3
Interpolation operators (Forward, Backward, shifting operators and its Properties) – Newton’s forward and backward difference interpolation for equal intervals – Lagrange’s and Newton’s divided difference interpolations for unequal intervals - Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.					
UNIT 5 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS					9 +3
Single step methods: Taylor’s series method - Euler’s method - Modified Euler’s method – Fourth order Runge- Kutta method for solving first order equations - Multi step methods: Milne’s and Adams- Bash forth predictor corrector methods for solving first order equations.					
TOTAL: 45 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.				



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

TEXT BOOKS

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

REFERENCES

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

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	-	-



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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	Learn the basic concepts and functions of operating systems (OS).				
2	Learn the mechanisms of OS to handle processes and threads and their communication				
3	Study the basic components of scheduling mechanisms and Deadlocks.				
4	Learn File management strategies in contemporary OS.				
5	Learn the Memory and Storage management in operating systems				
UNIT 1 INTRODUCTION TO OPERATING SYSTEMS					8
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					



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At the end of the course, the student will be able to	
CO1	Explain operating system operations and process management concepts.
CO2	Explain process synchronization techniques to ensure mutual exclusion and data consistency in operating systems.
CO3	Apply CPU scheduling algorithms and deadlock handling techniques in operating systems.
CO4	Describe file system structures and I/O management mechanisms.
CO5	Analyze memory and storage management techniques in 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”, 9th Edition, Pearson, 2018

2	Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
3	D. M. Dhamdhare, “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: <code>git clone git://pdos.csail.mit.edu/xv6/xv6.git</code>

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	3	2
CO2	3	2	-	-	-	-	-	-	-	-	1	2	3	2
CO3	3	3	3	1	2	-	-	-	-	-	1	3	2	2
CO4	3	2	-	-	-	-	-	-	-	-	1	2	2	1
CO5	3	3	2	1	1	-	-	-	-	-	1	2	3	1
AVG	3	2.4	2.5	1	1.5	-	-	-	-	-	1	2.2	2.6	1.8



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U24CS402	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3
Course Objectives: Designing the database for an online shopping platform like Amazon and SQL queries to fetch the record with normalization techniques to avoid data redundancy and anomalies					
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 – Unstructured Data -Introduction to Spatial and Temporal Databases – OO Databases – NoSQL					
TOTAL: 45 PERIODS					



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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'														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	–	2	–	1	3	3	3	2
CO2	3	3	3	3	3	3	–	2	–	1	2	3	3	2
CO3	3	3	3	3	3	3	–	3	–	1	3	3	3	2
CO4	3	3	3	3	3	3	–	1	–	1	2	3	3	2
CO5	3	3	3	3	3	3	–	2	–	1	3	3	3	2
AV G	3	3	3	3	3	3	–	2	–	1	2.6	3	3	2



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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					



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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	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



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U24IT401	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	2	4
Course Objectives : To Design, develop, and evaluate intelligent data-driven systems in Artificial Intelligence and Machine Learning					
1	Study about uninformed and Heuristic search techniques				
2	Learn techniques for reasoning under uncertainty				
3	Introduce Machine Learning and supervised learning algorithms				
4	Study about ensembling and unsupervised learning algorithms				
5	Learn the basics of deep learning using neural networks				
UNIT 1 PROBLEM SOLVING				9 +6	
Introduction to AI -AI Applications -Agents and Environment: Nature of Environment - Problem solving agents -search algorithms -Uninformed search strategies-Heuristic search - adversarial search -Local search and optimization problems-constraint satisfaction problems (CSP)					
Lab Components					
1.Demonstration of Installation procedure of required software's – python idle and jupyter notebook and Sample Programs in Python.					
2. Implementation of Uninformed search algorithms (BFS, DFS)					
3.Implementation of Informed search algorithms (A*)					
UNIT 2 KNOWLEDGE REPRESENTATION AND PROBABILISTIC REASONING				9 +6	
Knowledge Representation:Logical agents -Propositional logic -syntax and Semantics -Theorem Proving -Model Checking Inferences in first order logic -forward chaining -backward chaining					
Probabilistic Reasoning: Acting under uncertainty-Bayesian inference -naïve bayes models - Bayesian networks -exact inference in BN -approximate inference in BN					
Lab Components					
4.Implement naïve Bayes models					
5.Implement Bayesian Networks					
UNIT 3 SUPERVISED LEARNING				9 +6	
Introduction to machine learning -Linear Regression Models: Least squares -single & multiple variables-Bayesian linear regression -gradient descent ,Probabilistic discriminative model-Logistic regression -Probabilistic generative model, Naive Bayes - Maximum margin classifier-Support vector machine -Decision Tree					
Lab Components					
6.Build Regression models					
7.Implement Decision Tree Regressor Model for Predicting the Salary of the Employee					
8.Implement SVM For Spam Mail Detection					



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UNIT 4 ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9 + 6
Combining multiple learners:-Model combination schemes-Voting Ensemble Learning: -bagging-boosting, -stacking- Random forests , Unsupervised learning: -K-means -Instance Based Learning:-KNN-Gaussian mixture models -Expectation maximization. Lab Components 9. Implement ensembling techniques 10. Implement clustering algorithms 11. Implement EM for Bayesian networks	
UNIT 5 NEURAL NETWORKS	9+6
Perceptron-Multilayer perceptron, activation functions, network training -gradient descent optimization - stochastic gradient descent-error backpropagation, from shallow networks to deep networks Unit saturation (aka the vanishing gradient problem)-ReLU, hyperparameter tuning, batch normalization,-regularization, dropout. Lab Components 12. Build simple NN models 13. Build deep learning NN models 14. Mini Project- AI in healthcare	
TOTAL	45 +30=75

Course Outcomes

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

CO1	Use appropriate search algorithms for problem solving
CO2	Apply reasoning under uncertainty
CO3	Build supervised learning models
CO4	Build ensembling and unsupervised models
CO5	Build deep learning neural network models

TEXT BOOKS

1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2	Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020

REFERENCES

1	Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2007
2	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
4	Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press, 2014
5	Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 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	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	1	3	3	3	1	2	2
CO2	1	1	1	3	1	-	-	1	2	1	3	2	3	2
CO3	2	1	2	1	1	-	-	2	1	1	3	1	1	1
CO4	3	1	3	1	-	-	-	2	1	2	1	2	2	2
CO5	3	1	1	2	2	-	-	3	1	2	3	2	1	2
AVG	2	1	2	2	1	-	-	2	2	2	3	2	2	2



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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
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				



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TEXT BOOKS	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”l, 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	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	-	1	3	3	3	2	1	3
CO2	3	3	3	2	2	-	-	3	2	1	1	3	1	2
CO3	3	3	3	2	2	-	-	3	3	1	2	2	2	2
CO4	3	3	3	2	2	-	-	3	1	3	1	1	2	1
CO5	3	3	3	2	3	-	-	1	2	2	3	1	3	3
AVG	3	3	3	2	2	-	-	2.2	2.2	2	2	1.8	1.8	2.2

Product based Projects (Team)	
1	Real-Time Patient Monitoring System: Continuously monitors vitals (heart rate, BP, oxygen) and alerts anomalies.
2	Smart Traffic Light Control System : Real-time control based on vehicle density and emergency vehicle detection - Real-time sensor polling (IR, RFID)
3	Robotics:Communication between motion control, sensor processing, and AI modules.
4	Web-Based CPU Scheduling Simulator & Analyzer: A full-stack web app where users input processes and get Gantt charts, average waiting time, etc.
5	Mobile App: Disk Scheduling Game for OS Concepts:A gamified app where users "control the disk arm" and optimize access times using different strategies.
6	Custom I/O Scheduler for Data-Intensive Applications:Develop a pluggable I/O scheduling module for Linux or a container runtime.



