SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
NAAC Accredited with 'A' Grade,
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
TIRUCHENGODE- 637 205

CURRICULUM&SYLLABI

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS–2023

(REVISION II)

(I - VIII SEMESTER)

(For the students admitted from the Academic year 2025-2026 onwards).

(From (III to VIII Semesters) only applicable for the students admitted the Academic Year during 2023-24 and 2024-25)

Estd : 2001

Note: The regulations here under are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates including those already under going the programme under the same Regulationasmaybedecidedby the Academic Council.

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Chairman - BoS

DEAN (ACADEMICS)
SENGUNTHAR ENGINEERING COLLEGE
TIRUCHENGODE-637 205

PRINCIPAL
SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
TIRUCHENGODE - 637 205

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REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VISION

- To achieve excellence in the field of Artificial Intelligence by focusing knowledge-centric education, innovation and cutting-edge research to address the needs of industry and society.

MISSION

- Impart knowledge in Artificial Intelligence and data Science technologies with innovative thoughts and leadership skills with industry support.
- Educating the students by enhancing knowledge in the Artificial Intelligence domain.
- Strengthening the students to competence in Artificial Intelligence and Data Science through research and innovative activities.
- Enabling the students professional growth through training and self-learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- ✓ Utilize their proficiencies in the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volumes of data.
- ✓ Advance their technical skills to pursue pioneering research in the field of Artificial Intelligence and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.
- ✓ Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering Knowledge**	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis**	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3	**Design / development of solutions**	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	**Conduct investigations of complex problems**	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	**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 engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World**	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics**	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	**Individual and Collaborative Team work**	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication**	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	**Project Management and Finance**	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-Long Learning**	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.
PSO2	Arrive at actionable Foresight, Insight, hindsight from data for solving business and engineering problems.

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
I	I	23HST101 - Professional English	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-
		23MAT101 - Matrices and calculus	3	3	2	-	-	-	-	-	-	-	1	-	-
		23HST102 - தமிழர்மரபு/Heritage of Tamils	-	-	-	-	-	-	-	-	-	-	-	-	-
		23PHT102 - Applied Physics for Computer Engineering	3	3	1	1	-	-	-	-	-	-	-	-	-
		23CYT101 - Engineering Chemistry	2.2	2.0	2.6	1.8	1.8	1.8	1.5	1.7	1.3	1.3	1.3	-	-
		23GEE101 - Programming in C	2.8	2.8	2.5	1.8	3.0	–	1.0	1.0	1.3	1.0	2.0	3.0	2.7
		23PHL101- Applied Physics for Computer Engineering Laboratory	3	3	1	1	-	-	-	-	-	-	-	-	-
		23CYL101- Engineering Chemistry Laboratory	3	3	2	1	1	2	1	1	2	-	-	-	-
		23EEC101 - Soft Skills & Life Skills	1.25	1.60	1.00	1.00	3.00	1.40	2.00	2.60	2.80	2.60	2.0	1.2	1.6
		23MDC101 - Induction Program (2 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-
		MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME													
I	II	23MAT203 - Mathematical Foundations of Computing	3	3	2	1	1	-	-	-	-	-	2	-	-
		23PHT202 - Advanced Physics for Computer Engineering	3	2	1	1	1	1	1	-	-	-	-	-	-
		23CYT201 - Environmental Science and Sustainability	2	1.4	3	2	2.7	3	3	2	2.6	2.4	2.2	-	-
		23HST202 - தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	-	-	-	-	-	-	-	-	-	-	-	-	-
		23HSE201 - English for Engineers: Theory and Practice	1	2	-	2	1	2	1.5	2.3	3	2	1.6	-	-
		23CST201 - PC Hardware Service and Networking	3.0	2.6	2.0	1.6	2.8	1.6	1.3	1.3	1.0	1.0	2.2	3.0	2.8
		23EEE202 - Basic Electrical And Electronics Engineering	3	3	3	3	3	-	1	3	3	-	3	1.8	1.2
		23CSL201 - Reverse	3	3	3	2	3	1	1	2	2	1	2	3	3

		Engineering Laboratory													
		23EEC201 - Indian Language(Except Mother Tongue)/Foreign Language													
		Hindi	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-
		German	-	-	-	-	-	1	1.5	1.7	3	-	1.6	-	-
		Japanes	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-
		23MDC201 - Aptitude Skills	-	-	-	-	-	-	-	-	-	-	-	-	-
MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
II	III	23MAT303 - Discrete Mathematics	3	3	2	1	-	-	-	-	-	1	-	-	-
		23ECT302- Digital Principles and Computer Architecture	3	2.8	2.8	2.2	2	2	-	-	-	2	1.8	3	1.4
		23ADT302 - Programming Using Java	2	1	2	2	2	-	-	-	2	2	1	3	2
		23GEE301-Problem Solving and Python Programming	2.8	2.7	2.2	1.5	2.8	0.0	1.0	1.0	1.5	1.0	2.0	3.0	2.8
		23ADE301 - Foundations of Artificial Intelligence	2	3	3	3	2	-	-	-	-	-	2	3	3
		23ADE302 - Data Structures Design	3	2	2	3	2	2	-	-	-	-	2	3	3
		23EEC301 - Professional Development	-	-	-	-	-	-	-	-	-	-	-	-	-
MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
II	IV	23ADT401 - Advanced Networking and Protocols	2	2	2	2	2	-	-	-	2	2	2	2	2
		23ITT401 - Object Oriented Software Design	2.5	1.6	1.8	2	1	-	-	-	2	1.5	1.8	1.6	1.6
		23CST302-Operating Systems	3	2.6	2.6	2.6	2.8	1	-	-	-	-	-	2.8	2.8
		23ADE401 - Data Science and Analytics	1	1	2	2	2	-	-	-	2	2	2	2	2
		23ADE402 - Machine Learning Essentials	2	2	3	2	2	-	-	-	2	2	2	2	2
		23CSE402-Database Management Systems	3.0	3.0	2.8	2.7	3.0	1.3	1.0	1.2	1.2	1.2	2.7	3.0	3.0
		23EEC401 - Online Certification Courses	-	-	-	-	-	-	-	-	-	-	-	-	-
MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
III	V	23ADT501 - UI and UX Design	2	2	2	2	2	0	0	0	3	2	1	3	2
		23ADE501 - Deep Learning	2.6	2.6	1.6	2	1.4	-	-	-	2	2.4	2.2	2.4	2.8
		23ADE502 - IOT and its Applications	2.6	2.6	1.6	2	1.4	-	-	-	2	2.4	2.2	2.4	2.8
		23EEC501 - Industrial	-	-	-	-	-	-	-	-	-	-	-	-	-

Training													
Professional Elective – I													
23ADP501 - mobile Applications and its Development	2	2	2	1	-	-	-	-	-	2	2	2	1
23ADP502 - Knowledge Engineering	2.4	1.8	2.4	1.4	1.4	-	-	-	2	1.6	1.6	2.2	1.6
23CSP503 - Recommender Systems	2.8	2.6	2	2	2.4	1.2	0.4	0.8	1.4	1.2	2.4	3	3
23CSP504 - Text and Speech Analysis	3	2.6	2	2	2.8	1	0	0.6	1.2	1	2.8	3	2
23ITP501 - Image and Video Analysis	2	1.8	2.2	2.4	2.6	-	-	-	22	2	1.4	2	1.6
23CSP608 - Soft Computing	3.0	2.8	2.4	2.2	2.0	1.2	1.0	2.0	1.8	1.2	2.0	1.8	1.6
Professional Elective – II													
23ADP503 - Cloud Technologies	2.2	2.2	2.2	2	1.8	-	-	-	2.2	2.2	1	1.6	1.8
23ADP504 - App Development	1.6	1.8	2	1.4	2.6	-	-	-	1.4	1.2	2	2	2.2
23CSP511 - Web Application Security	2.8	2.4	2.4	2.4	2.4	1.4	2	1.4	1.2	2	1.8	2	1
23CSP508 - Cloud Services Management	2.2	2.4	2.6	2.6	2.6	1.8	1.2	0.4	1.6	1.2	2	2.2	2.4
23CSP510 - Software Testing and Automation	2.4	2	2.8	2.4	2.4	1	0	0	1.4	2	1.8	2	2
23CSP506 - Big Data Analytics	3.0	2.8	2.4	2.2	2.0	1.2	1.0	2.0	1.8	1.2	2.0	2	2
Professional Elective – III													
23CSP516 - Security and Privacy in Cloud	2	2.4	2.4	2.2	1.8	-	-	-	2.2	1.8	2.2	2.2	1.8
23CSP502- Exploratory Data Analysis	2.2	2.2	2.4	2.4	2.6	-	-	-	2.2	2	2.2	2	2.4
23ADP508 - Data Warehousing	3	2.6	2.6	1.2	2.5	1	-	-	2.5	-	2	-	-
23ITP505- Storage Technologies	1.8	1.8	1.8	2.2	2.4	-	-	-	1.8	1.4	2.2	2.2	2.4
23CSP514- Software Defined Networks	1.8	2.2	1.6	2.6	1.8	-	-	-	1.8	1.8	2	2.4	2.2
23CSP515-Stream Processing	2.6	1.8	1.8	2.6	2.2	-	-	-	2.6	2.6	1.4	1.4	1.4
Mandatory Course – I													
23MDC501- Introduction to Women and Gender Studies	-	-	-	-	-	-	-	-	-	-	-	-	-

	23MDC502- Elements of Literature	-	-	-	-	-	-	-	-	-	-	-	-	-
	23MDC503- Film Appreciation	-	-	-	-	-	-	-	-	-	-	-	-	-
	23MDC504- Disaster Risk Reduction and Management	-	-	-	-	-	-	-	-	-	-	-	-	-
	23MDC505- Constitution of India	-	-	-	-	-	-	-	-	-	-	-	-	-
MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME														
VI	23ADT601 - Business Intelligence	2.6	2.6	2.8	2.2	2.6	1	0.4	1	2.2	2.4	1.8	3	2.8
	23ADE601 - Natural Language Processing	3	3	2.7	3	3	1.1	1.3	0.5	2	1.8	2	2.8	2.6
	Professional Elective – IV													
	23ADP601 - Network Security	3	2.6	2	2.6	2.2	1	0.6	1	2.5	2.4	1.8	3	2.4
	23CSP601 - Hacking Techniques	2.6	2.8	2.2	2.6	3.0	1.8	-	2.2	2	1.4	-	2.8	2.2
	23ITP601 - Digital Forensics	2.6	2.8	2.4	2.4	2.0	2.2	-	-	-	-	-	2.6	2.4
	23CSP602 - Social Network Security	3.0	2.8	2.4	2.4	2.6	2.4	2.2	1.5	1.6	1.0	2.8	3.0	2
	23CSP603 - Engineering Secure Software Systems	3	3	2.8	2.6	2.4	1.6	2	1.5	1.8	1.4	2	2.8	2.4
	Professional Elective – V													
	23CSP604 - Augmented Reality / Virtual Reality	3	3	2.6	2.4	2.4	1.8	1.3	3	2	1.4	-	2	2
	23ITP603 - Game Development	2.2	2.2	1.6	1.6	2.2	-	-	-	-	-	-	2	2.2
	23ADP602 - Neural Networks and Deep Learning	2.6	2	2.8	2.2	2.4	0.4	0	0	1.6	0.6	0.8	1.4	1.6
	23ADP603 - Agile Methodology	3	2.8	2.8	3	2.6	1.5	1	1.6	2	2.6	2.4	2.8	2.4
	23CCP602 - Cyber Physical System Security	2.6	2.8	2.25	2.0	2.75	2.5	3.0	–	2.0	2.0	2.2	2.4	2.2
	23CSP609 - Cognitive Science	2.6	2.4	1.8	1.5	1.8	3	3	2.4	1.8	1.6	2	1.8	1.6
	Professional Elective – VI													
	23ADP604 - Ethics of Artificial Intelligence	2.6	1.6	1.8	2.4	2	-	-	-	1.6	2	1.8	2.4	2
	23CSP607 - Quantum Computing	3	3	-	2	2	2	2	-	-	-	2	2	2

23CCP603 - Cryptocurrency and Blockchain Technologies	3	2.8	2.6	2.6	2.8	1.6	1.2	2	1.8	2	2.2	2.8	2.6
23CSP610 - Optimization Techniques	3	3	2.4	2.2	2.4	1.3	1	2	2	1.2	2	2.8	2.2
23ITP604 - Information Assurance and Security	3	3	3	2.8	2.6	0.8	0.1	0.6	1	1	2.5	3	3
23CST401 - Distributed Computing	3	3	3	3	3	0.8	1	0	1.8	1.6	1.8	2.8	2
Open Elective – I / NCC I / L1/L3													
23CEO607 - Environmental and Social Impact Assessment	3.0	3.0	2.4	2.0	2.0	2.2	3.0	–	–	–	2.3	-	-
23CSO610- Introducation Drone Technologies	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-
23ECO602 - Fundamentals of Electronic Devices and Circuits	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-
23EEO603 - Electric Vehicle Technology	3	3	3	3	3	-	-	-	-	-	2	-	-
23MEO601 - Introduction to Industrial Engineering	3	3	2	-	-	-	-	-	-	-	2	-	-
23MEO605 - CNC Machining Technology	3	3	2	2	3	-	-	-	-	-	1	-	-
23MDO611 - Hospital Management	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-
23RAO609 - Foundation of Robotics	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-
23CSO612 - Cyber Forensics and Ethical Hacking	3	2.6	1.75	2.25	2.6	1.6	2.2	0.8	1.2	1	2	-	-
23PMO608 - Pharamaceutical Nanotechnology	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-
23MAO606 - Graph Theory	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-
GENERAL ELECTIVE													
23NCCL01 - NCC AIRFORCE LEVEL 1	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	–	–
23NCCL03 - NCC ARMY LEVEL – 3	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-
23EEJ601 - Project Work - Phase I	-	-	-	-	-	-	-	-	-	-	-	-	-
Mandatory Course – II													

		23MDC601- Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC602- History of Science and Technology in India	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC603- Political and Economical Thought for a Human Society	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC604- State,Nation Building and Politics in India	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC605- Industrial Safety	-	-	-	-	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