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U24CS407	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5
COURSE OBJECTIVES:					
1	Learn and implement important commands in SQL.				
2	Learn the usage of nested and joint queries.				
3	Understand functions, procedures and procedural extensions of databases.				
4	Understand design and implementation of typical database applications.				
5	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



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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	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



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U24ED411		IDEA AND SIMULATION LAB		L	T	P	C
				0	0	1	0.5
Course Objectives							
1	To understand the purpose and process of ideation and how to transition effectively from empathy and definition phases.						
2	To apply structured idea generation techniques such as Brainwriting and Brainstorming to foster creative solutions.						
3	To analyze and facilitate idea selection by evaluating desirability, feasibility, and viability of solutions.						
4	To evaluate and refine solutions using the SCAMPER framework and other ideation techniques to address real-world needs.						
5	To create actionable solution models by defining concepts, mapping processes, and outlining requirements for market-ready offerings.						
UNIT I IDEATE MODE						1	
<ul style="list-style-type: none"> • Transitioning from Empathize and Define Modes • What is the IDEATE Mode? • Why Ideate? • How to Ideate? • How to transition and move from “Ideate” to “Prototype” Modes 							
UNIT II IDEA GENERATION						2	
<ul style="list-style-type: none"> • How to generate ideas? • How to Brainwrite? (6-3-5 and 3-3-5 techniques) • How to prepare for Brainstorming? • Prepare a checklist for Brainstorming • Prepare Brainstorming rules 							
UNIT III BRAINSTORMING FACILITATION						4	
<ul style="list-style-type: none"> • Prepare warmup questions to facilitate effective brainstorming • Prepare focus areas and topics for brainstorming • Discuss desirability, feasibility and viability perspectives plus point-of-views • Document desirability, feasibility and viability ratings and rankings • Select promising ideas that has potential to become solutions 							
UNIT IV SKETCH TO THINK BEYOND						4	
<ul style="list-style-type: none"> • Introduction to “SCAMPER” Framework to improve solutions to promising products and services • Refine ideas to become potential solutions with stakeholder acceptable results • Do a reality check by assessing value, needs, challenges, and barriers • Improve and form new concepts leading to products and services • Write a one-sentence concept description (Why? Why is this solution the best in class?) 							
UNIT V TRANSLATE SOLUTIONS TO PRODUCTS AND SERVICES						4	
<ul style="list-style-type: none"> • Describe your idea with concept name • Draw a sketch or mind map reflecting at least Business, People, Process, Technology and Stakeholders / Customers • Describe how the product will work and produce the intended Output, Outcomes and Results • Evaluate resources and infrastructure requirements to build the products and services • Detail a plan to arrive at Market-Ready Product / Service 							
TOTAL PERIODS						15	



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Course Outcomes														
At the end of the course, students will be able to														
1	Describe the IDEATE mode, explain its role in design thinking, and illustrate the transition from ideate to prototype.													
2	Demonstrate the use of Brainwriting (6-3-5, 3-3-5) and construct effective brainstorming rules and checklists.													
3	Analyze ideas based on desirability, feasibility, and viability, and select high-potential ideas for further development.													
4	Evaluate ideas using SCAMPER, refine them by assessing value and barriers, and formulate concise concept descriptions.													
5	Design a product/service concept with clear stakeholder mapping, develop a detailed action plan, and justify its readiness for market.													
TEXTBOOKS														
1	An Introduction to Design Thinking PROCESS GUIDE, Hasso Plattner, d. School													
2	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Publications, 2009													
3	Don Norman, “The Design of Everyday Things”, Basic Books, 2013													
4	Tom Kelley, David Kelley, “Creative Confidence: Unleashing the Creative Potential Within Us All”, Currency, 2013													
REFERENCE BOOKS														
1	Hasso Plattner, Christoph Meinel, Larry Leifer, “Design Thinking: Understand – Improve – Apply (Understanding Innovation)”, Springer, 2011													
2	Jakob Schneider, Marc Stickdorn, “This Is Service Design Thinking: Basics, Tools, Cases”, John Wiley & Sons, 2011													
3	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001													
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO2	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO3	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO4	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO5	-	2	3	2	2	2	-	3	3	2	2	-	-	-
AVG	1	2	3	2	2	2	1	3	3	2	2	-	-	-



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U24RM412	HYPOTHESIS	L	T	P	C
		0	0	1	0.5
Course Objectives					
1	To understand the fundamental principles and types of hypothesis and their role in scientific research				
2	To enable students to formulate clear and testable hypothesis from research problems using variable analysis				
3	To equip students with knowledge of research methodology and statistical tools for hypothesis testing				
4	To apply hypothesis in real-world, interdisciplinary research while addressing ethical considerations				
5	To explore advanced hypothesis techniques in modern fields such as AI, business analytics, and design thinking				
UNIT1 Foundations of Hypothesis in Research				3	
Definition and Role of Hypothesis in Research, Characteristics of good hypothesis – testable, specific, falsifiable – Difference between assumptions, theories and hypotheses, Types – Null, alternative, directional, non-directional, Hypothesis vs Research questions.					
UNIT2 Hypothesis Formulation and Design				3	
Steps in developing a hypothesis from a problem statement, Operationalization of variables, Independent, dependent, and controlled variables, Conceptual vs. empirical hypothesis, Case studies on hypothesis framing in various disciplines.					
UNIT3 Research Methodology and Hypothesis Testing				3	
The scientific method and its relationship to hypotheses, Experimental vs. non-experimental designs, Statistical tools for hypothesis testing (t-test, chi-square, ANOVA, etc.), Type I and Type II errors, p-values, confidence intervals, Sampling techniques and hypothesis testing limitations.					
UNIT4 Applications of Hypothesis in Real-World Research				3	
Hypothesis-driven research in natural sciences, social sciences, and engineering, Hypothesis in qualitative vs. quantitative research, Hypothesis in interdisciplinary and applied research, Ethics in hypothesis formulation and testing, Case studies and analysis of published research papers.					
UNIT5 Advanced Topics and Contemporary Approaches				3	
Hypotheses in data science, AI, and machine learning (e.g., model hypothesis space), Hypothesis in action research and participatory methods, Iterative hypothesis development in design thinking, A/B testing and hypothesis validation in business research, Writing research proposals with strong hypothesis foundations.					
TOTAL: 15					



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

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

TEXT BOOKS

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

REFERENCES

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

CO/PO, PSO Mapping

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	2	-	1	-	-	-
CO2	3	3	2	-	-	-	-	-	2	-	2	-	-	-
CO3	3	3	3	3	2	-	-	-	2	-	2	-	-	-
CO4	3	3	2	3	2	2	3	2	2	1	3	-	-	-
CO5	3	3	3	3	3	2	2	2	3	2	3	-	-	-
AVG	3	2.8	2.5	3	2.3	2	2.5	2	2.2	1.5	2.2	-	-	-



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U24MC413	Indological Studies	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES					
1	Introduce students to the fundamental concepts of Indological Studies and Indian Knowledge Systems (IKS), highlighting their civilizational, cultural, and philosophical foundations				
2	Enable students to understand the contributions of ancient India to Science, Technology, Engineering, Mathematics, health, economy, art, and architecture				
3	Develop awareness of wellness concepts such as psychosomatic harmony, Ayurveda, and Yoga for holistic personal and professional life				
4	Foster appreciation of India's cultural identity, heritage, and global influence through art, architecture, and traditions				
5	Encourage independent learning, research skills, creativity, and application of traditional knowledge to contemporary challenges including Atmanirbhar Bharat				
UNIT 1 Introduction to Indological Studies				6	
<p>Overview of IKS- civilizational identity, culture and uniqueness of Bharat; Wisdom through ages</p> <p>Session 1: Indian Knowledge System (IKS) & Civilizational Identity</p> <ul style="list-style-type: none"> • What is IKS – Explanation of Indian Knowledge System • Why should one study IKS • Importance of Civilizational Identity in Personality Development <ul style="list-style-type: none"> ○ Civilizational identity as an anchor to shape personal identity <p>Session 2: Culture of India & IKS in Daily Life</p> <ul style="list-style-type: none"> • Introduction to Culture of India – Important Aspects • Uniqueness of Bharat in terms of: <ul style="list-style-type: none"> ○ Land ○ Language ○ Diversity ○ History ○ Knowledge Traditions • IKS for Daily Life – Shruti and Smriti • IKS for Daily Life – 18 Mahapuranas and Puranas • IKS for Daily Life – Itihasa (Ramayana and Mahabharata) • IKS for Daily Life – Economy of Ancient Bharat 					
UNIT 2 Contributions of IKS to STEM				6	
<p>Contributions of IKS in the field of Science, Technology, Engineering and Mathematics</p> <p>Session 3: Contributions of IKS to Science & Technology</p> <ul style="list-style-type: none"> • Contributions of IKS to Science • Contributions of IKS to Technology and Engineering <ul style="list-style-type: none"> ○ Engineering and metallurgical practices of ancient India; ○ Contributions to Mathematics – number system, zero, algebra and geometry; <p>Session 4: Contributions of IKS to Mathematics & Astronomy</p> <ul style="list-style-type: none"> • Contributions of IKS to Mathematics • Contributions of IKS to Astronomy 					
UNIT 3 Idea of wellness in Ancient India				6	



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Psychosomatic harmony ; Ayurveda - its main proponents, daily and seasonal routine; Yoga for holistic health	
Session 5: Psychosomatic Harmony & Ayurveda	
<ul style="list-style-type: none">• Introduction to the Session -Psychosomatic Harmony – Beyond Mind and Body (Panchakosha Viveka)• Ayurveda – Daily and Seasonal Routine	
Session 6: Yoga & Contributions of Ancient Indian Scholars	
<ul style="list-style-type: none">• Introduction to the Yoga & Contributions of Ancient Indian Scholars• Contributions of Charaka and Sushruta• Yoga for a Happy and Healthy Life• Ashtanga Yoga and the Concept of Yama and Niyama• Yoga for Daily Life	
UNIT4 Economy of Ancient India	6
Arthashastra- governance, public administration, economy; footprints of Bharat outside India; IKS for Atmanirbhar Bharat .	
Session 7: Arthashastra – Governance & Administration	
<ul style="list-style-type: none">• Introduction to the Session -Arthashastra – Context and Historical Background• Saptanga Theory and its Relevance to Modern Management• Governance and Public Administration in Arthashastra	
Session 8: Global Footprints of Bharat & Atmanirbhar Bharat	
<ul style="list-style-type: none">• Introduction to the Session- Footprints of Bharat Outside India – Temples• Other Living Traditions Outside India• IKS as an Inspiration for Self-Employment and Creation of Atmanirbhar Bharat	
UNIT 5 Art and Architecture of India	6
64 Kalas; Music, dance, painting, temple art and architecture; Thanjavur Brihadeeshwara Temple- A case study	
Session 9: Indian Art Traditions – 64 Kalas, Music & Painting	
<ul style="list-style-type: none">• Introduction to the Session -Overview of the 64 Kalas• Different Traditions of Music in India• Different Forms of Painting across India	
Session 10: Temple Art & Architecture – Case Study Approach	
<ul style="list-style-type: none">• Introduction to Temple Art and Architecture• Different Styles of Temple Architecture in India• Case Study: Brihadeeshwara Temple	
TOTAL:30	

At the end of the course, the student will be able to	
CO1	Identify core principles and ancient Indian contributions to global science and philosophy
CO2	Develop a deep appreciation for traditional wisdom and its role in shaping cultural identity
CO3	Apply traditional frameworks to solve contemporary professional and personal challenges
CO4	Strengthen creative thinking and communication through collaborative projects.
CO5	Gain the skills to independently research heritage topics aligned with their career goals
TEXT BOOKS	
1	Dharampal , <i>Indian Science and Technology in the Eighteenth Century</i> , Other India Press.
2	B. Mahadevan (Ed.) , <i>Indian Knowledge Systems – Vol. 1 & 2</i> , IIT Madras Publications.
3	Swami Vivekananda , <i>Complete Works of Swami Vivekananda</i> , Advaita Ashrama.
REFERENCES	



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1	Kautilya, <i>Arthashastra</i> , translated by R. Shamasastri, Penguin Classics.													
2	Sushruta Samhita, translated by K.K. Bhishagratna													
3	Patanjali, <i>Yoga Sutras</i> , with commentary by Swami Satchidananda													
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	2	3	1	1	-	1			
CO2	-	-	-	-	-	2	3	1	1	-	1			
CO3	1	2	2	1	-	2	3	1	1	1	2			
CO4	-	-	-	-	-	1	2	2	3	1	1			
CO5	1	1	1	2	1	2	3	1	2	1	3			
AVG	0.6	0.8	0.6	0.6	0.2	1.8	2.8	1.2	1.6	0.6	1.6			



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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	U24IT501	Computational Theory and Compiler Design	PCC	60	3	1	0	4
2		Open Elective-I	OEC	45	3	0	0	3
THEORY CUM PRACTICAL								
3	U24IT502	Computer Networks	PCC	75	3	0	2	4
4	U24IT503	Web Technologies	PCC	75	3	0	2	4
5		Professional Elective I	PEC	60	2	0	2	3
6		Professional Elective II	PEC	60	2	0	2	3
PRACTICAL								
7	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
8	U24IT502	Summer Internship*	EEC					1
9	U24RM512	Domain specific Experiments/Methodology/Algorithms	RMC	15	0	0	1	0.5
10	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
11	U24MC513	Fitness for Life-Yoga, Food nutrition	MC#	30	0	0	2	0
TOTAL				480	17	0	15	24



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U24IT501	COMPUTATIONAL THEORY AND COMPILER DESIGN	L	T	P	C
		3	1	0	4
Course Objectives : To model computational processes, recognize language patterns, and design efficient compilers					
1	To Explain finite state machines for modeling and their power to recognize the languages.				
2	To Summarize the concept of Regular languages and context free languages				
3	To learn the various phases of compiler.				
4	To understand intermediate code generation and process of semantic analysis.				
5	To analyze the code optimization & code generation techniques.				
UNIT 1 INTRODUCTION TO FORMAL LANGUAGES AND AUTOMATA AND REGULAR EXPRESSIONS					9
Introduction to Formal Languages: Introduction to Formal Languages – Chomsky Hierarchy (Overview)					
Automata Theory: Need for Automata Theory – Deterministic Finite Automata (DFA) – Non-Deterministic Finite Automata (NFA) – NFA to DFA Conversion – DFA Minimization					
Regular Expressions and Regular Languages: Regular Expressions (RE) – Conversion of RE to FA and FA to RE – Regular Languages – Properties of Regular Languages – Pumping Lemma					
UNIT 2 CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA					9
Context-Free Grammars (CFG): Context-Free Grammars (CFG) – Ambiguity in CFG – Grammar Simplification – Normal Forms					
Push-Down Automata (PDA): Introduction to Pushdown Automata (PDA) – PDA Acceptance Modes – Conversion between CFG and PDA – Deterministic vs Non-Deterministic PDA – Pumping Lemma for CFLs					
UNIT 3 INTRODUCTION TO COMPILERS LEXICAL & SYNTAX ANALYSIS					9
Introduction to Language Processors and Compiler Phases: Introduction to Language Processors – Phases of a Compiler					
Lexical Analysis: Lexical Analysis – Tokens and Regular Expressions – Finite Automata – Lexical Analyzer Generator (LEX)					
Syntax Analysis: Syntax Analysis – Context-Free Grammars – Top-Down Parsing (Predictive Parsing) – Bottom-Up Parsing (Shift-Reduce, LR Parsing) – SLR and LALR Parsers – Parse Trees and Error Handling					



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UNIT 4 SEMANTIC AND INTERMEDIATE CODE GENERATION	9
Semantic Analysis: Introduction to Semantic Analysis – Symbol Table Organization – Static Type Checking Intermediate Representations (IR): Intermediate Representations (IR) – Quadruples – Control Flow Graphs (CFGs) – Static Single Assignment (SSA) Runtime Environment: Activation Records – Parameter Passing – Stack vs Heap – Garbage Collection	
UNIT 5 CODE OPTIMIZATION AND CODE GENERATION	9
Code Optimization: Introduction to Code Optimization – Local and Global Optimization – Data Flow Analysis – Loop Optimization – SSA-Based Optimization Register Allocation: Register Allocation – Graph Coloring – Linear Scan Code Generation: Instruction Selection – Instruction Scheduling – Pipeline Hazards	
TOTAL: 45 PERIODS	

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Construct automata theory using Finite Automata and Write regular expressions for any pattern
CO2	Design context free grammar and Pushdown Automata
CO3	Design a lexical analyser for a sample language and learn to use the LEX tool
CO4	Understand semantics rules (SDT), intermediate code generation and run-time environment
CO5	Implement code generation and apply code optimization techniques.
TEXT BOOKS	
1	John E Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, “Introduction to Automata Theory Languages and Computation ”, 3rd Edition, Pearson Education, 2011.
2	Grewal. B.S. and Grewal. J.S., “Numerical Methods in Engineering and Science ”, 10th Edition, Khanna Publishers, New Delhi, 2015.
3	Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and Rama R, Pearson.