		23HST701 - Human Values and Ethics	2	2.3	-	3	-	3	3	1	1.5	-	1.6	1	1
		Elective-Management													
		23MGT701 - Principles of Management	1.66	1	1	1.5	1.5	1	1	2	3	1	1	-	-
		23MGT702 - Total Quality Management	3	2	2	-	1	-	-	-	-	-	2	2	1
		23MGT703 - Engineering Economics and Financial Accounting	2.0	2.8	1.7	1.0	2.0	1.4	1.0	1.0	1.2	3.0	1.2	-	-
		23MGT704 - Human Resource Management	1	2	1.5	2	1.5	1.2	1.8	2.2	1.6	1.5	2	-	-
		23MGT705 - Knowledge Management	2.0	2.4	1.7	1.3	1.6	1.3	2.0	1.3	1.5	1.7	2.2	-	-
		23MGT706 - Industrial Management	1.7	3.2	1.0	-	2.0	2.0	2.0	2.4	2.4	3.7	2.0	-	-
IV	VII	23MGT707 - Supply Chain Management	1.8	2	1.8	1.5	1.5	1.4	1	1	1.5	2	2.2	1	1
		23MGT708 - e-Waste Management	1.8	2.4	2.4	1.8	1.4	2	1.2	1.3	1.8	2	1.8	-	-
		Open Elective - II / NCC - II L2 / L4													
		23CEO704 - Remote Sensing Concepts	3	-	1	1	2	-	-	-	2	1	1	-	-
		23ECO708 - Energy Technology	2.2	2	1.8	3	3	1	1	1	1	1.6	3	-	-
		23EEO709 - Sensors and Actuators	3	3	3	3	3	-	-	-	-	-	2	-	-
		23MEO703 – Fundamentals of Mechatronics	3	2	2	-	-	-	-	-	-	-	1	-	-
		23MEO704 - Nano Technology	3	1.8	2.6	2.4	1	2	1.8	1	2.4	1.4	-	-	-
		23MEO712 - Smart Manufacturing	2.0	2.6	2.5	2.0	2.6	-	1.5	-	-	-	1.5	-	-
		23RAO707 - Mobile Robots	3	3	2.8	2.6	2.8	1.2	1	1	1.6	-	1.6	-	-

		23CSO711 – Introduction to Cyber Security	3.0	2.6	2.4	2.3	2.5	2.0	2.0	2.5	1.6	2.0	2.0	-	-
		23PMO706 - Intellectual Property Rights for Pharma Industry	2.4	2.2	2.2	1.2	2.2	1.8	1.6	2	1	1	1.7	-	-
		Open Elective - II / NCC - II L2 / L4													
		23NCCL02 - NCC AIRFORCE LEVEL – 2	2.5	2.5	2.2	2.3	2.5	2.8	2.5	2.3	2.5	2.3	2.0	-	-
		23NCCL04 - NCC ARMY LEVEL – 4	2	2	2.5	-	2	2.5	2	3	2.5	2	2	-	-
		Open Elective – III													
		23CEO717- Geographical Information System	3	2	2	-	3	2	-	-	2	2	1		-
		23CSO715- Fundamentals of Blockchain Technology	2.8	2.5	2.3	1.7	2.8	1	1	2	1.3	2	2.2	-	-
		23ECO718 - VLSI Design	3	3	3	2	2	1.6	1	-	1	1	1	-	-
		23EEO716 - Electrical,Electronic and Magnetic Materials	3	3	3	3	3	-	-	-	-	-	2	-	-
		23MEO720 - Marine Vehicles	3	2	2	2	3	-	-	-	-	-	-	-	-
		23MDO719 - Wearable Technology	2.2	2.4	1.8	1.8	2.3	1.5	1.0	-	-	-	1.4	-	-
		23MDO723 - Medical Waste Management	2	2.4	1.8	1.75	1.8	2.8	2	1	1	1.2	1.2	-	-
		23MDO724 / Lifestyle Diseases	2	2.4	1.8	1.5	2	2.2	1.2	1	1	1.2	1.4	-	-
		23RAO721 / Robotics Process Automation	3	2.8	2.4	2.4	2.8	1.2	-	-	1.2	1.2	1.2	-	-
		23MAO714 / Advanced Numerical Methods	3	3	2.4	1.4	2	-	-	-	-	-	2	-	-
		23EEJ701 - Project Work - Phase II	-	-	-	-	-	-	-	-	-	-	-	-	-
MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
IV	VIII	23EEJ801 - Product Development	3	3	3	3	3	3	3	3	3	3	3	3	3
		23EEC801 - Internship	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC503- Film Appreciation	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC504- Disaster Risk Reduction and Management	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC505- Constitution of India	-	-	-	-	-	-	-	-	-	-	-	-	-

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST101	Professional English	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23PHT102	Applied Physics for Computer Engineering	BS	3	0	0	3	40	60	100
23CYT101	Engineering Chemistry	BS	3	0	0	3	40	60	100
23HST102	தமிழர் மரபு /Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
PRACTICALS									
23PHL101	Applied Physics for Computer Engineering Laboratory	BS	0	0	2	1	60	40	100
23CYL101	Engineering Chemistry Laboratory	BS	0	0	2	1	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
	TOTAL CREDITS IN SEMESTER - I		**21**						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE –SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT203	Mathematical Foundations of computing	BS	3	1	0	4	40	60	100
23PHT202	Advanced Physics for Computer Engineering	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23CST201	PC Hardware Services and Networking	PC	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23EEE202	Basic Electrical and Electronics Engineering	ES	3	0	2	4	50	50	100
PRACTICALS									
23CSL201	Reverse Engineering Laboratory	PC	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Indian Language(Except Mother Tongue)/ Foreign Language	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Aptitude Skills	MC	3	0	0	0	-	-	-
	TOTAL CREDITS IN SEMESTER - II		**25**						

HS : Humanities and Social Sciences
BS : Basic Sciences
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OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
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P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT303	Discrete Mathematics	BS	3	1	0	4	40	60	100
23ECT302	Digital Principles and Computer Architecture	ES	3	0	0	3	40	60	100
23ADT302	Programming Using Java	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100
23ADE301	Foundations of Artificial Intelligence	PC	3	0	2	4	50	50	100
23ADE302	Data Structures Design	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER - III			23						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23ADT401	Advanced Networking and Protocol	PC	3	0	0	3	40	60	100
23ITT401	Object Oriented Software Design	PC	3	0	0	3	40	60	100
23CST301	Operating Systems	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ADE401	Data Science and Analytics	PC	3	0	2	4	50	50	100
23ADE402	Machine Learning Essentials	PC	3	0	2	4	50	50	100
23CSE402	Database Management Systems	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC401	Online Certification Courses	EEC	3	0	0	3	100	-	100
TOTAL CREDITS IN SEMESTER - IV			24						

HS : Humanities and Social Sciences
BS : Basic Sciences
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PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23ADT501	UI and UX Design	PC	3	0	0	3	40	60	100
	Professional Elective I	PE	3	0	0	3	40	60	100
	Professional Elective II	PE	3	0	0	3	40	60	100
	Professional Elective III	PE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ADE501	Deep Learning	PC	3	0	2	4	50	50	100
23ADE502	IOT and its Applications	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
	Mandatory Course – I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - V			22						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
GE	:	General Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23ADT601	Business Intelligence	PC	3	0	0	3	40	60	100
	Professional Elective IV	PE	3	0	0	3	40	60	100
	Professional Elective V	PE	3	0	0	3	40	60	100
	Professional Elective VI	PE	3	0	0	3	40	60	100
	Open Elective - I / NCC I L1 / L3	OE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ADE601	Natural Language Processing	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ601	Project Work - Phase I	EEC	0	0	8	4	60	40	100
MANDATORY COURSE									
	Mandatory Course – II	MC	3	0	0	0	-	-	-
	TOTAL CREDITS IN SEMESTER - VI		23						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
GE	:	General Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100
	Elective-Management	GE	3	0	0	3	40	60	100
	Open Elective - II / NCC II L2 / L4	OE	3	0	0	3	40	60	100
	Open Elective – III	OE	3	0	0	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ701	Project Work - Phase II	EEC	0	0	8	4	60	40	100
TOTAL CREDITS IN SEMESTER - VII			16						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
GE	:	General Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VIII			8						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

LIST OF HUMANITIES AND SOCIAL SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HST101	Professional English	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு / Heritage of Tamils	HS	1	0	0	1	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும்தொழில்நுட்பமும் / Tamil and Technology	HS	1	0	0	1	40	60	100
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100

LIST OF BASIC SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23PHE102	Applied Physics for Computer Engineering	BS	3	0	2	4	50	50	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	50	50	100
23MAT203	Mathematical Foundations of Computing	BS	3	1	0	4	40	60	100
23PHT202	Advanced Physics for Computer Engineering	BS	3	0	0	3	40	60	100
23PHT201	Solid State Physics and Nano Electronic Devices	BS	3	0	0	3	40	60	100
23MAT301	Discrete Mathematics	BS	3	1	0	4	40	60	100

LIST OF ENGINEERING SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23EEE202	Basic Electrical And Electronics Engineering	ES	3	0	2	4	50	50	100
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100
23ECT302	Digital Principles and Computer Architecture	ES	3	1	0	4	40	60	100

LIST OF PROFESSIONAL CORE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23CST201	PC Hardware Service and Networking	PC	3	0	2	4	50	50	100
23CSL201	Reverse Engineering Laboratory	PC	0	0	4	2	60	40	100
23ADT302	Programming Using Java	PC	3	0	0	3	40	60	100
23ADE301	Foundation of Artificial Intelligence	PC	3	0	2	4	50	50	100
23ADE302	Data Structures Design	PC	3	0	2	4	50	50	100
23ADT401	Advanced Networking and Protocol	PC	3	0	0	3	40	60	100
23 ITT401	Object Oriented Software Design	PC	3	0	0	3	40	60	100
23CST302	Operating Systems	PC	3	0	0	3	40	60	100
23ADE401	Data Science and Analytics	PC	3	0	2	4	50	50	100
23ADE402	Machine Learning Essentials	PC	3	0	2	4	50	50	100
23CSE402	Database Management Systems	PC	3	0	2	4	50	50	100

23ADT501	UI and UX Design	PC	3	0	0	3	40	60	100
23ADE501	Deep Learning	PC	3	0	2	4	50	50	100
23ADE502	IOT and Its Applications	PC	3	0	2	4	50	50	100
23ADT601	Business Intelligence	PC	3	0	0	3	40	60	100
23ADE601	Natural Language Processing	PC	3	0	2	4	50	50	100

LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23ADP501	Mobile Applications and its Development	PE	3	0	0	3	40	60	100
23ADP502	Knowledge Engineering	PE	3	0	0	3	40	60	100
23CSP503	Recommender Systems	PE	3	0	0	3	40	60	100
23CSP504	Text and Speech Analysis	PE	3	0	0	3	40	60	100
23ITP501	Image and Video Analytics	PE	3	0	0	3	40	60	100
23CSP608	Soft Computing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23ADP503	Cloud Technologies	PE	3	0	0	3	40	60	100
23ADP504	App Development	PE	3	0	0	3	40	60	100
23CSP511	Web Application Security	PE	3	0	0	3	40	60	100
23CSP508	Cloud Services Management	PE	3	0	0	3	40	60	100
23CSP510	Software Testing and Automation	PE	3	0	0	3	40	60	100
23CSP506	Big Data Analytics	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23CSP516	Security and Privacy in Cloud	PE	3	0	0	3	40	60	100
23CSP502	Exploratory Data Analysis	PE	3	0	0	3	40	60	100
23ADP508	Data Warehousing	PE	3	0	0	3	40	60	100
23ITP505	Storage Technologies	PE	3	0	0	3	40	60	100
23CSP514	Software Defined Networks	PE	3	0	0	3	40	60	100
23CSP515	Stream Processing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23ADP601	Network Security	PE	3	0	0	3	40	60	100
23CSP601	Hacking Techniques	PE	3	0	0	3	40	60	100
23ITP601	Digital Forensics	PE	3	0	0	3	40	60	100
23CSP602	Social Network Security	PE	3	0	0	3	40	60	100
23CSP603	Engineering Secure Software Systems	PE	3	0	0	3	40	60	100
23ITP504	Human Computer Interaction	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE -V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23CSP604	Augmented Reality / Virtual Reality	PE	3	0	0	3	40	60	100
23ITP603	Game Development	PE	3	0	0	3	40	60	100
23ADP602	Neural Networks and Deep Learning	PE	3	0	0	3	40	60	100
23ADP603	Agile Methodology	PE	3	0	0	3	40	60	100

23CCP602	Cyber Physical System Security	PE	3	0	0	3	40	60	100
23CSP609	Cognitive Science	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - VI

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23ADP604	Ethics of Artificial Intelligence	PE	3	0	0	3	40	60	100
23CSP607	Quantum Computing	PE	3	0	0	3	40	60	100
23CCP603	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	40	60	100
23CSP610	Optimization Techniques	PE	3	0	0	3	40	60	100
23ITP604	Information Assurance and Security	PE	3	0	0	3	40	60	100
23CST401	Distributed Computing	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVE - I

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO607 / Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
CSE	23CSO610 / Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
ECE	23ECO602 / Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
EEE	23EEO603 / Electric Vehicle Technology	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO601 / Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
	23MEO605 / CNC MACHINING TECHNOLOGY	OE	3	0	0	3	40	60	100

MEDICAL ELECTRONICS	23MDO611 / Hospital Management	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO609 / Fundamentals of Robotics	OE	3	0	0	3	40	60	100
CSE (Cyber Security)	23CSO612 / Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO608 / Pharamaceutical Nanotechnology	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO606 / Graph Theory	OE	3	0	0	3	40	60	100

OPEN ELECTIVE- II

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO704 / Remote Sensing Concepts	OE	3	0	0	3	40	60	100
ECE	23ECO708 / Energy Technology	OE	3	0	0	3	40	60	100
EEE	23EEO709 / Sensors, Actuators and its Application	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO703 / Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
	23MEO704 / Nano Technology	OE	3	0	0	3	40	60	100
	23MEO712 / Smart Manufacturing	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO705 / Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO707 / Mobile Robots	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO711 / Introduction to Cyber Security	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO706 / Intellectual Property Rights for Pharma Industry	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO710 / Operations Research	OE	3	0	0	3	40	60	100

OPEN ELECTIVE – III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO717 / Geographical Information System	OE	3	0	0	3	40	60	100
CSE	23CSO715 / Fundamentals of Blockchain Technology	OE	3	0	0	3	40	60	100
ECE	23ECO718 / VLSI Design	OE	3	0	0	3	40	60	100
EEE	23EEO716 / Electrical,Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO720 / Marine Vehicles	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO719 / Wearable Technology 23MDO723 / Medical Waste Management 23MDO724 / Lifestyle Diseases	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO721 / Robotics Process Automation	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO714 / Advanced Numerical Methods	OE	3	0	0	3	40	60	100
MANAGEMENT	23MGO722 / Cost management of Engineering Projects	OE	3	0	0	3	40	60	100

GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23NCCL01	NCC AIRFORCE LEVEL 1	GE	3	0	0	3	40	60	100
23NCCL02	NCC AIRFORCE LEVEL – 2	GE	3	0	0	3	40	60	100
23NCCL03	NCC ARMY LEVEL – 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY LEVEL – 4	GE	3	0	0	3	40	60	100

ELECTIVE - MANAGEMENT

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MGT701	Principles of Management	GE	3	0	0	3	40	60	100
23MGT702	Total Quality Management	GE	3	0	0	3	40	60	100
23MGT703	Engineering Economics and Financial Accounting	GE	3	0	0	3	40	60	100
23MGT704	Human Resource Management	GE	3	0	0	3	40	60	100
23MGT705	Knowledge Management	GE	3	0	0	3	40	60	100
23MGT706	Industrial Management	GE	3	0	0	3	40	60	100
23MGT707	Supply Chain Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100

LIST OF EMPLOYABILITY ENHANCEMENT COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2	100	-	100
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
23EEC401	Online Certification Courses	EEC	3	0	0	3	100	-	100
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
23EEJ601	Project Work - Phase I	EEC	0	0	8	4	60	40	100
23EEJ701	Project Work - Phase II	EEC	0	0	8	4	60	40	100
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100

LIST OF MANDATORY COURSES

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC501	Introduction to Women and Gender Studies	MC	3	0	0	0	-	-	-
23MDC502	Elements of Literature	MC	3	0	0	0	-	-	-
23MDC503	Film Appreciation	MC	3	0	0	0	-	-	-
23MDC504	Disaster Risk Reduction and Management	MC	3	0	0	0	-	-	-
23MDC505	Constitution of India	MC	3	0	0	0	-	-	-

MANDATORY COURSES - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC601	Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	0	-	-	-
23MDC602	History of Science and Technology in India	MC	3	0	0	0	-	-	-
23MDC603	Political and Economical Thought for a Human Society	MC	3	0	0	0	-	-	-
23MDC604	State, Nation Building and Politics in India	MC	3	0	0	0	-	-	-
23MDC605	Industrial Safety	MC	3	0	0	0	-	-	-

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

CREDIT SUMMARY

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	4	-	-	-	-	3	-	11
BS	12	7	8	-	-	-	-	-	27
ES	4	10	-	-	-	-	-	-	14
GE	-	-	-	-	-	-	3	-	3
PC	-	4	14	21	11	7	-	-	59
PE	-	-	-	-	9	9	-	-	18
OE	-	-	-	-	-	3	6	-	9
EEC	1	2	1	3	2	4	4	8	25
MC	-	-	-	-	-	-	-	-	-
Total	21	27	23	24	22	23	16	8	164

Chairman - BoS

SEMESTER I

23HST101	PROFESSIONAL ENGLISH	L T P C
	(Common to all B.E. & B.Tech. Branches)	3 0 0 3

OBJECTIVES

- To build vocabulary proficiency and familiarity with varied lexical and contextual usages.
- To strengthen grammatical accuracy for effective sentence construction and language application.
- To develop clarity and coherence in written communication across academic and business contexts.
- To enhance oral fluency, confidence, and interactive communication skills.
- To promote efficient reading strategies for comprehension, analysis, and note-making.

UNIT I VOCABULARY 8

Synonyms and Antonyms - Word Formation - Sentence Types (declarative, imperative, interrogative & exclamatory) - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones - Collocation - British and American Vocabulary.

UNIT II GRAMMAR 10

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition - Direct and Indirect Speech - Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

UNIT III WRITING 9

Letter Writing - Business communications - quotations, placing orders, complaints, replies to queries from business customers - Dialogue Writing – Paragraph Writing (descriptive, narrative, expository & persuasive) - Essay Writing - Writing Instructions.

UNIT IV SPEAKING 9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Tongue twisters.

UNIT V READING SKILLS 9

Reading Comprehension – Reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short Comprehension Passages, practice skimming - Scanning and Predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

TOTAL: 45 PERIODS

OUTCOMES

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

- Use a wide range of vocabulary effectively in oral and written communication.
- Frame grammatically and meaningful sentences.
- Write formal and informal letters, develop coherent paragraphs and essays, and engage in meaningful dialogues.
- Apply speaking skills for self-introduction, speeches, and technical presentations.
- Read, comprehend, and take organized notes from passages and technical conte.

TEXT BOOKS

1. "Using English A Course book for Under graduate Engineers and Technologists", : Orient Black Swan Limited, Hyderabad, Board of Editors: 2015.
2. Richards, C. Jack ,"Interchange Students' Book-2",2015.

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", First Edition, Orient Black Swan,2012.
2. Krishna Mohan, Meera Banerji, "Developing Communication Skills", Paperback, MacMillan, 2019.

E-RESOURCES

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	-	-	-	1	-	-	2	3	-	2	-	-
3	-	1	2	-	1	-	-	2	3	1	2	-	-
4	-	-	1	-	-	-	-	2	3	2	2	-	-
5	1	1	-	2	1	-	-	1	3	-	2	-	-
AVG	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MAT101	MATRICES AND CALCULUS	L	T	P	C
	(Common to all B.E./ B.Tech. Branches)	3	1	0	4

OBJECTIVES

- To develop the use of matrix algebra and its properties.
- To explore the techniques of differential and integral calculus.
- To categorize methods for functions of several variables.
- To introduce the use of multiple integrals and their applications.
- To provide knowledge of vector calculus.

UNIT I MATRICES 9+3

Eigen values and Eigen vectors – Properties of Eigen values – Cayley-Hamilton theorem – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic form.

UNIT II DIFFERENTIAL AND INTEGRAL CALCULUS 9+3

Differentiation rules: Derivatives of polynomials and exponential functions – The product and quotient Rules – Derivatives of trigonometric functions – The Chain rule – Implicit differentiation – Applications of differentiation: Maximum and Minimum Values – Techniques of integration: Integration by parts – Trigonometric integrals – Integration of rational functions by partial fractions.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial derivatives – Homogeneous functions – Euler's theorem – Total derivative – Jacobians –Taylor's theorem for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS 9+3

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

UNIT V VECTOR CALCULUS 9+3

Scalar and vector point functions – Gradient – Divergence and curl – Line integral – Surface integral – Green's theorem in a plane – Volume integral – Divergence theorem – Irrotational and Solenoidal fields.

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply matrix algebra methods to solve practical problems.
- Apply the concepts of differential and integral calculus.
- Analyze the ideas of differential calculus for functions of several variables.
- Apply multiple integral ideas in solving areas and volumes.

- Solve the engineering problems using the concepts of vector calculus.

LIST OF EXPERIMENTS

1. Computation of Eigen values and Eigenvectors.
2. Matrix addition and multiplications.
3. Calculate differentiations of simple functions.
4. Calculate integrations of simple functions.
5. Determining Maxima and minima of functions for one variable.
6. Determining Maxima and minima of functions for two variables.
7. Evaluating double integral with constant limits.
8. Evaluating triple integral with constant limits.
9. Computing Gradient, divergence and curl of point functions.
10. Evaluating line integral in vector calculus.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Fourty Third Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, Seventh Edition, New Delhi, 2015.

REFERENCES

1. Bali N.P, Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, Seventh Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, New Delhi, Second Edition, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/111105121 (Differential Calculus and Integral Calculus)
2. https://nptel.ac.in/courses/111107112 (matrix analysis)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23PHT102 APPLIED PHYSICS FOR COMPUTER ENGINEERING L T P C

(Common to CSE, CSE-SC, IT, AI&DS and AI&ML) 3 0 0 3

OBJECTIVES

- To introduce the fundamental principles of lasers and their general scientific and engineering applications.
- To explain the fundamentals of quantum mechanics and Schrödinger's wave equation for understanding complex physical phenomena.
- To impart knowledge of the basic concepts of integrated circuits (ICs) and digital electronic components.
- To provide an understanding of the principles and operation of magnetic and optical storage devices.
- To familiarize students with the fundamentals of nanomaterials and their various synthesis methods.

UNIT I PHOTONICS 9

Spontaneous and Stimulated Emission- Population Inversion - Derivation of Einstein's A and B coefficients – Principle and working of He Ne Laser - Direct bandgap and Indirect Bandgap Semiconductors - Semiconductor Diode Laser (Homojunction & heterojunction) - Applications of Lasers in Science, Engineering and Medicine – Working principle of Laser printer.

UNIT II QUANTUM PHYSICS 9

Black Body Radiation – Planck's theory (derivation) – Electron Diffraction – Wave function and its Physical significance – Schrödinger's wave equations: Time Independent and Time Dependent Equation - Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunneling & Scanning Tunneling Electron Microscope.

UNIT III FUNDAMENTALS OF DIGITAL ELECTRONICS AND LOGIC DESIGN 9

INTEGRATED ELECTRONICS: Introduction of ICs - Steps in Fabrication of Monolithic IC's – General applications of IC's.

DIGITAL ELECTRONICS AND LOGIC DESIGN : Number System and Representation - Programs - Boolean Algebra and Logic Gates – Demorgan's Theorem - Combinational Logic Circuits - Flip-Flops and Sequential Circuits.

UNIT IV DATA STORAGE MATERIALS 9

PRIMARY STORAGE: Random Access Memory (RAM)– Static RAM – Dynamic RAM – Read only Memory (ROM) - **SECONDARY STORAGE** : Magnetic Disc Memories –Hard Disk Drive and Solid State Drive - **TERTIARY STORAGE** : Optical Data Storage Devices: Principle-Disc data storage- Structure and

Operating Principle of DVD & Blu-ray Disc - **OFF-LINE STORAGE** : USB Flash drive – Memory card – **FUTURE STORAGE DEVICES (Concept only)** : Holographic data storage - DNA digital data storage - Helium Drives.

UNIT V INTRODUCTION TO NANO SCIENCE & NANOELECTRONICS 9

NANO SCIENCE: Emergence of Nanoscience - Role of Particle Size - quantum structures: Quantum Well, Quantum Wire And Quantum Dot- Properties at Nano scale (optical, electronic and magnetic) - Synthesis of Nanomaterials: Physical Vapour Deposition (PVD) - Pulsed Laser Deposition (PLD).

NANO-ELECTRONICS: Single electron transistors, Spintronics - Nanotechnology in Computer Science.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, students will be able to :

- Explain the fundamental principles of lasers and their applications.
- Analyze the principles of quantum mechanics and Schrödinger's wave equation to identify complex physical phenomena.
- Apply the concept of digital electronics to design various logic gates.
- Analyze the working principles of different storage media and storage devices.
- Analyze the properties of nanomaterial's and various synthesis methods.

TEXT BOOKS

1. K.G.Aswani, "A Text book of Material Science", S. Chand & Company Ltd, (2001).
2. M.Arumugam, "Semiconductor Physics and Optoelectronics", Anuradha Agencies, 2019.
3. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2019

REFERENCES

1. Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2016
2. Hanson G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2019
3. C.N.R. Rao, P.J. Thomas and G.U. Kulkarni, "Nanocrystals: Synthesis, Properties and Applications", Springer (2017)

E-RESOURSES

1. https://archive.nptel.ac.in/courses/122/107/122107035/
2. https://nptel.ac.in/courses/118102003

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CYT101 **ENGINEERING CHEMISTRY** L T P C

(Common to CSE, EEE, ECE, CSE (CS), MDE, AIDS, IT, PT& CSE(AIML)) 3 0 0 3

OBJECTIVES

- To introduce the characteristics of water and water treatment methods for industrial applications.
- To familiarize students with the types, properties, and applications of polymers and related materials.
- To employ the principles of phase rule, alloy formation, and heat treatment methods.
- To discuss the synthesis, characterization, and applications of nanomaterials.
- To apply electrochemical principles to understand corrosion mechanisms and corrosion control methods.

UNIT I WATER TECHNOLOGY 9

Introduction - Characteristics – Hardness – Estimation of hardness by EDTA method – Alkalinity and its estimation - Boiler feed water -- Requirements –Boiler troubles (Scale and Sludge) – Internal conditioning (phosphate, calgon and carbonate conditioning methods) – External conditioning – Zeolite process, Demineralization process – Desalination of brackish water by reverse osmosis.

UNIT II POLYMER CHEMISTRY 9

Introduction - Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting plastic. Functionality – Degree of polymerization. Types of polymerization: Addition Condensation and Copolymerization, Property of polymer: Glass transition temperature,Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers – Types – Vulcanization of rubber – Plastics – Moulding constituents of plastics – Moulding of plastics – Compression and injection - Biodegradable polymers- Conducting polymers.

UNIT III PHASE RULE AND ALLOYS 9

Phase rule - Explanation of terms involved – One component system – Water system – Condensed phase rule- Simple eutectic systems (Lead – Silver system only). Alloys: Introduction – Definition- Properties of alloys- Significance of alloying, functions and effect of alloying elements - Ferrous alloys – Nichrome and stainless steel – Heat treatment of steel, non-ferrous alloy – Brass.

UNIT IV CHEMISTRY OF NANO MATERIALS 9

Nano chemistry – Basics (Surface area to volume ratio - Distinction between molecules, nanoparticles and bulk materials- Characterization of nanomaterials using EDX and HR-TEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition - Applications of nanomaterials (Nano products of today).

UNIT V ELECTROCHEMISTRY, CORROSION AND ITS CONTROL 9

Introduction- Electrochemical cells, applications of electrochemical series-Reference Electrode-standard calomel electrode, ion selective electrode, glass electrode, Corrosion – Types – Chemical Corrosion – Electrochemical Corrosion (galvanic and differential aeration) - Factors influencing corrosion – Material selection and design aspects-Control methods of corrosion –sacrificial anodic and impressed current cathodic protection.

OUTCOMES

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

- Explain the quality parameters of water and identify appropriate methods for removing impurities for both domestic and industrial applications.
- Describe various types of polymers, their polymerization processes, and discuss their special properties and engineering applications.
- Apply the phase rule to understand alloy formation and its relevance in engineering applications.
- Discuss the fundamentals of nanomaterials and apply the core concepts of nanochemistry to engineering problems.
- Analyze the causes of corrosion and propose effective prevention and control strategies.