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REFERENCES														
1	Peter Linz, “ An introduction to Formal Languages and Automata ”, 6th Edition, Jones & Bartlett, 2016													
2	V.Raghavan, “ Principles of Compiler Design” ,1 st Edition,McGrawHillEducation,2017.													
3	Mishra and Chandrashekar, “ Theory of Computer Science – Automata Languages and Computation ”, 3rd Edition, PHI, 2009													
4	K.V.N.Sunitha , N.Kalyani, “ Formal Languages and Automata Theory ”, 1st Edition, TMH, 2010													
5	Michel Sipser, “ Introduction to Theory of Computation ”, 2nd Edition, Thomson, 2012													
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	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	-	-



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U24IT502	COMPUTER NETWORKS	L	T	P	C
		3	0	2	4
Course Objectives : To analyze, design, and troubleshoot network systems effectively and Develop a Chat Application between client and Server					
1	To understand the concept of layering in networks.				
2	To know the functions of protocols of each layer of TCP/IP protocol suite.				
3	To visualize the end-to-end flow of information.				
4	To learn the functions of network layer and the various routing protocols				
5	To learn concepts related to network addressing and routing.				
UNIT1 PHYSICAL LINK LAYER					9+6
Introduction – Layered Architecture, ISO/OSI Model, Internet Architecture (TCP/IP) – Link Layer Framing, Addressing – Error Detection/ Correction Techniques – Switched Local Area Networks (ARP, Ethernet, VLAN) – Wireless LAN (802.11)					
Lab Components :					
1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.					
2. Write a HTTP web client program to download a web page using TCP sockets					
UNIT2 NETWORK LAYER					9+6
Inside a Router – Internet Protocols – IPV4, IPV6, IP Addressing and NAT – Subnetting – Variable Length Subnet Mask (VLSM) – Classless Inter– Domain Routing (CIDR)					
Lab Components :					
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat					
4. Simulation of DNS using UDP sockets.					
UNIT3 ROUTING PROTOCOLS					9+6
Distance Vector Routing – Link State Routing – RIP – OSPF – BGP – ICMP – DHCP – Introduction to Quality of Services (QoS)					
Lab Components :					
5. Experiential Learning: Configure DHCP servers and clients in virtual environments.					
6. Industrial Application:DHCP in corporate and ISP networks.					
7. Content Beyond Syllabus:BGP security: RPKI, BGPsec.					
UNIT4 TRANSPORT LAYER					9 + 6
Introduction – Connectionless Transport: User Datagram Protocol – Principles of Reliable Data Transfer (GBN, SR) – Connection– Oriented Transport – TCP – Connection establishment and teardown – Triggering transmission – Flow Control – Congestion Control					
Lab Components :					
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.					
8. Study of TCP/UDP performance using Simulation tool.					



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UNIT5	APPLICATION LAYER	9 + 6
Building a network, Network edge and core – Networking Devices: Hubs, Bridges, Switches, Routers, and Gateways – Performance Metrics – Application Layer protocols – HTTP – FTP – Email – DNS		
Lab Components :		
9. Simulation of Distance Vector/ Link State Routing algorithm.		
10. Simulation of an error correction code (like CRC)		
TOTAL: 75		
At the end of the course, the student will be able to		
CO1	Explain the basic layers and its functions in computer networks.	
CO2	Understand the basics of how data flows from one node to another.	
CO3	Analyze routing algorithms.	
CO4	Describe protocols for various functions in the network.	
CO5	Analyze the working of various application layer protocols.	
TEXT BOOKS		
1	James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down and Approach”, Eighth Edition, Pearson Education, 2022.	
2	"Data Communications and Networking with TCPIP Protocol Suite 6th Edition" by Behrouz A. Forouzan.	
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, 222.	

CO/PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	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	0.6	-	1.4	-	1	3	3	3	3



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U24IT503	WEB TECHNOLOGIES	L	T	P	C
		3	0	2	4
Course Objectives- To design, develop, and deploy dynamic web applications using HTML5, CSS3, JavaScript, server-side scripting, and database integration.					
1	To comprehend and analyze the basic concepts of web programming and internet protocols.				
2	To learn HTML5, CSS3 fundamentals, and styling techniques for web design.				
3	To learn JavaScript fundamentals, including variables, functions, objects, and event handling techniques.				
4	To demonstrate the uses of scripting languages - server-side scripting				
5	To create database applications				
UNIT 1 - Introduction to Web Technology				9+6	
Internet Overview - Fundamental computer network concepts - Network Topologies- Network Standards: Overview - Web Protocols- URL - Domain Name- Web Browsers and Web Servers - Working principle of a Website - Creating a Website - Client-side and server-side scripting - Use cases of various web applications like flipkart, blinkit etc.					
Lab Components					
1. Study Experiments on Network Components					
2. Creation of interactive web sites - Design using HTML and authoring tools					
UNIT 2 - HTML and CSS				9+6	
Introduction to HTML5 – HTML5 Tags – HTML5- Forms – HTML Graphics - HTML Media- Cascading Style Sheets (CSS3) Fundamentals - CSS Properties - CSS Styling (Background, Text Format, Controlling Fonts)- CSS ID and Class - Box Model - Positioning - Frames-XHTML: Syntax and Semantics					
Lab Components					
1. Design of static webpage primarily with text and CSS that handle Multimedia content.					
2. Design the HTML forms (text boxes, text areas, radio buttons, check boxes and other elements by understanding the input types and specified needs) and validate according to the inputs.					
UNIT 3 - Client Side Scripting - Java Script				9+6	
Introduction to JavaScript - Variables and Data Types-Statements - Operators - Literals-Functions - Objects - Arrays-Built-in Objects - Regular Expression- Exceptions- Event handling - DOM tree - Javascript Debuggers					
Lab Components					
3.Simple exercises on JavaScript Objects, functions, and Modules.					
Working with DOM tree and Events.					
UNIT 4 - Server Side Scripting - PHP				9+6	
Introduction PHP - Working principle of PHP - PHP Variables - Constants - Operators - Flow Control and Looping - Arrays - Strings - Functions- File Handling - File Uploading - Email Bsics - Email Attachment - PHP and HTML - Simple PHP scripts - Database ith PHP					
Lab Components					
4.Creation of simple PHP scripts					
5.Creation of information retrieval system using web, PHP and MySQL					
UNIT 5 - Servlet and Emerging Technology				9+6	
Servlets: Java Servlet Architecture - Servlet Life cycle - Form GET and POST actions - Sessions - Cookies - Database connectivity - JDBC Creation of simple interactive applications - Emerging Web Technologies- Web Security Best Practices- Web Performance Optimization.					