TOTAL:45 PERIODS

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", SeventeenthEdition, DhanpetRai Publishing Company (P) Ltd. New Delhi, 2015.
2. Viswanathan B, "Nanomaterials" First Edition, Alpha Science International Ltd, 2009.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", Tenth Edition, S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/104105084
2. http://library.iitbbs.ac.in/open-access-e-resources.php

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	1	3	-	1	-	3	-	-	-	-	-	-
2	1	2	2	2	1	1	-	2	1	2	1	-	-
3	3	3	3	2	2	2	1	1	2	1	1	-	-
4	2	2	2	1	2	2	1	-	1	1	1	-	-
5	3	2	3	2	3	2	1	2	1	-	2	-	-
AVG	2.20	2.00	2.60	1.40	1.80	1.40	1.20	1.00	1.00	0.80	1.00	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23HST102	HERITAGE OF TAMILS	L T P C
	(Common to All Branches)	1 0 0 1

OBJECTIVES

- To familiarize the students on extensive literature of classical Tamil.
- To analyze rock art paintings to modern art.
- To acquire knowledge on folk and martial arts.
- To apply the concepts of Thinai in Tamils.
- To realize the contribution of Tamils in Indian freedom struggle.

UNIT I LANGUAGE AND LITERATURE 3

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.

UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART–SCULPTURE 3

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.

UNIT III FOLK AND MARTIAL ARTS 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

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.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India– Self-Respect Movement- Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

OUTCOMES

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

- Analyze the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Examine Thinai concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).

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 the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23HST102	தமிழர்மரபு	L T P C 1 0 0 1

(அனைத்துதுறைகளுக்கும்பொதுவானது)

நோக்கங்கள்:

மாணவர்கள்கண்டிப்பாகஅறியவேண்டுவன:

- செம்மொழியானதமிழ்மொழியின்விரிவானஇலக்கியத்தைப்பற்றிஅறிதல்.
- பாறைஓவியங்கள்முதல்நவீனஓவியங்கள்வரைஉள்ளகலைகளைபகுப்பாய்வுசெய்தல்.
- நாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகளைப்புரிந்துகொள்ளுதல்.
- தமிழர்களின்திணைக்கோட்பாடுகளைச்செயல்படுத்துதல்.
- இந்தியவிடுதலைப்போராட்டத்திற்கும்பண்பாட்டிற்கும்தமிழர்களின்பங்களிப்பைஉணருதல்.

அலகு 1மொழிமற்றும்இலக்கியம் 3

இந்தியமொழிக்குடும்பங்கள் - திராவிடமொழிகள் - தமிழ்ஒருசெம்மொழி - தமிழ்செவ்விலக்கியங்கள் -சங்கஇலக்கியத்தின்சமயச்சார்பற்றதன்மை - சங்கஇலக்கியத்தில்பகிர்தல்அறம்-திருக்குறளில்மேலாண்மைக்கருத்துக்கள்- தமிழக்க்காப்பியங்கள், தமிழகத்தில்சமணபௌத்தசமயங்களின்தாக்கம்- பக்திஇலக்கியம், ஆழ்வார்கள்மற்றும்நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில்நவீனஇலக்கியத்தின்வளர்ச்சி -
தமிழ்இலக்கியவளர்ச்சியில்பாரதியார்மற்றும்பாரதிதாசன்ஆகியோரின்பங்களிப்பு.

அலகு IIமரபு - பாறைஓவியங்கள்முதல்நவீனஓவியங்கள்வரை - சிற்பக்கலை 3

நடுகல்முதல்நவீனசிற்பங்கள்வரை - ஐம்பொன்சிலைகள் - பழங்குடியினர்மற்றும்அவர்கள்தயாரிக்கும்கைவினைப்பொருட்கள்,

பொம்மைகள் - தேர்செய்யும்கலை - சுடுமண்சிற்பங்கள் - நாட்டுப்புறத்தெய்வங்கள் -குமரிமுனையில்திருவள்ளுவர்சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின்சமூகபொருளாதாரவாழ்வில்கோவில்களின்பங்கு.

அலகு IIIநாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள்.

அலகு IVதமிழர்களின்திணைக்கோட்பாடுகள் 3

தமிழகத்தின்தாவரங்களும், விலங்குகளும் - தொல்காப்பியம்மற்றும்சங்கஇலக்கியத்தில்அகம்மற்றும்புறக்கோட்பாடுகள் - தமிழர்கள்போற்றியஅறக்கோட்பபாடு - சங்ககாலத்தில்தமிழகத்தில்எழுத்தறிவும், கல்வியும் - சங்ககாலநகரங்களும்துறைமுகங்களும் - சங்ககாலத்தில்ஏற்றுமதிமற்றும்இறக்குமதி - கடல்கடந்தநாடுகளில்சோழர்களின்வெற்றி.

அலகு V

இந்தியதேசியஇயக்கம்மற்றும்இந்தியபண்பாட்டிற்குத்தமிழர்களின்பங்களிப்பு 3

இந்தியவிடுதலைப்போரில்தமிழர்களின்பங்கு - இந்தியாவின்பிறப்பகுதிகளில்தமிழ்ப்பண்பாட்டின்தாக்கம் - சுயமரியாதைஇயக்கம் - இந்தியமருத்துவத்தில்சித்தமருத்துவத்தின்பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப்புத்தகங்களின்அச்சுவரலாறு.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின்முடிவில், மாணவர்கள்அறிந்துகொள்வன:

- தமிழ்மொழியின்செம்மொழிதன்மையையும்சங்கஇலக்கியத்தின்முக்கியத்துவத்தையும்உணர்வார்கள்.
- தமிழர்களின்சிற்ப, ஓவிய, இசைமரபுகளைபுரிந்துகொள்வார்கள்.
- நாட்டுப்புறக்கலைகளையும்வீரவிளையாட்டுகளையும்வகைப்படுத்துவார்கள்.
- தமிழர்களின்திணைக்கோட்பாடுகளும்சங்ககாலவர்த்தகமும்புரிந்துகொள்வார்கள்.
- இந்தியவிடுதலைப்போராட்டம், சுயமரியாதைஇயக்கம், சித்தமருத்துவம்ஆகியவற்றில்தமிழர்களின்பங்களிப்பைவிளக்குவார்கள்.

உரைமற்றும்குறிப்புபுத்தகங்கள்:

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு:தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).

2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)

4. பொருநை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).

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 the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23GEE101 **PROGRAMMING IN C** L T P C

(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To impart fundamental knowledge of C programming concepts, syntax, data types, operators, control structures, and program development.
- To develop students' understanding of arrays, strings, searching, and sorting techniques for solving computational problems.
- To train students in designing modular programs using functions, recursion, pointers, and parameter passing mechanisms.
- To familiarize students with structures, unions, dynamic memory allocation, and their applications in software development.
- To enable students to perform file handling operations and develop efficient C programs using sequential and random file processing.
- To develop C programs to solve real-world programming problems.

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Structure of C program – C programming: Data Types– variables–Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions –Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process.

Coding practices :

1. Develop a program to find the largest of three numbers using nested if statements.
2. Develop a program to generate multiplication tables using loops.

Problem - solving assignments :

1. Write a program to calculate the area and perimeter of a rectangle, circle, and triangle.
2. Write a program to calculate simple interest and compound interest.

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode – Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) – String operations: length, compare, concatenate, copy –Sorting – Selection sort, Insertion sort, Merge sort, quick sort –Searching – linear and binary search.

Coding practices :

1. Develop a program to perform matrix addition and transpose using two-dimensional arrays.
2. Write a program to sort an array using Insertion Sort.

Problem - solving assignments :

1. Develop a program to perform matrix operations such as addition and transpose using two-dimensional arrays.
2. Write a program to search for an element in an array using Linear Search and Binary Search.

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function call, Built–in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions – Pointers – Pointer operators – Arrays and pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

Coding practices :

1. Develop a recursive program to generate the Fibonacci series.
2. Develop a program to implement a scientific calculator using built-in mathematical functions.

Problem - solving assignments :

1. Write a program to perform arithmetic operations using user-defined functions.
2. Write a program to swap two numbers using pass-by-value and pass-by-reference.

UNIT IV STRUCTURES AND UNION 9

Structure – Example Programs – Nested structures – Pointer in Structures – Array of structures Example Program using structures and pointers – Self referential structures – Dynamic memory allocation, Union- Storage classes.

Coding practices :

1. Develop a program to generate an employee salary slip using structures and pointers.
2. Develop a program using nested structures to represent student academic details.

Problem - solving assignments :

1. Write a program to store and display employee details using an array of structures.
2. Develop a program to demonstrate dynamic memory allocation using structures.

UNIT V FILE PROCESSING 9

Files – Operations of File – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

Coding practices:

1. Write a program to create, write, and read a text file.
2. Develop a program to copy the contents of one file to another.

Problem - solving assignments :

1.Write a program to create, write, and read student records using sequential file processing.

2.Write a program to implement command-line arguments for performing arithmetic operations

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision–making constructs.
2. Write a program to find whether the given year is leap year or Not.
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4. Check whether a given number is Armstrong number or not?
5. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
   a) 5 if it is a perfect cube.
   b) 4 if it is a multiple of 4 and divisible by 6.
   c) 3 if it is a prime number.
6. Populate an array with height of persons and find how many persons are above the average height.
7. From a given paragraph perform the following using built–in functions:(i)Find the total number of words.(ii)Capitalize the first word of each sentence.(iii)Replace a given word with another word.
8. Solve towers of Hanoi using recursion.
9. Locate and Display the Contents of an Array using Pointers.
10. Generate salary slip of employees using structures and pointers.
11. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of C programming and develop programs using data types, operators, expressions, and control structures.
- Develop C programs using arrays, strings, searching, and sorting techniques to solve computational problems.
- Construct modular C programs by applying functions, recursion, pointers, and parameter passing

techniques.

- Develop applications using structures, unions, pointers, and dynamic memory allocation for efficient data organization and manipulation.
- Analyze file processing techniques using sequential and random access methods to perform data storage and retrieval operations.
- Develop reliable software solutions using C programming for real-world applications.

TEXT BOOKS

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, Eighth Edition, 2019.
2. Kernighan, B.W and Ritchie,D.M,"The C Programming language", Second Edition, Pearson Education, 2016.

REFERENCES

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt.Ltd., 2011.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105085/ (Introduction to C Programming)
2. https://nptel.ac.in/courses/106/106/106106210/ (File Operations)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	–	3	–	–	–	–	–	2	2	2
2	3	3	2	1	3	–	–	–	–	–	2	2	3
3	3	3	3	2	3	–	–	–	–	–	2	2	3
4	3	3	3	2	3	–	–	–	1	–	2	2	3
5	2	3	2	2	3	–	–	–	1	–	2	2	3
6	3	3	3	2	3	–	1	1	2	1	2	2	3
AVG	2.8	2.8	2.5	1.8	3.0	–	1.0	1.0	1.3	1.0	2	2	1.6

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23PHL101 APPLIED PHYSICS FOR COMPUTER ENGINEERING LABORATORY L T P C

(Common to CSE, CSE-SC, IT AI&DS and AI&ML) 0 0 2 1

OBJECTIVES

- To understand and apply the fundamental principles of lasers, quantum mechanics, nanomaterials, digital circuits, and storage devices

LIST OF EXPERIMENTS

(Any Eight experiments to be conducted)

1. Determination of wavelength of laser.
2. Determination of particle Size lycopodium powder using laser.
3. Fibre Optics: Determination of Numerical Aperture and Acceptance angle.
4. Determination of velocity of ultrasonic in liquid.
5. Verification of truth tables of logic gates using IC's: (OR, AND, NOT, XOR, NOR and NAND)
6. Verification of Universal NOR & NAND gates.
7. Determination of Young's modulus - Uniform bending.
8. Determination of bandgap of a given semiconductor diode.
9. Determination of Kinetic Energy - Photoelectric Effect.(Virtual).
10. Determination of frequency of an electrically driven tuning fork- Melde's string method (Virtual)

TOTAL: 15 PERIODS

OUTCOMES

Upon completion of this course, students will be able to;

- Demonstrate an understanding of the principles of lasers, quantum mechanics, nanomaterials, digital circuits, and storage devices.

TEXT BOOK

- Indu Prakash and Ramakrishna, "A Text Book of Practical Physics", Sultan Chand & Sons, (2006).

REFERENCE

- R.K. Shukla and Anchal Srivastava, "Practical Physics", New Age International Publishers, (2011).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	1	1	-	-	-	-	-	-	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CYL101 **ENGINEERING CHEMISTRY LABORATORY** L T P C

(Common to CSE, CSE (CS), AI&DS, AI&ML and IT) 0 0 2 1

OBJECTIVE

- To inculcate practical skills in the determination of water quality parameters and instrumental analysis.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Conductometric Precipitation Titration using $BaCl_2$ and Na_2SO_4.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of Ferrous ions by Potentiometric Titration.
10. Estimation of copper content in the brass by Iodometry.

OUTCOME

Upon completion of the course, Students will be able to

- Determine the water quality parameters and perform quantitative chemical analysis bypH metery, flame photometry, conductometry and potentiometry.

TOTAL: 15 PERIODS

TEXT BOOKS

1. J. Mendham, R. C. Denney, J. D. Barnes, and M. J. K. Thomas, *Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed. Pearson Education, 2015.

REFERENCES

1. B. K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, 2005.

23EEC101	SOFTSKILLS & LIFE SKILLS	L T P C 1 0 0 1

(Common to all First year / First Semester B.E., B.Tech., Branches)

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES 3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS 3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS 3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS 3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS 3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

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

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.

23EEC101 **SOFTSKILLS & LIFE SKILLS** L T P C 1 0 0 1

(Common to all First year / First Semester B.E., B.Tech., Branches)

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES 3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS 3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS 3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS 3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS 3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

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

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.

TEXT BOOKS

1. Life Skills for Engineers. McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan. Hyderabad. 2015
3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana: (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

E-RESOURSES

1. **https://uhv.org.in/**
2. **https://nptel.ac.in**

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	0	0	0	2	2	3	2	1	0	-	-
2	1	3	1	1	0	1	0	2	3	3	1	-	-
3	0	1	0	0	0	1	0	3	3	3	1	-	-
4	2	2	1	1	3	1	0	2	3	3	3	-	-
5	1	1	1	0	0	2	0	3	3	3	3	-	-
AVG	1.25	1.60	1.0	1.0	3.0	1.4	2.0	2.6	2.8	2.6	2.0	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MDC101 **INDUCTION PROGRAMME (2 Weeks)**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Physical Activity

This would involve a daily routine of physical activity with games and sports etc.

Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE

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SEMESTER II

23MAT203	MATHEMATICAL FOUNDATIONS OF COMPUTING	L	T	P	C
	[Common to CSE, CSE (CS), CSE (AI&ML), IT, and AI&DS]	3	1	0	4

OBJECTIVES

- To explore techniques for solving ordinary differential equations and recurrence relations.
- To compose the purpose of using Laplace transforms to create a new domain in which problems can be handled more easily
- To develop the concepts of solving algebraic, transcendental and system of linear equations.
- To introduce the numerical techniques of interpolation and integration.
- To provide the knowledge of congruences and classical theorems in number theory.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS AND RECURRENCE RELATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Legendre's linear equations – Simultaneous linear equations with constant coefficients – Recurrence relations: Solving linear homogeneous recurrence relations with constant coefficients.

UNIT II LAPLACE TRANSFORMS 9+3

Definition – Conditions for existence – Transforms of elementary functions – Properties of Laplace transforms – Transform of Periodic functions – Transforms of derivatives and integrals – Multiplication by 't^n' and division by 't' – Evaluation of integrals by Laplace transforms – Inverse transforms – Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations by Newton Raphson method – Solution of simultaneous algebraic equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods – Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9+3

Interpolation with equal intervals: Newton's forward interpolation formula – Newton's backward interpolation formula – Interpolation with unequal intervals: Lagrange's interpolation formula – Divided differences – Newton's divided difference formula – Numerical integration: Trapezoidal rule – Simpson's one-third rule – Numerical double integration by Trapezoidal rule.

UNIT V CONGRUENCES AND CLASSICAL THEOREMS 9+3

Congruences – Linear Congruences – The Chinese Remainder Theorem – 2 x 2 Linear Systems – Wilson's Theorem – Fermat's Little Theorem – Euler's Theorem.

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply appropriate techniques to solve ordinary differential equations and recurrence relations.
- Solve engineering problems using the concept of Laplace transforms.
- Compute the numerical solution of algebraic, transcendental and system of linear equations.
- Apply the numerical techniques of interpolation and integration.
- Analyze the concepts of congruences and classical theorems in number theory.

LIST OF EXPERIMENTS

1. Solving ordinary differential equations.
2. Compute homogeneous recurrence relations.
3. Calculate Laplace Transform of simple functions.
4. Calculate Inverse Laplace transform of a given function.
5. Solution of simultaneous algebraic equations by Gauss Seidel method.
6. Find the Eigen values of a matrix by Power method.
7. Illustrate Lagrange's interpolation formula.
8. Evaluation of line integral by Simpson's one-third rule.
9. Determine congruence relations.
10. Solving problems in Chinese Remainder Theorem.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal B.S.,"Higher Engineering Mathematics", Khanna Publishers, Fourty fourth Edition, 2022.
2. Grewal,B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Eleventh Edition, 2023.

REFERENCES

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Tenth Edition, 2016.
2. Thomas Koshy, "Elementary Number Theory with Applications", Elsevier Publishers, Second Edition, 2007.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/111/102/111102129/ (Transforms)

2. https://nptel.ac.in/courses/111/107/111107105/ (Numerical Methods)

3. http://nitttrc.edu.in/nptel/courses/video/106108227/L58.html (Congruences)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23PHT202 **ADVANCED PHYSICS FOR COMPUTER ENGINEERING** L T P C

(Common to CSE, CSE(SC), CSE (AI&ML), IT and AI&DS) 3 0 0 3

OBJECTIVES

- To provide knowledge on semiconductor physics and technologies used in Computer Engineering.
- To explain the working principles of magnetic devices and sensors applied in computer systems.
- To impart understanding of optical phenomena in display device fabrication and nanoelectronic devices.
- To teach the fundamentals of fiber optics and data transmission systems.
- To introduce emerging technologies in Computer Engineering.

UNIT I SEMICONDUCTORS & TECHNOLOGIES 9

Elemental and Compound Semiconductors – Intrinsic Semiconductor & Extrinsic Semiconductor – Intrinsic Carrier Concentration Derivation– Semiconductor Devices for Computer (Diodes and Transistors) - MOSFET- basic operation and fabrication - Latest developments in semiconductor technology – system on chip.

UNIT II MAGNETIC DEVICES & SENSORS 9

Ferromagnetism and their Properties - Domain Theory of Ferromagnetim – Hard and Soft magnetic Materials - Magnetic Storage Devices - Modern Hard Disk Drive technologies. SENSORS – Classification of Sensors – Types of Sensors - Sensors in Internet of Things (IOT) – Image sensors (CCD & CMOS)

UNIT III DISPLAY DEVICES & NANOELECTRONIC DEVICES 9

Introduction - Electroluminescence Process - Liquid Crystal Display - TFT-LCD – LED Display Touch screen Display - Organic LED display – Micro LED display - Quantum Dots Display.

Nanoelectronic Devices: Nanoscale MOSFETs - Nano and Micro Opto -Electro-Mechanical Systems (NOEMS/MOEMS).

UNIT IV FIBER OPTICS & DATA TRANSMISSION SYSTEMS 9

Principle and Propagation of Light in an Optical Fibers - Fiber Optics: Principle, Acceptance Angle - Numerical Aperture,— types of Optical Fibers (Material, Refractive Index, Mode) – Fiber Optic Communication Systems – Bluetooth - Wi-Fi – Li-Fi – Infrared Data Transfer – Satellite data transmission and reception.

UNIT V EMERGING TECHNOLOGIES 9

Quantum Computing - 3D Printing - 5G & 6G Cellular Communications - Explainable Artificial Intelligence(AI) - Biometrics - Cloud Computing - Quantum Cryptography - Robotic Process Automation - Wearable Computing Virtual Reality(VR) – Augmented Reality (AR) – Mixed Reality (MR).

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, students will be able to:

- Explain the principles of semiconductors and their applications in computer engineering technologies.
- Describe the working of magnetic devices and sensors used in computer systems.
- Explain optical phenomena in display devices and the basics of nanoelectronic devices.
- Describe the fundamentals of fiber optic communication and data transmission systems.
- Identify and explain emerging technologies in Computer Engineering.

TEXT BOOKS

1. Rajendran V, "Engineering Physics", Tata McGraw Hill Publications, 2015.
2. Sze S. M., Lee M. K., "Semiconductor Physics and Devices" Wiley, 2021.
3. Brajesh Kumar Kaushik, "Nanoelectronics: Devices, Circuits and Systems (Micro and Nano Technologies)", Elsevier, 2018.

REFERENCES

1. Simon M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", Wiley-Interscience, 2016.
2. Takao Kuroda, "Essential Principles of Image Sensors", CRC Press, 2021.
3. *B.P.Pal , "Fundamentals of Fibre Optics in Telecommunication and Sensor Systems" New Age International Private Limited, 2023.*

E – RESOURCES

1. https://novapublishers.com/shop/internet-of-everything-smart-sensing-technologies/
2. https://www.ukri.org/news/revealed-the-50-new-technologies-that-could-shape-the-future/

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CYT201 **ENVIRONMENTAL SCIENCE AND SUSTAINABILITY** L T P C

(Common to All B.E. /B.Tech. Branches) 3 0 0 3

OBJECTIVES

- To familiarize students with the concepts of environment, ecosystems, biodiversity, and their conservation.
- To create awareness about environmental pollution, individual responsibilities in pollution prevention, and basic disaster management.
- To impart knowledge about major social and environmental issues, environmental protection laws, and green chemistry principles.
- To analyze population-related issues, human health, social welfare, and the role of information technology in environmental and human health.
- To develop an understanding of sustainability concepts, climate change issues, and sustainable management practices for addressing environmental challenges.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – Need for public awareness - Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (d) aquatic ecosystems (oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity –Value of biodiversity – Threats to biodiversity – Endangered and endemic species of India – Conservation of biodiversity: In-Situ and Ex-Situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution – Solid waste management: causes, effects and control measures of municipal solid wastes - E-waste – Role of an individual in prevention of pollution - Pollution case studies – Disaster management: floods, earthquake and cyclone.

Activity: Local pollution case study and report submission.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act –Water (Prevention and control of Pollution) act

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

Activity: Visit to local primary health center.

UNIT V SUSTAINABLE MANAGEMENT 9

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability-From unsustainability to sustainability-—Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste, Material Life cycle assessment, Sustainable habitat: Energy efficiency, Sustainable transports.

Activity: Field trips to local organizations or facilities with sustainable practices in place.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the basics of environment, ecosystems, biodiversity, and conservation.
- Identify major sources of pollution and understand individual responsibilities in pollution prevention and disaster management.
- Describe key social and environmental issues, environmental laws, and green chemistry principles.
- Analyse population growth, human health, social welfare, and the role of IT in environmental and health management.
- Apply sustainability concepts, climate change mitigation, and sustainable management practices to environmental challenges.

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2019.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Eighth Edition, Pearson Education, 2021.
3. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Third Edition, Prentice Hall, 2018.

REFERENCES

1. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt Ltd, 2016.

2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, 2018.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	3	-	-	3	3	-	-	2	1	-	-
2	2	2	3	2	3	3	3	-	-	3	3	-	-
3	2	1	3	2	2	3	3	-	2	3	3	-	-
4	2	1	3	2	3	3	3	2	3	2	2	-	-
5	2	1	3	2	3	3	3	2	3	2	2	-	-
AVG	2	1.4	3	1.6	2.2	3	3	0.8	1.6	2.4	2.2	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23CST201 PC HARDWARE SERVICES AND NETWORKING L T P C

3 0 0 3

OBJECTIVES

- To impart the students with fundamental components of a motherboard, memory devices and their functionalities.
- To enable students to understand operation of IO devices, interfaces and common troubleshooting techniques.
- To train the students in the BIOS setup functions, Power management, and necessary precautions of PC maintenance.
- To foster the students in troubleshooting techniques for diagnosing, and resolving hardware-related issues.
- To familiarize students with the fundamentals of data communication, computer networking concepts.

UNIT I MOTHERBOARD COMPONENTS AND MEMORY STORAGE DEVICES 9

Introduction: Hardware, Software and Firmware. Mother board, IO and memory expansion slots. SMPS-Processors: Architecture and block diagram of multicore Processor, Features of new processor-chipsets (Concepts only). Bus Standards: Overview and features of PCI, AGP, PCMCIA Primary Memory-Secondary Storage-Removable Storage.

Problem - Solving Assignments

1. Identify the motherboard type.
2. Explain how you will verify chipset compatibility.

UNIT II I/O DEVICES AND INTERFACE 9

Keyboard: Signals –mechanical keyboards–troubleshooting - wireless Keyboard. Mouse: types, connectors, operation of Optical mouse and Troubleshooting. Printers: Types of printers- Dot Matrix, Inkjet Laser, MFP (Multi Function Printer) and Thermal printer-I/O Ports: Serial, Parallel, USB, Game Port and HDMI. Displays: Principles of LED, LCD and TFT Displays-Modem: Working principle. Power Supply: Servo Stabilizers, online and offline UPS - working principles.

Problem - Solving Assignments

1. Keyboard Not Working Issue ,USB keyboard is not detected.List troubleshooting steps.
2. A system consumes 400W power.Suggest suitable UPS capacity.

UNIT III MAINTENANCE OF DESKTOP 9

Bios-setup: Standard CMOS setup, Advanced BIOS setup, Power management, advanced chipset features. PC Bios communication– upgrading BIOS, Flash BIOS -setup.POST: Definition – IPL hardware –

POST Test sequence – beepcodes.Diagnostic Software and Viruses:Computer Viruses – Precautions – Anti-virus Software – identifying the signature of viruses – Firewalls and latest diagnostic softwares

Problem - Solving Assignments

1. A system shows unwanted pop-ups and slow performance.Suggest antivirus and firewall solutions.
2. A new processor is not detected.Explain BIOS update process.

UNIT IV TROUBLESHOOTING OF DESKTOP AND LAPTOPS 9

Laptop: Types of laptop –block diagram – working principles–configuring laptops and power settings -SMD components, ESD and precautions. Laptop components: Adapter – types, Battery – types, Laptop Mother Board - block diagram.Laptop Keyboard and Touchpad .Installation and Troubleshooting: Formatting, Partitioning and Installation of OS – Trouble Shooting Laptop Hardware problems - Preventive maintenance techniques for laptops.

Problem - Solving Assignments

1. During Windows installation, hard disk not detected. Identify reasons.
2. Laptop Not ChargingCheck adapter, battery, charging port.

UNIT V COMPUTER NETWORK DEVICES 9

Data Communication: Components of a data communication.Data flow: simplex – half duplex – full duplex.Topologies: Star, Bus, Ring, Mesh, Hybrid – Advantages and Disadvantages of each topology.Networks: Definition -Types of Networks: LAN – MAN – WAN –CAN – HAN – Internet –Intranet – Extranet, Client-Server, Peer To Peer Networks.Network devices: Features and concepts of Switches – Routers(Wired and Wireless) – Gateways.

Problem - Solving Assignments

1. Two systems cannot communicate.Check IP configuration.
2. Compare Star and Mesh topology for a bank network.

OUTCOMES

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

- Explain the functionalities of computer hardware components, motherboard, memory devices.
- Demonstrate operation, configuration, and troubleshooting of input/output devices.
- Analyze BIOS setup functions and virus prevention techniques for system maintenance.
- Analyze hardware and software issues in desktop and laptop and use troubleshooting techniques to solve the issues.
- Explain the principles of data communication, network topologies, and networking devices.

TEXT BOOKS

1. Scott Mueller, Upgrading and Repairing *PCs*, 22nd Edition, Que Publishing (Pearson), 2011. (A guide to PC hardware, troubleshooting, repair, upgrades, diagnostics and servicing).
2. Behrouz A. Forouzan, Data Communications and Networking, 6th Edition, McGraw-Hill Education, 2022.