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Lab Components

6. Write programs using Servlets:
- i. To invoke servlets from HTML forms
 - ii. Session tracking using hidden form fields and Session tracking for a hit count
7. Creation of personal Information System using front and back end

TOTAL | 75 Hours

Course Outcomes

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

CO1	understand the basic concepts of data communications, Web Protocols and networking.
CO2	create dynamic website/web-based applications using HTML5, and CSS3
CO3	understand the syntax, semantics, and dialects of the JavaScript programming language
CO4	Construct simple PHP scripts and develop database applications using PHP
CO5	Build Web applications using Servlet and Database connectivity

TEXT BOOKS

1	Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", 5th edition, Pearson Education, 2012.
2	Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014.
3	Niederst Robbins, Jennifer, "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics", Fifth Edition, O'Reilly Media, 2018

REFERENCES

1	Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2	Steven Holzener , "PHP – The Complete Reference", 1st Edition, Mc-Graw Hill, 2017
3	Bates, "Developing Web Applications", Wiley Publishers, 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'

	P O 1	PO 2	P O 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	0	2	2	2	3	3	2	1
CO2	2	2	3	3	1	2	0	2	0	2	3	3	2	1
CO3	2	2	2	2	1	2	0	2	2	2	3	3	2	1
CO4	2	2	2	3	2	1	0	1	1	2	3	3	2	1
CO5	2	2	2	3	2	1	0	0	0	2	3	3	2	1
AVG	2	2	2	3	2	2	0	2	1	2	3	3	2	1



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U24RM512	DOMAIN SPECIFIC EXPERIMENTS / METHODOLOGY / ALGORITHMS	L	T	P	C
		0	0	2	1
Course Objectives:					
1	Analyze different research paradigms and experimental design types to select appropriate methodologies for domain-specific research.				
2	Apply experimental methodologies and instrumentation techniques in laboratory and simulation contexts for engineering research.				
3	Analyze and implement domain-specific algorithms and optimization techniques using computational tools.				
4	Analyze qualitative research methodologies and tools for social science data collection and analysis.				
5	Evaluate interdisciplinary research approaches and emerging technologies to enhance research quality and reproducibility.				
UNIT 1 Introduction to Research Methodologies and Experimental Design					6
Review of research paradigms (qualitative, quantitative, mixed methods), Types of experimental designs (true, quasi, and non-experimental), Domain-specific needs: controlled vs. field experiments, Key concepts: validity, reliability, reproducibility, Ethical considerations in experimentation					
UNIT 2 Experimental Methodologies in Science and Engineering					6
Laboratory vs. simulation-based experiments, Design of Experiments (DoE) in engineering, Measurement systems and calibration, Data acquisition and instrumentation techniques, Case studies: electrical circuits, mechanical systems, fluid dynamics, etc.					
UNIT 3 Algorithms in Computational and Data-Driven Domains					6
Algorithmic problem-solving in domain-specific contexts (e.g., shortest path in transportation, clustering in biology), Numerical methods and optimization algorithms, AI/ML algorithms and model evaluation strategies, Domain-specific programming and simulation tools (e.g., MATLAB, Python, R, NS-3, Ansys, etc.), Case studies: image processing, robotics, bioinformatics, cybersecurity, etc.					
UNIT 4 Methodologies in Social Sciences and Humanities					6
Survey research, interviews, and ethnographic methods, Sampling techniques and field data collection, Case study and content analysis, Tools: SPSS, NVivo, ATLAS.ti, Case studies: behavioral research, education studies, cultural research					
UNIT 5 Interdisciplinary Approaches and Emerging Trends					6
Cross-domain methodologies: combining qualitative and quantitative, IoT-based experiments (e.g., smart agriculture, smart health), Simulation-based research and digital twins, Research using big data and cloud platforms, Ethics, reproducibility, and open science trends					
TOTAL PERIODS					:30
Course Outcomes					
At the end of the course, the student will be able to					
CO1	Differentiate research paradigms and experimental designs, evaluating their applicability and ethical considerations in various fields.				
CO2	Design and conduct experiments using DoE principles, data acquisition systems, and measurement calibration in engineering applications.				
CO3	Solve algorithmic problems using numerical methods and AI/ML models, applying appropriate programming and simulation tools.				



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CO4	Design and conduct surveys, interviews, and case studies using qualitative tools like SPSS, NVivo, and ATLAS.ti.
CO5	Integrate cross-domain methods, employ IoT and big data tools, and uphold ethical standards in modern research contexts.

TEXT BOOKS

1	R. Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 4th ed. London, UK: SAGE Publications, 2019.
2	D. C. Montgomery, Design and Analysis of Experiments, 9th ed. Hoboken, NJ, USA: Wiley, 2017.
3	S. J. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Upper Saddle River, NJ, USA: Pearson, 2020.

REFERENCES

1	B. Stroustrup, Programming: Principles and Practice Using C++, 2nd ed. Boston, MA, USA: Addison-Wesley Professional, 2014. (for algorithm implementations)
2	S. S. Rao, Engineering Optimization: Theory and Practice, 5th ed. Hoboken, NJ, USA: Wiley, 2020.

CO-PO, PSO Mapping

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

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



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U24ED511	PROTOTYPE AND MARKET VALUATION	L	T	P	C
		0	0	1	0.5
COURSE OBJECTIVES:					
1	To understand the purpose, process, and transition from ideation to prototyping in the design thinking framework.				
2	To develop the ability to plan and perform testing processes for validating prototypes and iterating for improvement.				
3	To analyze and create various forms of rapid and resource-efficient experimentation methods including risk and failure analysis				
4	To evaluate and incorporate feedback through structured methods for refining the prototype based on stakeholder insights.				
5	To create a strategic roadmap for evolving prototypes into validated market-ready solutions through metrics and stakeholder planning.				
UNIT 1 PROTOTYPE					1
<ul style="list-style-type: none"> • Transitioning from Ideate Mode • What is the Prototype mode? • Why Prototype? • How to Prototype? • How to seamlessly transition from Prototype to Test? 					
UNIT 2 TEST					2
<ul style="list-style-type: none"> • What is the Test Mode? • How to Test? • How to iterate for continuous improvements? • Deciding how to move forward (Persevere or Pivot) • How to make the process to repetitively lead to product / service improvements 					
UNIT 3 EXPERIMENTATION					4
<ul style="list-style-type: none"> • Make prototypes (Fast & Cheap / Simulate & Stimulate) • Create and Try, Experience Prototypes by shrinking big things down • Rapid Concept Development • Assumptions, Constraints, Limitations, Potential point of failures and Risk Analysis • Test prototypes by Customer Co-Creation 					
UNIT 4 FEEDBACK					4
<ul style="list-style-type: none"> • Identify potential sources of feedback • Obtain feedback from select participants (Client / Customer / Consumer / Stakeholder) • Build a questionnaire guide by starting specific to moving broad • Probe deep, facilitate feedback prompts, capture input and integrate overall feedback • Identify costs, resources, infrastructure, features and functionalities to iterate based on what is available vs. needed at the institution to decide buying needs 					
UNIT 5 EVOLUTION					4
<ul style="list-style-type: none"> • Track learnings and establish Learning Launches • Define success with Impact Guidance • Identify methods of tracking (Measures / Metrics – Lag or Lead) 					



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- Document progress and asset needs iteratively by effective stakeholder engagement to plan next steps
- Define RASCI / RACI Chart to prepare and pitch product or service concept for Market Valuation by Storytelling

TOTAL PERIODS **15**

Course Outcomes

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

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

TEXTBOOKS

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

REFERENCES

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

CO-PO, PSO Mapping

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

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



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SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24IT601	Full Stack Web Development	PCC	45	3	0	0	3
2	U24MC613	Integrated Disaster Management	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
3	U24CS601	Object Oriented Software Engineering	PCC	75	3	0	2	4
4	U24IT603	Embedded Systems and IOT	PCC	75	3	0	2	4
5		Professional Elective III	PEC	60	2	0	2	3
6		Professional Elective IV	PEC	60	2	0	2	3
PRACTICAL								
8	U24IT602	Full Stack Web Development Laboratory	PCC	45	3	0	0	1.5
9	U24RM612	Data Collection, Analysis and Interpretation	RMC	30	0	0	2	1
10	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1
11	U24ED611	Business Management - Go To Market & Start-up Journey	EDIC	15	0	0	1	0.5
TOTAL				480	14	0	16	21



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U24IT601	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES					
1	To understand the various components of full stack development				
2	To learn Node.js features and applications				
3	To develop applications with MongoDB				
4	To understand the role of Angular and Express in web applications				
5	To develop simple web applications with React				
UNIT1 BASICS OF FULL STACK					9
Understanding the Basic Web Development Framework - User - Browser - Webserver - Backend Services - MVC Architecture - Understanding the different stacks- The role of Express- Angular- Node - MongoDB – React					
UNIT2 NODE JS					9
Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP and HTTPS services in Node.js					
UNIT3 MONGO DB					9
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – Spring Frameworks-simple applications- Introduction to Typescript					
UNIT4 EXPRESS and ANGULAR					9
Implementing Express in Node.js – Configuring routes – Using Request and Response objects – Angular – Typescript – Angular Components – Expressions – Data binding – Built-in directives- Overview of Web Pack					
UNIT 5					9
MERN STACK – Basic React applications – React Components – React State –React Forms - React CSS - Express REST APIs – Modularization and Webpack – Routing with React Router – Server-side rendering- Deployment a simple application in any one of the STACK(MEAN, Ruby on Rails, LAMP, Danjgo etc.)					
TOTAL:					45 Hours



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At the end of the course, the student will be able to														
CO1	Understand the various stacks available for web application development													
CO2	Use Node.js for application development													
CO3	Develop applications with MongoDB													
CO4	Use the features of Angular and Express													
CO5	Develop React applications													
TEXT BOOKS														
1	Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018													
2	Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.													
3	Frank Zammetti, Modern Full-Stack Development Using TypeScript, React, Node.js, Webpack, and Docker, Apress, 2020													
4	David Choi, Full-Stack React, TypeScript, and Node, Packt Publications, 2020.													
REFERENCES														
1	Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018													
2	Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018													
3	https://www.tutorialspoint.com/the_full_stack_web_development/index.asp													
4	http://www.coursera.org/specializations/full-stack-react													
5	http://www.udemy.com/course/the-full-stack-web-development/													
CO/PO, PSO Mapping														
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	0	0	0	1	1	1	1	1	1	0
CO2	3	3	3	3	2	1	0	2	0	2	3	2	2	1
CO3	3	3	2	2	2	2	0	2	2	2	3	2	2	1
CO4	3	3	2	2	2	1	0	1	1	2	2	2	1	1
CO5	3	3	3	3	3	1	0	0	0	2	2	2	2	1
AVG	3	3	2	2	2	1	0	1	1	2	2	2	2	1



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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 1 SOFTWARE PROCESS AND AGILE DEVELOPMENT					9+6
Introduction to Software Engineering - Software Process - Perspective and Specialized Process Models - Introduction to Agility - Agile process - Unified process - UML diagrams -Use case - Case Study					
Lab Components:					
1. Identify a software system that needs to be developed.					
2. Document the Software Requirements Specification (SRS) for the identified system.					
UNIT 2 REQUIREMENT ANALYSIS AND SPECIFICATION					9+6
Requirements gathering and analysis - Software Requirement Specification - Formal system specification - Unified Modeling Language, Tools (Bannari) - Object modelling using UML - Object modelling using UML - Class diagrams - Interaction diagrams - Activity diagrams - state chart diagrams - Functional modelling - Data Flow Diagram-CASE TOOLS					
Lab Components :					
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.					
UNIT 3 SOFTWARE DESIGN					9+6
Design process - Design concept - Coupling - Cohension - Design patterns - Model-view-controller - Publish-subscribe - Command - Strategy -Observer - Proxy - Façade - Architectural styles - Layered - Client Server - Tiered - Pipe and filter - User interface design-Case study					
Lab Components :					
7. Implement the system as per the detailed design					
UNIT4 SOFTWARE TESTING AND MAINTENANCE					9+6
Testing - Unit testing - Black box testing - White box testing - Integration and System testing - Regression testing - Debugging - Program analysis - Symbolic execution - Model Checking- Case study					
Lab Components :					
8. Test the software system for all the scenarios identified as per the usecase diagram					



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UNIT5	PROJECT MANAGEMENT	9+6
Software Project Management - Software Configuration Management - Project Scheduling - Motivation- Cloud as a platform - Operations - Deployment Pipeline: Overall Architecture Building and Testing" - Deployment – Tools- Case study		
Lab Components :		
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.		
		TOTAL: 75
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	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	1	1	2	2	2	1
CO2	3	3	2	2	2	-	-	2	2	3	2	3	2	1
CO3	3	3	2	2	2	-	-	2	2	3	2	2	3	1
CO4	3	3	2	2	2	-	-	2	-	3	2	2	3	1
CO5	3	3	2	2	2	-	-	-	-	-	1	3	2	2
AVG	3	2.8	2	2	2	-	-	2	1.75	2.5	1.8	2.4	2.4	1.2



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U24IT603	EMBEDDED SYSTEMS AND IOT	L	T	P	C
		3	0	2	4
COURSE OBJECTIVES					
1	To learn the internal architecture and programming of an embedded processor.				
2	To introduce interfacing I/O devices to the processor.				
3	To introduce the evolution of the Internet of Things (IoT).				
4	To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.				
5	To apply the concept of Internet of Things in real world scenario.				
UNIT 1 8-BIT EMBEDDED PROCESSOR					9+6
8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.					
Lab Components					
<ol style="list-style-type: none"> 1. Write 8051 Assembly Language experiments using simulator. 2. Test data transfer between registers and memory. 					
UNIT:2 EMBEDDED C PROGRAMMING					9+6
Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.					
Lab Components					
<ol style="list-style-type: none"> 3. Write Basic and arithmetic Programs Using Embedded C. 4. Introduction to Arduino platform and programming 					
UNIT 3 IOT AND ARDUINO PROGRAMMING					9+6
Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – integration of Sensors and Actuators with Arduino					
Lab Components					
<ol style="list-style-type: none"> 5. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth) 					
UNIT 4 IOT COMMUNICATION AND OPEN PLATFORMS					9+6
IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.					
Lab Components					
<ol style="list-style-type: none"> 6. Introduction to Raspberry PI platform and python programming 7. Interfacing sensors with Raspberry PI 8. Communicate between Arduino and Raspberry PI using any wireless medium 9. Setup a cloud platform to log the data 					
Log Data using Raspberry PI and upload to the cloud platform					



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UNIT 5 APPLICATIONS DEVELOPMENT													9+6		
Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.															
Lab Components															
11. Design an IOT based system															
															TOTAL: 75
At the end of the course, the student will be able to															
CO1	Explain the architecture of embedded processors.														
CO2	Write embedded C programs.														
CO3	Design simple embedded applications.														
CO4	Compare the communication models in IOT.														
CO5	Design IoT applications using Arduino/Raspberry Pi /open platform.														
TEXT BOOKS															
1	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 201														
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	Michael J. Pont, “Embedded C”, Pearson Education, 2007														
2	Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006														
3	Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015														
4	Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer's Guide”, Morgan Kauffman Elsevier, 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	PSO1	PSO2	PSO3	
CO1	3	3	3	3	-	-	-	1	2	3	3	2	1	3	
CO2	2	1	3	2	2	--	-	1	2	2	3	3	1	3	
CO3	3	1	3	3	1	-	-	1	2	1	1	1	3	3	
CO4	3	2	3	2	1	-	-	1	2	1	1	1	3	4	
CO5	2	3	3	2	2	-	-	1	3	3	2	3	1	3	
AVG	2.6	2	2	2.4	1.5	-	-	1	2.2	2.2	2.4	2.2	1.6	2.6	



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U24IT602	FULL STACK WEB DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives					
1	To develop full stack applications with clear understanding of user interface, business logic and data storage.				
2	To design and develop user interface screens for a given scenario				
3	To develop the functionalities as web components as per the requirements				
4	To implement the database according to the functional requirements				
5	To integrate the user interface with the functionalities and data storage.				
List of Experiments					
1	Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.				
2	Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items				
3	Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them				
4	Create a food delivery website where users can order food from a particular restaurant listed in the website.				
5	Develop a classifieds web application to buy and sell used products.				
6	Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.				
7	Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.				
8	Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.				
					Total 45 periods