REFERENCES

1. T Stephen Rood, "Computer Hardware Maintenance", 1st Edition, Elsevier, 1996.
2. Christian Huitema, "Internet Routing Architectures", 2nd Edition, Prentice Hall, 2000.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/106/106106144/ (PC Hardware fundamentals)
2. https://onlinecourses.nptel.ac.in/noc22_cs19/(Computer Networks and Internet Protocol)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	2	1	–	–	1	–	2	2	2
2	3	3	2	2	3	1	1	1	1	–	2	1	2
3	3	3	2	2	3	2	2	1	1	–	2	1	2
4	3	3	3	2	3	2	1	2	1	1	3	2	3
5	3	2	2	1	3	2	1	1	1	–	2	2	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	2.4	2.5	2.4	3	3	-	2	-	-	2.2	1.6	2.4

1 - Low, 2-Medium, 3-High,"-" - No Correlation

Chairman - BoS

23HST202 **தமிழரும் தொழில்நுட்பமும் / Tamil and Technology** **L T P C**

1 0 0 1

OBJECTIVES

- To gain knowledge about weaving and ceramic Technology
- To create a design and construction Technology
- To analyze manufacturing Technology
- To apply agriculture and irrigation Technology
- To remember scientific and scientific Tamil and Tamil computing

UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo -Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY **3**

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY **3**

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING **3**

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

TOTAL: 15 PERIODS

OUTCOMES:

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

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE BOOKS

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

2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

3.கீழடி – வைகைநதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறை வெளியீடு)

4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல்துறை 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 the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

Mapping of COs-POs & PSOs

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

1 - Low, 2-Medium, 3-High,"-" - No Correlation

Chairman - BoS

23HST202 **தமிழரும் தொழில்நுட்பமும்** L T P C
1 0 0 1

(அனைத்து துறைகளுக்கும் பொதுவானது)

நோக்கம்:

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன:

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப்பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில்நுட்பத்தைப்பகுப்பாய்வு செய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல் மற்றும் அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை நினைவில் கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பாணை தொழில்நுட்பம் 3

சங்ககாலத்தில்நெசவுத்தொழில் - பாணைதொழில்நுட்பம் - கருப்பு, சிவப்புபாண்டங்கள் – பாண்டுகளில் கீறல் குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம் 3

சங்ககாலத்தில்வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு- சங்ககாலத்தில் கட்டுமானபொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடைஅமைப்புபற்றிய விவரங்கள் - மாமல்லபுரச்சிற்பங்கள், கோவில்களும் – சோழர்காலததூபெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கள் நாயக்கர்கால கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ – சாரோ செனிக்கட்டிடக்கலை.

அலகு 3 உற்பத்தித்தொழில்நுட்பம் 3

கப்பல்கட்டும் கலை - உலோகவியல் – இரும்பு தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் – நாணயங்கள் அச்சடிகள் – மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்பு துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம் 3

அணை, குளங்கள், மடகு – சோழர்காலகு முளிதூம் பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல் சார் அறிவு - மீன்வளம் – முத்து மற்றும் முத்து குளித்தல் – பெருங்கடல் குறித்தபண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ்நூல்களை மின்பதிப்பு செய்தல் – தமிழ்மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக்கல்விக்கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- பீங்கான் மற்றும் நெசவு தொழில்நுட்பத்தைப்புரிந்துகொள்ளுதல்.
- புதிய வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்.
- உற்பத்தித்தொழில்நுட்பத்தை அடையாளம் காணுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத்தைப்புரிந்து கொள்ளுதல்.
- அறிவியல் தமிழ் மற்றும் தமிழ்கணிப்பொறி தொடர்பான அறிவை பெறுதல்.

உரை மற்றும் குறிப்பு புத்தகங்கள்:

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

2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).

3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல்துறை 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 the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)

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

Mapping of COs-POs & PSOs

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

1 - Low, 2-Medium, 3-High,"-" - No Correlation

Chairman - BoS

23HSE201 **ENGLISH FOR ENGINEERS: THEORY AND PRACTICE** L T P C

(Common to all B.E. & B.Tech. Branches) 3 0 2 4

OBJECTIVES

- To strengthen grammatical accuracy for effective communication.
- To develop listening and reading comprehension skills.
- To improve writing proficiency for academic and formal purposes.
- To train in business and professional correspondence.
- To enhance speaking abilities for social and professional contexts.
- To provide practical exposure through interactive language activities.

UNIT I GRAMMAR 9

Articles ; Prepositions - Conditionals - Subject verb agreement - Error Spotting - Active and Passive voice

UNIT II LISTENING & READING 9

Syllabification – Improving Vocabulary - Reading Newspapers - Listening to Youtube Documentaries - Listening to Podcast - Listening to Motivational Movies.

UNIT III WRITING 9

Checklist - Recommendations - Formal letters – inviting guests – acceptance/declining letters

UNIT IV BUSINESS WRITING 9

E-mail writing - fixing an appointment, cancelling appointment, paper submission for seminars and conferences - Job Application Letter and Résumé.

UNIT V SPEAKING 9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting - Situational Role-play.

TOTAL: 45 PERIODS

LIST OF EXERCISES

1. Stage Dynamics (Body Language and Paralanguage - Presentation)
2. Day today real time speaking exposures – Story narration, simple, general topics and incidents.
3. Group Discussion
4. Power Point Presentation (Corporate Skills & Public Speaking)
5. Loud Reading
6. Picture Description

7. Interview Skills (Mock Interview & Interview Etiquette)
8. Case Study Report

TOTAL: 15 PERIODS

OUTCOMES

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

- Use correct grammar in speech and writing.
- Understand and interpret information from various audio and reading sources.
- Write clear, structured, and formal documents.
- Prepare professional emails, résumés, and job-related letters.
- Communicate effectively in group discussions and presentations.
- Apply communication skills confidently in real-time situations.

TEXT BOOKS

1. S. Sumant, "Technical English II", Maven Learning Private Limited, 2012.
2. Joshi, Manmohan, *"Soft Skills"*, First Edition, Bookboon, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, First Edition, 2013.
2. Seely, John. "Oxford Guide to Effective Writing and Speaking", Oxford University Press. UK, 2013.

E-RESOURCES

1. https://www.fluentu.com/Blog/english/english-small-talk
2. https://www.britishcouncil.com

EXTENSIVE READING

1. Stephen R. Covey, " The 7 Habits of Highly Effective People", Simon & Schuster, 2019.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	2	-	2	-	-	-	-	3	-	1	-	-
3	1	-	-	-	-	-	1	-	3	2	2	-	-
4	-	-	-	-	1	-	2	-	3	2	2	-	-
5	-	-	-	-	-	-	1	3	3	2	1	-	-
6	-	-	-	-	-	2	2	2	3	-	2	-	-
AVG	1	2	-	2	1	2	1.5	2.3	3	2	1.6	1	2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEE202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L T P C
	(Common to AIDS, CSE, CSE-CS, IT, Robotics, PT)	3 0 2 4

OBJECTIVES

- To enhance the basic concepts of DC and AC electrical circuits and fundamental circuit laws.
- To impart knowledge on the construction, working principles, and applications of basic electrical machines.
- To instruct the operation and characteristics of basic semiconductor devices.
- To familiarize the fundamentals of number systems and basic digital logic circuits in digital world.
- To instruct the principles of electrical measuring instruments and power measurement.
- To provide knowledge on basic electrical and electronic concepts through simple hands-on experiments.

UNIT I ELECTRICAL CIRCUITS 9

DC circuits: Circuit components: Conductor, Resistor, Inductor, Capacitor - Ohm's Law - Kirchhoff's Laws - Independent and Dependent sources - Nodal analysis, Mesh analysis with Independent sources only (Steady state) – Thevenin's theorem – Maximum Power Transfer theorem.

Introduction to AC circuits and parameters: Waveforms, Average value, RMS value, Instantaneous power, real power, reactive power and apparent power, power factor - Steady state analysis of RL, RC & RLC circuits.

UNIT II ELECTRICAL MACHINES 9

DC Generators: Construction and working principle, EMF equation, Types and applications – DC Motors: Working principle, Types and applications - Construction, Working principle and applications: Single phase transformer, Three phase alternator and Three phase induction motor – BLDC Stepper Motor – PMSM.

UNIT III ANALOG ELECTRONICS 9

PN junction diodes and its applications - Zener diode: structure, operation, Zener diode as regulator – Biasing of BJT - JFET, SCR, MOSFET, IGBT - Types, VI characteristics.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, Combinational logic - Representation of logic functions - SOP and POS forms, K-map representations - Minimization using K maps - Half adder, Full adder – Multiplexer, Demultiplexer.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Operating principle and Types of Moving coil and Moving iron meters - Measurement of power and Energy meter - Data acquisition.

LIST OF EXPERIMENTS

1. Verification of KVL & KCL.
2. Load test on DC shunt motor.
3. Characteristics of PN and zener diodes
4. Characteristics of BJT.
5. Half wave and full wave rectifiers
6. Verifications of Half adder and Full adder.
7. Measurement of power and Energy meter.

TOTAL : 45+15 = 60 PERIODS

OUTCOMES

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

- Apply the basic electrical laws and theorems to analyze simple DC and AC circuits.
- Explain the working principles and applications of DC machines, transformers and motors.
- Analyze the characteristics and applications of diodes and semiconductor devices.
- Apply the digital logic concepts to design and analyze simple combinational circuits.
- Examine the operation of electrical instruments and basic data acquisition systems.
- Analyze the basic electrical and electronics concepts by performing simple hands-on laboratory experiments and interpreting the results

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, 2019.

REFERENCES:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill Education, Fourth Edition, 2019.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2021.

E-RESOURCES:

1. https://nptel.ac.in/courses/108108076 - (Basics of Electrical Technology).
2. https://www.digimat.in/nptel/courses/video/108105112/L01.html - (Fundamentals of Electrical Engineering).

2. https://www.digimat.in/nptel/courses/video/108105112/L01.html - (Fundamentals of Electrical Engineering).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	-	1	-	-	-	3	2	1
2	3	3	3	3	3	-	1	-	-	-	3	1	1
3	3	3	3	3	3	-	1	-	-	-	3	2	1
4	3	3	3	3	3	-	1	-	-	-	3	2	2
5	3	3	3	3	3	-	1	-	-	-	3	2	1
6	3	3	3	3	3	-	1	3	3	-	3	2	1
AVG	3	3	3	3	3	-	1	3	3	-	3	1.8	1.1

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23CSL201 **REVERSE ENGINEERING LABORATORY** L T P C
0 0 4 2

OBJECTIVES

- To provide practical exposure in computer hardware components, motherboard analysis, peripheral troubleshooting, network configuration, and operating system installation for effective computer maintenance.

LIST OF EXPERIMENTS

1. Identify the different components of a computer.
2. Assemble and reassemble the different components of a computer like CPU, RAM, GPU, Motherboard, Storage Devices, etc.
3. Analyze the peripheral devices such as SATA, USB, PCIe and observe the bus signals and transactions when troubleshooting.
4. Identify the mechanical vs. electronic failures in storage devices.
5. Study about the mother board layout and identify the components in it. Trace the signal paths between CPU, RAM, and storage.
6. Demonstrate the signed and unsigned boot in a system to understand secure boot flow, trust anchors, and how UEFI Secure Boot prevents unauthorized images.
7. Study about the Ethernet cable types. Using a cable tester crimp the RJ-45plugs and RJ-45 pinouts.
8. Configure static IPs, subnet mask, gateway, understand subnet calculation and host ranges.
9. Configure default gateway and basic static routes to connect separate subnets.
10. Install various operating systems (Windows, Linux, etc.) on your system and learn about partitioning, formatting and installing.

OUTCOMES

- Implement troubleshooting techniques, and configure computer hardware, networking components, boot processes, and operating systems to perform effective system maintenance and reverse engineering tasks.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	3	1	1	2	2	1	2	3	3

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEC201

INDIAN LANGUAGE

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE
(Common to all B.E. & B.Tech. Branches)

L T P C
0 0 4 2

OBJECTIVES

- To learn the Hindi alphabet, pronunciation, and basic writing.
- To understand and use basic Hindi grammar correctly.
- To develop basic reading, writing, listening, and speaking skills in Hindi.
- To use Hindi for simple everyday communication.
- To prepare learners to successfully clear the Hindi Examination.

UNIT I वर्णमालाएवंमूलभूतव्याकरण (ALPHABET AND BASIC GRAMMAR) 5

Hindi Vowels (स्वर)- Hindi Consonants (व्यंजन) -Matras (मात्राएँ)- Barakhadi (बारहखड़ी)-Word Formation (शब्दनिर्माण)- Gender (लिंग)- Number (वचन)- Basic Sentence -Formation (सरलवाक्यरचना)

UNIT II शब्दभंडारएवंव्याकरण (VOCABULARY AND GRAMMAR) 7

Nouns (संज्ञा)- Pronouns (सर्वनाम) -Adjectives (विशेषण) -Verbs (क्रिया) -Tenses (काल– Present, Past, Future) - Opposite Words (विलोमशब्द) -Synonyms (पर्यायवाची) -One-word Substitutions (अनेकशब्दोंकेलिएएकशब्द)

UNIT III पठनएवंलेखनकौशल (READING AND WRITING SKILLS) 7

Reading Simple Hindi Passages -Comprehension (गद्यांश) -Paragraph Writing (अनुच्छेदलेखन)- Letter Writing (पत्रलेखन)- Dialogue Writing (संवादलेखन) -Picture Description (चित्रवर्णन) -Dictation Practice (श्रुतिलेख)

UNIT IV दैनिकजीवनमेंहिंदी (HINDI FOR EVERYDAY COMMUNICATION) 7

Greetings and Introductions -Family Members (परिवार)- Days, Months, Seasons -Numbers (१–१००) -Time and Date - Colours, Fruits, Vegetables - Shopping Conversations - School and Classroom Vocabulary - Common Everyday Conversations

UNIT V साहित्यएवंपुनरावृत्ति (LITERATURE AND REVISION) 4

Simple Poems (कविताएँ)- Short Stories (लघुकथाएँ)- Proverbs and Idioms (मुहावरेएवंलोकोक्तियाँ– basic) -Moral Stories - Translation (English/Tamil to Hindi – Simple Sentences) - Revision of Grammar - Model Question Papers and Practice Tests

TOTAL: 30 PERIODS

OUTCOMES

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

1. Write basic Hindi words and sentences.
2. Apply fundamental Hindi grammar in simple communication.
3. Develop basic reading, writing, listening, and speaking skills in Hindi.
4. Use Hindi confidently in day-to-day conversations.
5. Develop proficiency required to successfully clear the Hindi Examination.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	1	1	3	-	1	-	-
CO3	-	-	-	-	-	-	1	2	3	-	2	-	-
CO4	-	-	-	-	-	1	2	2	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	2	-	3	-	-
AVG	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-

1-Low 2-Medium 3-High '-' – No Correlation.

P. Kavitha
Chairman - BoS

23EEC201 **INDIAN LANGUAGE**

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C

(Common to all B.E. & B.Tech. Branches) 0 0 4 2

OBJECTIVES

- To learn the German alphabet, pronunciation, and basic communication.
- To understand and use basic German grammar and vocabulary.
- To communicate in German in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in German.
- To apply basic German language skills confidently through practice and revision.