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Course Outcomes														
At the end of the course, the student will be able to														
CO1	Design full stack applications with clear understanding of user interface, business logic and data storage.													
CO2	Design and develop user interface screens													
CO3	Implement the functional requirements using appropriate tool													
CO4	Design and develop database based on the requirements													
CO5	Integrate all the necessary components of the application													
TEXT BOOKS														
1	Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018													
2	Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.													
3	"Learning React" by Alex Banks and Eve Porcello													
4	"Node.js Design Patterns" by Mario Casciaro													
5	"The DevOps Handbook" by Gene Kim, Jez Humble, Patrick Debois, and John Willis.													
REFERENCES														
1	Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018													
2	Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018													
3	https://www.tutorialspoint.com/the_full_stack_web_development/index.asp													
4	https://www.coursera.org/specializations/full-stack-react													
5	https://www.udemy.com/course/the-full-stack-web-development/													
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	1	1	2	1	1	1	2	2	1
CO2	3	3	3	2	3	1	1	2	1	1	1	2	2	1
CO3	3	3	3	3	3	1	1	2	1	1	1	2	2	1
CO4	3	3	3	3	3	2	1	1	1	2	1	1	2	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	2	1
AVG	3	3	3	2	3	1	1	1	1	1	1	2	2	1



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U24RM612	DATA COLLECTION, ANALYSIS AND INTERPRETATION	L	T	P	C
		0	0	1	0.5
COURSE OBJECTIVES					
1	Analyze different types of data, sources, and sampling methods in research contexts to ensure appropriate data collection.				
2	Apply appropriate digital and manual tools for designing and administering data collection instruments across disciplines.				
3	Analyze and preprocess raw data using statistical and visualization techniques to prepare it for analysis.				
4	Evaluate statistical methods and domain-specific analysis techniques for their suitability in different research scenarios.				
5	Evaluate the significance of data analysis results and effectively communicate findings through structured research outputs.				
UNIT 1 INTRODUCTION TO RESEARCH DATA AND COLLECTION TECHNIQUES					3
Types of data: qualitative vs. quantitative; primary vs. secondary, Sources of data: surveys, experiments, sensors, interviews, observations, literature, Tools and techniques for data collection: questionnaires, focus groups, digital sensors, APIs, Sampling methods: probability and non-probability sampling, Data quality: validity, reliability, accuracy, and bias					
UNIT 2 TOOLS AND METHODS FOR DATA COLLECTION					3
Designing data collection instruments: scales, forms, and logs, Using online tools: Google Forms, Survey Monkey, KoboToolbox, IoT and sensor-based data acquisition in engineering and science, Ethical considerations in data collection: consent, privacy, anonymization, Case studies from various domains					
UNIT 3 DATA PREPARATION AND ANALYSIS TECHNIQUES					3
Data cleaning and preprocessing: handling missing, duplicate, and outlier data, Organizing data: tabulation, coding, categorization, Descriptive statistics: mean, median, mode, standard deviation, variance, Data visualization: charts, graphs, dashboards using Excel, Python, R, Introduction to data analysis tools: SPSS, Excel, Python (Pandas), R					
UNIT 4 STATISTICAL AND ANALYTICAL METHODS					3
Inferential statistics: hypothesis testing, confidence intervals, Correlation and regression analysis, ANOVA, chi-square, and non-parametric tests, Multivariate analysis (introductory), Domain-specific analysis techniques (e.g., sentiment analysis in social sciences, FFT in engineering)					
UNIT 5 DATA INTERPRETATION AND RESEARCH REPORTING					3
Interpreting statistical results in context, Drawing meaningful conclusions and identifying patterns, Reporting and visualizing findings (charts, tables, narrative explanation), Using data to support or refute hypothesis, Writing data-driven research papers, reports, and presentations					
TOTAL PERIODS					: 15
COURSE OUTCOMES					
At the end of the course, the student will be able to					
CO1	Distinguish and evaluate data types, sources, and sampling methods to design valid and reliable research strategies.				
CO2	Design effective data collection tools using platforms like Google Forms, SurveyMonkey, and IoT-based systems, while addressing ethical considerations.				
CO3	Clean, organize, and summarize datasets using descriptive statistics and visualize results using tools like Excel, Python, or R.				
CO4	Select and apply appropriate statistical and analytical techniques such as regression, ANOVA, and chi-square to interpret research data.				



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CO5	Interpret analytical outcomes and prepare data-driven research reports and presentations that effectively communicate insights.
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TEXTBOOKS

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

REFERENCES

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

CO-PO, PSO Mapping

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

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



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U24ED611	BUSINESS MANAGEMENT: GO-TO-MARKET & STARTUP JOURNEY	L	T	P	C
		0	0	1	0.5
Course Objectives					
1	To understand the fundamentals of business management and the startup lifecycle from idea to market entry.				
2	To analyze and design business models and revenue models suitable for innovative products and services.				
3	To develop go-to-market strategies including marketing, sales, and customer acquisition planning				
4	To understand financial planning, funding options, and legal aspects of starting and scaling a venture.				
5	To prepare students to present and manage a startup journey through effective pitching and stakeholder engagement.				
UNIT I IDEATE MODE					1
<ul style="list-style-type: none"> • Meaning and scope of business management. • Startup lifecycle: idea, validation, launch, growth, and scale. • Role of entrepreneurship in economic development. • Overview of startup ecosystem: incubators, accelerators, investors, and government initiatives. • Ethics and sustainability in business. 					
UNIT II IDEA GENERATION					2
<ul style="list-style-type: none"> • Business Model Canvas and value proposition design. • Customer segments, channels, and customer relationships. • Revenue models: subscription, freemium, licensing, transaction-based models. • Cost structure and key resources. • Lean startup and effectuation principles. 					
UNIT III BRAINSTORMING FACILITATION					4
<ul style="list-style-type: none"> • Market segmentation, targeting, and positioning. • Marketing mix and branding basics. • Digital marketing channels and customer acquisition strategies. • Sales strategy and distribution channels. • Pricing strategies and competitive positioning. 					
UNIT IV SKETCH TO THINK BEYOND					4
<ul style="list-style-type: none"> • Basics of financial planning and budgeting. • Understanding unit economics and break-even analysis. • Sources of funding: bootstrapping, angel investors, venture capital, and government schemes. • Legal forms of business organization. • Intellectual Property Rights (IPR) and regulatory compliance. 					
UNIT V TRANSLATE SOLUTIONS TO PRODUCTS AND SERVICES					4
<ul style="list-style-type: none"> • Operational planning and team building. • Risk management and decision-making. • Performance metrics and growth tracking. • Storytelling and investor pitch deck preparation. • Preparing for market launch and scaling strategy. 					
TOTAL PERIODS					15



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Course Outcomes

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

1	Explain the concepts of business management and the stages of the startup journey.
2	Design appropriate business and revenue models for innovative products and services.
3	Develop effective go-to-market strategies including marketing and sales plans.
4	Apply financial planning and legal knowledge to assess venture feasibility.
5	Prepare and present a structured business pitch for launching and scaling a startup.

TEXTBOOKS

1	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, <i>Entrepreneurship</i> , McGraw Hill Education, 11th Edition, 2020
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REFERENCE BOOKS

1	Kotler, P. & Keller, K. L., <i>Marketing Management</i> , Pearson Education
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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	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO2	1	2	3	2	2	2	1	3	3	2	2	-	-	-
CO3	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO4	-	2	3	2	2	2	-	3	3	2	2	-	-	-
CO5	-	2	3	2	2	2	-	3	3	2	2	-	-	-
AVG	1	2	3	2	2	2	1	3	3	2	2	-	-	-



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SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24IT701	Wireless Networks	PCC	45	3	0	0	3
2		Open Elective - II	OEC	45	3	0	0	3
3		Open Elective - III	OEC	45	3	0	0	3
4	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
5	U24MC713	Constitution of India	MC [#]	30	2	0	0	0
THEORY CUM PRACTICAL								
6		Professional Elective V	PEC	60	2	0	2	3
7		Professional Elective VI	PEC	60	2	0	2	3
PRACTICAL								
8	U24IT702	Summer Internship*	EEC					1.0
9	U24RM712	Technical Writing and Research Ethics	RMC	15	0	0	1	0.5
TOTAL				300	14	0	6	19.5



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U24IT701	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3
Course Objectives: To develop the skills and understanding needed for roles in network engineering, wireless planning, telecom R&D, and IOT infrastructure design.					
1	To study the various network layer and transport layer protocols for wireless networks.				
2	To study the architecture and interference mitigation techniques in 3G standards				
3	To learn about 4G technologies and LTE-A in mobile cellular network.				
4	To learn about the layer level functionalities in interconnecting networks				
5	To study the emerging techniques in 5G network.				
UNIT 1 WIRELESS PROTOCOLS					9
Mobile network layer-Fundamentals of Mobile IP, data forwarding procedures in mobile IP IPv4, IPv6, IP mobility management, IP addressing-DHCP, Mobile transport layer Traditional TCP, congestion control, slow start, fast recovery/fast retransmission classical TCP improvements-Indirect TCP-snooping TCP-Mobile TCP					
UNIT 2 3G EVOLUTION					9
IMT-2000, W-CDMA CDMA 2000-Radio & network components, network structure Packet-data transport process flow-Channel Allocation, core network interference-mitigation techniques- UMTS- services, air interface-network architecture of 3GPP-UTRAN – architecture High Speed Packet Data-HSDPA, HSUPA.					
UNIT 3 4G EVOLUTION					9
Introduction to LTE-A-Requirements and Challenges, network architectures-EPC, E- UTRAN architecture- Mobility management, resource management, services, channel-Logical and transport channel mapping - Downlink/uplink data transfer -MAC control element -PDU packet formats, scheduling services- Random access procedure					



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UNIT 4 LAYER-LEVEL FUNCTIONS		9
<p>Characteristics of wireless channels-Downlink physical layer, uplink physical layer, MAC scheme Frame structure, resource structure -Mapping, synchronization-Reference signals and channel estimation, - SC-FDMA, interference cancellation Comp -Carrier aggregation, Services -Multimedia broadcast/multicast -Location-based services</p>		
UNIT 5 5G EVOLUTION		9
<p>5G Roadmap, Pillars of 5G-5G Architecture, The 5G internet-IoT and context awareness Networking reconfiguration and virtualization support-Mobility QoS control-Emerging approach for resource over provisioning, Small cells for 5G mobile networks-Capacity limits and achievable gains with densification-Mobile data demand, Demand Vs Capacity, Small cell challenges,-Conclusion and future directions.</p>		
TOTAL 45 HOURS		
Course Outcomes		
At the end of the course, the student will be able to		
CO1	Design and implement the various protocols in wireless networks.	
CO2	Analyze the architecture of 3G network standards.	
CO3	Analyze the difference of LTE-A network design from 4G standard.	
CO4	Design the interconnecting network functionalities by layer level functions	
CO5	Explore the current generation (5G) network architecture.	
TEXT BOOKS		
1	Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008	
2	Theodore S. Rappaport, " <i>Wireless Communications: Principles and Practice</i> ", Pearson Education, 2nd Edition, 2010.	
3.	Afif Osseiran, José F. Monserrat, Patrick Marsch, " <i>5G Mobile and Wireless Communications Technology</i> ", Cambridge University Press, 2016.	



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REFERENCES

1	Vijay K.Garg, “Wireless Network Evolution - 2G & 3G”. Prentice Hall, 2008.
2	Clint Smith,P.E, Dannel Collins, “3G Wireless Networks” Tata McGraw- Hill, 2nd Edition, 2011
3	Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014
4	Abd-Elhamid M. Taha and Hossam S. Hassanein, Najah Abu Ali ,”LTE, LTE-Advanced and WiMAX”, John Wiley, 2012
5	Vijay K.Garg, “Wireless Network Evolution - 2G & 3G”. Prentice Hall; August 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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	-	-	-	-	2	3	3	1	1
CO2	3	3	2	1	3	2	-	-	-	-	-	-	3	2	2
CO3	3	3	3	3	2	1	-	-	-	-	-	3	3	2	2
CO4	2	3	3	3	2	2	-	-	-	-	-	3	2	1	2
CO5	2	-	3	3	2	2	-	-	-	-	-	3	2	2	1
AVG	2.6	2.75	2.6	2.6	2.4	1.6	-	-	-	-	2	3	2.6	1.6	1.6



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U24RM712	TECHNICAL WRITING AND RESEARCH ETHICS	L	T	P	C
		0	0	1	0.5
COURSE OBJECTIVES					
1	Apply the principles of clarity, conciseness, coherence, and correctness in technical writing tasks.				
2	Analyze the structure and components of various research and technical documents using the IMRaD format.				
3	Apply principles of formal, objective, and precise language in crafting professional technical documents.				
4	Evaluate the effectiveness of visual elements (tables, charts, graphs) in technical documentation and revise them for clarity and precision.				
5	Analyze ethical issues related to research publication, data integrity, authorship, and collaborative writing.				
UNIT 1 Fundamental of Technical Writing				3	
Nature and scope of technical writing vs. academic writing, Characteristics of effective technical writing: clarity, conciseness, coherence, correctness, Audience analysis and purpose identification, Writing process: planning, drafting, revising, editing, Common technical documents: manuals, reports, proposals, research papers					
UNIT 2 Writing Research and Technical Documents				3	
Structure and format of research papers (IMRaD structure), Writing abstracts, introductions, literature reviews, methodologies, results, and conclusions, Writing technical reports, project documentation, lab reports, Research proposals and funding applications, Case studies of well-written technical documents					
UNIT 3 Language and Style in Technical Writing				3	
Use of formal, objective, and precise language, Active vs. passive voice; tone and style, Grammar, punctuation, and sentence construction, Avoiding jargon, redundancy, and ambiguity, Consistency in units, terminology, and symbols					
UNIT 4 Data Presentation and Visual Communication				3	
Integrating tables, charts, graphs, and diagrams effectively, Captioning, labelling, and referencing visuals, Tools for creating visuals (Excel, Python, R, LaTeX), Guidelines for formatting figures and tables (APA, IEEE, etc.), Visual abstracts and infographics in technical communication					
UNIT 5 Ethics, Review, and Publishing				3	
Plagiarism, citation styles (APA, MLA, IEEE), and referencing tools (Zotero, Mendeley), Ethics in authorship, collaborative writing, and data reporting, Ethical issues in Research planning and design, Ethics in data collection, analysis and interpretation, Publication ethics and professional conduct, Contemporary and Emerging ethical challenges.					
TOTAL PERIODS				15	
COURSE OUTCOMES					
At the end of the course, the student will be able to					
CO1	Draft effective technical documents that demonstrate clarity, coherence, and appropriateness for a specified audience and purpose.				
CO2	Deconstruct well-written technical documents and identify effective strategies in structuring abstracts, literature reviews, and methodologies.				
CO3	Produce grammatically accurate and stylistically appropriate texts while minimizing ambiguity and redundancy.				
CO4	Design and integrate well-labeled, correctly formatted visuals to support technical arguments in reports and presentations.				
CO5	Critically assess research practices for ethical compliance, and apply appropriate citation and referencing standards using tools like Zotero or Mendeley.				



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TEXT BOOKS														
1	M. Alley, The Craft of Scientific Writing, 3rd ed. New York, NY, USA: Springer, 1996.													
2	A. Eisenberg, Guide to Technical Writing, New York, NY, USA: Macmillan, 1978.													
3	W. Strunk Jr. and E. B. White, The Elements of Style, 4th ed. Boston, MA, USA: Pearson, 2022.													
4	D. B. Resnik, The Ethics of Science: An Introduction, 2nd ed. New York, NY, USA: Routledge, 2018.													
5	A. E. Shamoo and D. B. Resnik, Responsible Conduct of Research, 4th ed. New York, NY, USA: Oxford Univ. Press, 2022.													
REFERENCES														
1	J.-L. Lebrun, Scientific Writing: A Reader and Writer's Guide, Singapore: World Scientific, 2007.													
2	S. Bailey, Academic Writing: A Handbook for International Students, 5th ed. New York, NY, USA: Routledge, 2018.													
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	1	1	1	2	3	1	2	1	1	1
CO2	2	3	2	3	2	1	2	2	3	2	3	1	1	1
CO3	2	2	2	1	1	1	2	2	3	2	3	1	1	1
CO4	2	2	3	2	3	1	1	2	3	3	3	1	1	1
CO5	2	2	1	2	2	2	3	2	3	2	3	1	1	1
AVG	2	2	2	1.8	1.8	1.2	1.8	2	3	2	2.8	1	1	1



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