UNIT I INTRODUCTION TO GERMAN LANGUAGE 6

German alphabet and pronunciation – Greetings - Self-introduction (Name, age, nationality, profession) - Numbers (0–100) -Days, months, seasons, and dates - Basic classroom expressions - Personal pronouns -Verb **sein** (to be) -Simple sentence formation

UNIT II BASIC GRAMMAR AND VOCABULARY 7

Definite and indefinite articles (der, die, das; ein, eine) - Nouns and gender - Singular and plural forms - Verb conjugation (regular verbs) - Present tense - Question words (Wer, Was, Wo, Wann, Wie, Warum) - Negation (nicht, kein) - Vocabulary: Family, occupations, countries, languages, colors

UNIT III EVERYDAY COMMUNICATION 7

Daily routine - Time and clock reading - Food and beverages - Shopping conversations - Asking for and giving directions -Making simple requests -Modal verbs (möchten, können) -Vocabulary: Home, school, transportation, weather

UNIT IV READING, WRITING, LISTENING, AND SPEAKING SKILLS 5

Reading short dialogues - Listening to simple conversations - Writing short paragraphs - Describing people, places, and objects - Introducing family and friends

UNIT V PRACTICAL APPLICATIONS AND REVISION 5

Travel and tourism vocabulary - At the restaurant - At the railway station and airport - Revision of grammar topics - Translation of simple sentences (English to German and German to English)

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify the German alphabet and pronounce basic German words correctly.
- Use basic German vocabulary and simple grammar in sentences.
- Practice in simple German for everyday situations.
- understand basic German texts and conversations.
- Apply basic German language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	1	2	2	3	-	2	-	-
4	-	-	-	-	-	-	1	2	3	-	2	-	-
5	-	-	-	-	-	1	2	2	3	-	2	-	-
AVG	-	-	-	-	-	1	1.5	1.7	3	-	1.6	-	-

1-Low 2-Medium 3-High '-' – No Correlation

P. Kavitha
Chairman - BoS

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
NAAC Accredited with 'A' Grade
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
TIRUCHENGODE- 637 205

23EEC201

INDIAN LANGUAGE

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the Japanese writing system, pronunciation, and basic vocabulary.
- To understand and use basic Japanese grammar and sentence patterns.
- To communicate in Japanese in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in Japanese.
- To apply basic Japanese language skills confidently through practice and real-life communication.

UNIT I WRITING SYSTEMS & PRONUNCIATION 5

Hiragana chart reading and writing - Katakana chart reading and writing - Basic pronunciation rules (long vowels, double consonants) – Numbers - Colours, body parts, pets description

UNIT II KANJI & BASIC GRAMMAR 7

First 50 Kanji (Numbers, Time & Days, Basic Directions & People) - Topic marker は (wa) - Identification sentences: Noun + です (desu) - Possession particle の (no) - Inclusion particle も (mo) - Subject marker が (ga) - Direction particles へ (he) and に (ni) - Self-introductions and greetings (Aisatsu) - Numbers, prices, shopping terms - Days, months, relative time - Family members and occupations

UNIT III KANJI & FUNCTIONAL GRAMMAR 8

Next 50 Kanji (Nature, Core Verbs, Adjectives & Nouns) - Verb groups (Group 1, Group 2, Group 3) - Masu forms (Present, Past, Positive & Negative) - Te-form (~て): requests, connecting sentences, continuous actions (~ている) - Adjective conjugation (い & な adjectives) - Desires (~たい) and invitations (~ましょう)

UNIT IV VOCABULARY & FUNCTIONAL COMMUNICATION 5

Action verbs (daily routine, hobbies) - Adjectives for people, food, and places - Positional words (inside, outside, next to, between) - Transport, travel, and location vocabulary - Simple conversations in everyday situations

UNIT V READING & LISTENING COMPREHENSION 5

Reading short sentences in Hiragana, Katakana, and basic Kanji - Understanding classroom instructions - Listening to slow, clear daily-life conversations - Understanding simple shopping dialogues

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify the Japanese writing system and pronounce basic Japanese words correctly.
- Use basic Japanese vocabulary and simple grammar in sentences.
- Communicate in simple Japanese for everyday situations.
- Read, write, listen to, and understand basic Japanese texts and conversations.
- Apply basic Japanese language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	1	1	-	1	2	-	-	-	-
CO2	-	-	-	-	1	2	-	2	2	-	-	-	-
CO3	-	-	-	-	2	2	1	2	3	-	1	-	-
CO4	-	-	-	-	2	2	1	3	3	-	1	-	-
CO5	-	-	-	-	1	1	1	2	3	-	1	-	-
AVG	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-

1-Low 2-Medium 3-High '-' – No Correlation

P. Kavitya
Chairman - BoS

23MDC201	APTITUDE SKILLS (Common to all Branches)	L T P C 3 0 0 0

OBJECTIVES

- To introduce the basics concepts and techniques of numbers, Highest common factor and Least common multiple.
- To develop the use of decimal fraction and problems on ages.
- To introduce the basic concepts of time, work, distance, calendar and clock.
- To explain the student with the concept of simple and compound interest.
- To provide the knowledge of polynomial and quadratic equations.

UNIT I NUMBERS, HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE 9

Numbers and their basic classification – Types of number – Basic operations of numbers – Progression – Tests of divisibility – Highest common factor – Least common multiple

UNIT II DECIMAL FRACTION AND PROBLEMS BASED ON AGES 9

Decimal fraction – Types of fraction – Comparison of fractions – Inserting fractions in between two given fractions – Relation between decimal fraction and normal fraction – Conversion of a decimal fraction into a vulgar fraction – Types of decimals – Conversion of mixed recurring decimal into a vulgar fraction – Standard form of decimal – Problems based on ages.

UNIT III TIME, WORK, DISTANCE, CALENDER AND CLOC 9

General rule for time and work – General rule for work and wages – Speed – Unit of speed – Average speed – Some useful relations – Problems on Trains – Calendars and clocks – Odd days – Ordinary year – Leap year.

UNIT IV SIMPLE INTEREST, COMPOUND INTEREST AND ELEMENTARY ALGEBRA 9

Simple interest – Compound interest – Some useful relations – Difference between compound interest and simple interest – Short cut methods to solve special types of problems – Elementary Algebra and averages

UNIT V POLYNOMIAL AND QUADRATIC EQUATIONS 9

Polynomial introduction – Degree of a polynomial – Types of polynomial – Operations on polynomial – Remainder and factor theorem – Quadratic equation – Pure Quadratic equation – Discriminant – Roots of the Quadratic equations – Solution of Quadratic equation – Framing of a Quadratic equation – Special

types of roots

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply basic concepts and techniques highest common factor and least common multiple on numbers
- Apply the concept of decimal fraction and problems on ages.
- Apply the concept of time, work, distance, calendar and clock.
- Develop proficiency in simple interest, compound interest and basic algebraic skills.
- Explain the concepts and properties of polynomial and quadratic equations.

TEXT BOOKS

1. Agarwal R.S., "Quantitative Aptitude", S. Chand & Company Ltd, New Delhi, 2012.
2. Dinesh Khattar, "Quantitative Aptitude for competitive examinations ", Pearson India Education Services Pvt. Ltd., New Delhi, 2019.

REFERENCES

1. Praveen R.V., "Quantitative Aptitude and Reasoning", PHI Learning Private Limited, Delhi, 2013.
2. Gupta P, "A unique Approach to Quantitative Aptitude ", Unique Publishers (I) Pvt. Ltd. New Delhi, 2017.

E-RESOURCES

1. https://youtube.com/playlist?list=RDQM5XI256aOq24
2. https://youtu.be/KE7tQf9spPg

Chairman - BoS

23MAT303	DISCRETE MATHEMATICS	L	T	P	C
	[Common to CSE, CSE (CS), IT and AI&DS]	3	1	0	4

OBJECTIVES

- To provide knowledge of logic and proofs.
- To explore generating functions, mathematical induction, and counting techniques.
- To introduce the basics of graph theory.
- To explain algebraic structures and their properties.
- To introduce the concepts of lattices and Boolean algebra.

UNIT I LOGIC AND PROOFS 9+3

Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Normal forms.

UNIT II INDUCTION AND COUNTING 9+3

Mathematical induction – Strong induction and well-ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Binomial coefficients – Generating functions – Inclusion and exclusion principle

UNIT III GRAPHS 9+3

Graphs and graph models – Graph terminology and special types of graphs – Representing Graphs and Graph Isomorphism – Euler and Hamilton paths – Trees: Introduction to Trees.

UNIT IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids – Groups: Definitions and examples – Subgroups and homeomorphisms – Cosets and Lagrange's theorem – Normal subgroups – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

Lattices as partially ordered sets: Definitions and examples – Some properties of lattices – Lattices as algebraic systems – Sub lattices, direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 45+15

PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the concept of logic and proofs.
- Apply the concepts of generating functions, induction and counting techniques.

- Use the applications of graph theory.
- Identify the concepts and properties of algebraic structures.
- Compute the real-time applications using lattices.

TEXTBOOKS:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", Seventh Edition, McGraw Hill Education (India) Private Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, Thirty Reprints, 2011.

REFERENCES:

1. Ralph P Grimaldi and B.V Ramana., "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education limited, 2014.
2. Satinder Bal Gupta., "Discrete Mathematics and structures", University science press, New Delhi, Fifth Edition, 2008.

E-RESOURCES

1. https://nptel.ac.in/courses/106106183 (Discrete Mathematics)
2. https://nptel.ac.in/courses/106108227 (Discrete Mathematics)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BOS

23ECT302 DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of digital circuits and simplification methods.
- To discuss about various combinational digital circuits using logic gates.
- To examine the design procedures for synchronous and asynchronous sequential circuits.
- To gain knowledge on addressing modes, instructions and its operations.
- To summarize the memory hierarchies, cache memories and bus architecture.

UNIT I INTRODUCTION TO DIGITAL CIRCUITS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II COMBINATIONAL CIRCUITS 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III SEQUENTIAL CIRCUITS 9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of synchronous & asynchronous circuits – Design Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV COMPUTER ARCHITECTURE AND REGISTERS 9

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNIT V MEMORY AND I/O ORGANIZATION 9

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the different methods used for simplification of Boolean expressions.
- Design various combinational digital circuits using logic gates.
- Analyze synchronous and asynchronous sequential circuits.
- Examine the addressing modes and instructions used in computer.
- Develop the memory design and bus architectures.

TEXT BOOKS

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2017.
2. David Harris ,"Digital Design and Computer Architecture", Morgan Kaufmann,2012.

REFERENCES

1. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010
2. John F. Wakerly, "Digital Design Principles and Practices", Fifth Edition, Pearson Education, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/117/106/117106086/ (Digital Design)
2. https://nptel.ac.in/courses/108/105/108105132/ (Integrated Circuits)
3. https://onlinecourses.nptel.ac.in/noc24_cs83/ (Computer Architecture)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO3
1	3	3	2	2	2	2	-	-	-	-	2	3	2
2	3	3	3	2	2	2	-	-	-	-	2	2	2
3	3	3	3	2	2	2	-	-	-	-	2	3	2
4	3	2	3	2	2	2	-	-	-	-	2	2	1
5	3	3	3	3	2	2	-	-	-	-	2	3	2
AVG	3	2.8	2.8	2.2	2	2	-	-	-	2	1.8	3	1.4

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADT302 PROGRAMMING USING JAVA L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts of Object-Oriented Programming and the Java programming language.
- To familiarize students with classes, inheritance, packages, interfaces, and exception handling in Java.
- To enable students to develop Java applications using file handling, event handling, and Swing.
- To enhance students' knowledge of collections, strings, generics, multithreading, and their applications in Java programming.
- To foster the ability to develop Java applications using database connectivity and event handling mechanisms to solve real-world problems.

UNIT I 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

Coding Exercises:

1. Write Java classes with data members, constructors, methods, static members, and apply access specifiers.
2. Use Java data types, arrays, operators, control statements in small programs.
3. Write JavaDoc comments for classes and methods.

Problem-Solving Assignments:

1. Design classes like Dog, Rectangle, Circle with attributes and methods.
2. Implement simple calculators and object management classes.

UNIT II 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

Coding Exercises:

1. Demonstrate method overloading, passing and returning objects.
2. Build class hierarchies showing inheritance, method overriding, use of super.
3. Implement static, nested, and inner classes.

Problem-Solving Assignments:

1. Build real-world hierarchies e.g. Employee-Manager with inheritance.

2. Create package-based projects with interfaces.

UNIT III EXCEPTION HANDLING 9

Exception fundamentals – uncaught exception – exception types – exception hierarchy- using try and catch – multiple catch blocks – throw, throws, finally – user defined exception

Coding Exercises:

1. Implement try-catch blocks, multiple catch, throw and throws in programs.
2. Use finally and create user-defined exceptions.

Problem-Solving Assignments:

1. Write applications with exception handling for common errors.

UNIT IV STRING HANDLING AND IO STREAMING 9

String Constructors - String concatenation with other data types – Character Extraction Methods – String Comparison - Modifying a String – Searching String – StringBuffer – Wrapper Classes(Integer, Float, Double, Number, Character, Boolean) - Character Streams and Byte Streams – Reading and Writing Characters and Strings – Reading and Writing Files

Coding Exercises:

1. Manipulate strings using various string methods.
2. Use StringBuffer and wrapper classes.
3. Write programs reading/writing files using character and byte streams.

Problem-Solving Assignments:

1. Develop programs for string data processing and file handling projects.

UNIT V EVENT HANDLING 9

The Delegation Event Model – Event Classes – Event Listener Interfaces - Layout Managers (Flow, Border, Grid and GridBagLayouts) - Handling Mouse Events - Introduction to Swing – JFrame, JTextField, JButton, JTextArea, JComboBox, JTahhedPane, JScrollPane

Coding Exercises:

1. Create Swing GUI applications using JFrame, JButton, JTextField, JTextArea, JComboBox etc.
2. Handle events with listeners and implement layout managers (Flow, Border, Grid, GridBag)

Problem-Solving Assignments:

1. Build interactive GUI apps such as login forms, calculators, and event-driven controls.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply the concepts of classes and objects to solve simple problems
- Develop programs using inheritance, packages and interfaces
- Apply the use of exception handling mechanisms and multithreaded model to solve real world problems
- Analyze Java applications with I/O packages, string classes, Collections and generics concepts
- Design the concepts of event handling and JavaFX components and controls for developing GUI based applications

TEXT BOOKS

1. Herbert Schildt, "Java: The Complete Reference", McGraw Hill Education ,Eleventh Edition, 2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", McGraw Hill Education, First Edition, 2015

REFERENCES

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, Prentice Hall , Eleventh Edition, 2018
2. ReemaTherja,"Programming in C",Oxford University Press, Second Edition, 2016.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105191/ (Programming in Java)
2. https://nptel.ac.in/courses/106/105/106105191/ (Inheritance)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23GEE301 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C

3 0 2 4

OBJECTIVES

- To impart the fundamentals of computational thinking, algorithm design, and problem-solving techniques for developing efficient software solutions.
- To develop students proficiency in Python programming using data types, expressions, operators, statements, and debugging techniques.
- To enable students to apply control structures, functions, recursion, and string manipulation for solving computational problems.
- To train students to use lists, tuples, dictionaries, and advanced data processing techniques for structured programming.
- To inculcate the knowledge of file handling, exception handling, modules, packages, and data visualization for developing robust Python applications.
- To develop the students in analytical, programming, and computational skills through coding practices, and to solve real-world problems using Python.
- omputational skills through coding practices, and to solve real-world problems using Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocksofalgorithms(statements,state,controlflow,functions),notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Coding Exercises:

1. Write a Python program to find the minimum element in a list using iteration.
2. Implement a function to insert an integer into a sorted list at the correct position.
3. Write a recursive program to solve the Towers of Hanoi puzzle for n disks.

Problem-solving Assignments:

1. Develop a Python program to guess an integer within a given range using binary search
2. Write a program that implements algorithmic problem solving strategies and prints the sum of digits of a number recursively

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 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: exchange the values of two variables, circulate the values of n variables, distance between two points.

Coding Exercises:

1. Write a program to exchange the values of two variables.
2. Implement a program to circulate the values of n variables.
3. Calculate the distance between two points given their coordinates.

Problem-solving Assignments:

1. Create a program to convert temperatures between Celsius and Fahrenheit.
2. Write a program to compute the area and perimeter of basic shapes using variables and expressions.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 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, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Coding Exercises:

1. Write a function that returns the square root of a number using the Newton-Raphson method.
2. Implement a function to compute the Greatest Common Divisor (GCD) of two numbers using recursion.
3. Write programs for linear and binary search on arrays.

Problem-solving Assignments:

1. Develop a program to sum an array of numbers using recursion.
2. Write a program that computes exponentiation using recursive functions.

UNIT IV LISTS, TUPLES, DICTIONARIES 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 andmethods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

Coding Exercises:

1. Write a program using list comprehensions to generate a list of squares of integers.
2. Implement a histogram function that counts the frequency of characters in a string.
3. Use dictionaries to implement a simple phonebook application.

Problem-solving Assignments:

1. Write a program to prepare a retail bill with item prices and quantities using dictionaries and lists.
2. Develop a student marks management system that stores data in dictionaries and supports basic queries.

UNIT V FILES, MODULES, PACKAGES& DATA VISUALIZATION 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments. errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - Importing Matplotlib – Introduction to plotting – visualizing errors – density and contour plots – Histograms.

Coding Exercises:

1. Write a Python program to read from a text file and count the number of words.
2. Implement a program to copy the content of one file to another using file handling.

Problem-solving Assignments:

1. Create a module with functions and import it into a program to perform mathematical calculations.
2. Use Matplotlib to plot a histogram and a density plot from a given dataset.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3.Scientific problems using Conditionals and Iterative loops.(Number series,Number Patterns, pyramid pattern)

4.Implementation of real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)

5. Implementation of real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)

6. Implementation of programs using Functions.(Factorial,largest number in a list,area of shape)

7. Implementation of programs using Strings.(reverse,palindrome,charecter count,replacingcharacters)

8.Implemenation of programs using written modules and Python Standard Libraries(p and as, numpy. Matplotlib. scipy)

9. Implementation of real-time/technical applications using File handling.(copy from one file to another,

word count, longest word)

10. Implementation of real-time/technical applications using Exception handling.(divide by zero error, voter s age validity, student mark range validation)

TOTAL:45+15= 60 PERIODS

OUTCOMES

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

- Analyze computational problems to develop effective problem-solving strategies.
- Apply python constructs to develop programs for python applications.
- Apply control structures and functions to solve computational problems.
- Apply Python built-in data structures such as lists, tuples, and dictionaries to process and manipulate data efficiently.
- Analyze the operations of file handling, exception handling, modules, packages, and data visualization techniques for real-world applications.
- Implement python programs for solving various computational problems.

TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", O'Reilly Publishers ,Second Edition, , 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", BCS Learning & Development Limited ,First Edition, 2017.

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, First Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", Notion Press ,First Edition , 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/106104074(Introduction to Algorithms)
2. https://archive.nptel.ac.in/courses/106/106/106106182/ (Joy of Computing)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	-	-	-	-	-	-	3	2
2	3	3	3	2	2	-	-	-	-	-	-	3	2
3	3	3	3	3	3	-	-	-	-	-	-	3	2
4	3	3	3	2	3	-	-	-	-	-	-	3	2
5	3	3	3	3	3	-	-	-	-	-	-	2	2
6	3	3	3	2	2	-	-	-	-	-	-	3	2
AVG	2.8	2.7	2.2	1.5	2.8	–	1.0	1.0	1.5	1.0	2.0	3.0	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE301 FOUNDATIONS OF ARTIFICIAL INTELLIGENCE L T P C

3 0 2 4

OBJECTIVES

- To impart the knowledge on AI and Intelligent systems.
- To familiarize the students on problem solving methods in AI
- To foster the knowledge on game playing and constraint satisfaction problems.
- To train the students on designing software agents.
- To inculcate the knowledge on AI technologies and its application.
- To implement AI techniques for solving real-world problems.

UNIT I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

Coding Exercises:

1. Implement a simple problem-solving agent that navigates a maze to reach a goal.
2. Write a program simulating an agent performing uninformed search strategies (e.g., breadth-first search) in a graph.
3. Create functions to represent an agent's state, possible actions, and goal test in a problem space.

Problem-solving Assignments:

1. Design and simulate an AI agent that performs rational actions in a partially observable environment.
2. Develop an agent that uses state space representation to solve a simple puzzle like the 8-puzzle or water jug problem.

UNIT II PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

Coding Exercises:

1. Implement a heuristic search algorithm such as greedy best-first search on a sample problem.
2. Write local search algorithms (e.g., hill climbing) to optimize a simple function.
3. Create an online search agent that adapts to unknown environments using feedback.

Problem-solving Assignments:

1. Solve a problem involving search with non-deterministic actions using appropriate heuristics.
2. Design an optimization algorithm using local search to find the minimum of a function.

UNIT III GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte -carlo tree search – stochastic games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

Coding Exercises:

1. Implement alpha-beta pruning for a two-player game tree.
2. Write a Monte Carlo tree search simulation for a simple game.
3. Solve a constraint satisfaction problem using backtracking search.

Problem-solving Assignments:

1. Design a program to solve Sudoku using constraint propagation and local search.
2. Implement a stochastic game simulation and analyze optimal decisions.

UNIT IV LOGICAL REASONING 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – forward chaining – backward chaining – resolution.

Coding Exercises:

1. Create a knowledge-based agent that uses propositional logic for reasoning.
2. Implement forward and backward chaining algorithms for inference in logic.
3. Write a program demonstrating propositional model checking.

Problem-solving Assignments:

1. Develop a program for resolution-based theorem proving on given logical formulas.
2. Design a knowledge representation system using first-order logic syntax and semantics.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot.

Coding Exercises:

1. Implement a simple Natural Language Processing task like tokenization and sentence segmentation.
2. Write a basic program for information retrieval using keyword searching.
3. Develop a speech recognition simulation using pattern matching.

Problem-solving Assignments:

1. Create a machine translation system for a limited vocabulary and grammar rules.
2. Design and simulate a basic robot environment with perception and action capabilities.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmetic.
2. Implement A* and memory bounded A* algorithms
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
4. Solve constraint satisfaction problems
5. Implement propositional model checking algorithms
6. Implement forward chaining, backward chaining, and resolution strategies
7. Build naive Bayes models
8. Implement Bayesian networks and perform inferences
9. Mini-Project

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Develop uninformed search strategies to solve state-space search problems..
- Explain the principles of game theory and optimal decision-making in AI.
- Analyze local search methods for solving complex constraint satisfaction problems.
- Apply propositional and first-order logic inference techniques, including forward chaining, backward chaining, and resolution.
- Analyze real-world AI applications and evaluate their impact across different domains.
- Implement AI techniques for language processing, machine translation, speech recognition, and robotics applications.

TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2020.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc. First Edition, 2008.

REFERENCES

1. Gerhard Weiss, "Multi Agent Systems", MIT Press, Second Edition, , 2013.
2. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, First Edition, 2010.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105077 (Uninformed Search)

2 https://nptel.ac.in/courses/106/106/106106126 (Propositional and First Order Logic)

Mapping of COs-POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	1	1	1	1	1	2	3	2
CO2	3	3	3	3	3	1	1	2	2	2	2	3	3
CO3	3	3	3	3	3	1	1	2	2	2	3	3	3
CO4	3	3	3	3	3	2	1	1	2	3	3	3	3
CO5	3	3	3	3	3	2	1	1	3	3	3	3	3
CO6	3	3	3	3	3	3	2	1	3	3	3	3	3
AVG	3	3	3	3	3	1.6	1.1	1.3	2.1	2.3	2.6	3	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE302 DATA STRUCTURES DESIGN L T P C

3 0 2 4

OBJECTIVES

- To introduce the concepts of Abstract Data Types (ADTs).
- To familiarize students with linear and non-linear data structures using Python.
- To enhance students' understanding of sorting and searching algorithms.
- To foster problem-solving skills through the implementation of data structures.
- To impart knowledge in representing and traversing graph structures.
- To develop students' skills in implementing, analyzing, and applying data structures such as lists, stacks, queues, trees, and graphs using Python.

UNIT I ABSTRACT DATA TYPES 9

Abstract Data Types (Adts) – ADT And Classes – Introduction To OOP – Classes In Python – Inheritance – Namespaces – Shallow And Deep Copying Introduction To Analysis of Algorithms – Asymptotic Notations – Divide & Conquer – Recursion – Analyzing Recursive Algorithms.

Coding Exercises:

1. Implement a Python class representing an abstract stack with push, pop, and is_empty methods.
2. Write recursive functions and analyze their time complexity using asymptotic notation.
3. Create examples demonstrating shallow vs deep copying of Python objects.

Problem-solving Assignments:

1. Design and implement a class hierarchy using inheritance to represent different types of abstract data types.
2. Analyze and compare the efficiency of a recursive vs iterative algorithm for the Fibonacci series.

UNIT II LINEAR STRUCTURES 9

List ADT – array-based implementations – linked list implementations – singly linked lists – doubly linked lists – Stack ADT – Queue ADT – double ended queues – applications

Coding Exercises:

1. Implement singly and doubly linked lists with insert, delete, and traverse operations.
2. Write Python programs for stack and queue ADTs and demonstrate typical applications.
3. Implement a double-ended queue (deque) and show enqueue and dequeue from both ends.

Problem-solving Assignments:

1. Create a Python program to reverse a linked list and detect cycles in the list.

2. Use stack ADT to check for balanced parentheses in an expression.

UNIT III SORTING AND SEARCHING 9

Bubble sort – selection sort – insertion sort – merge sort – quick sort – analysis of sorting algorithms– linear search – binary search

Coding Exercises:

1. Implement bubble sort, selection sort, and insertion sort for a list of elements.
2. Write Python programs for merge sort and quick sort algorithms.
3. Implement linear and binary search algorithms.

Problem-solving Assignments:

1. Analyze and compare the time complexities of sorting algorithms with different input sizes.
2. Develop a program to find the kth smallest element in an unsorted array using sorting and searching techniques.

UNIT IV TREE STRUCTURES 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi- way search trees

Coding Exercises:

1. Implement binary tree with inorder, preorder, and postorder traversals.
2. Write Python programs to insert, delete, and search elements in a binary search tree.
3. Implement AVL tree rotations and balancing operations.

Problem-solving Assignments:

1. Design a program that converts an unbalanced BST into a balanced AVL tree.
2. Implement a heap and demonstrate heap sort on a dataset.

UNIT V GRAPH STRUCTURES 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – greedy algorithms – dynamic programming – shortest paths – minimum spanning trees – introduction to complexity classes and intractability

Coding Exercises:

1. Represent a graph using adjacency matrix and adjacency list, and implement graph traversals (DFS and BFS).
2. Write Python programs to implement topological sorting for a directed acyclic graph.
3. Implement Dijkstra's algorithm for shortest path in a weighted graph.

Problem-solving Assignments:

1. Develop a program to find the minimum spanning tree of a graph using Prim's or Kruskal's

algorithm.

2 Create a dynamic programming solution for the shortest path problem in a grid.

LIST OF EXPERIMENTS

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implement The Stack And Queue Adt
6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Tree representation and traversal algorithms
9. Implementation of Binary Search Trees
10. Graph representation and Traversal algorithmsA

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the concepts of abstract data types and their role in organizing and managing data efficiently.
- Apply linear data structures, including stacks and queues, to solve computational problems.
- Apply searching and sorting algorithms and evaluate their performance using appropriate complexity measures.
- Analyze tree structures and algorithms for efficient data organization and retrieval.
- Analysis graph structure and traversal techniques for real-world problems.
- Develope Python-based data structures such as lists, stacks, queues, trees, and graphs to solve computational problems.

TEXTBOOKS

1) Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021

2. Kamthane, "Introduction to Data Structures in C", Pearson Education ,first Edition, 2007.

REFERENCES

1) Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015

2) Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011

E-RESOURCES

1) https://nptel.ac.in/courses/110106072 (stack)

2) https://nptel.ac.in/courses/110106073(queue)

Mapping of COs-POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	1	1	1	1	1	2	3	3
CO2	3	3	3	3	2	1	1	2	2	2	2	3	3
CO3	3	3	3	3	2	1	1	2	2	2	3	3	3
CO4	3	3	3	3	2	2	1	1	2	3	3	3	3
CO5	3	3	3	3	3	2	1	3	3	3	3	3	3
CO6	3	3	3	3	3	3	1	3	3	3	3	3	3
AVG	3	3	2.8	2.8	2.1	1.6	1	2	2.1	2.3	2.6	3	3

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEC301 PROFESSIONAL DEVELOPMENT L T P C
0 0 2 1

OBJECTIVES

To be proficient in important Microsoft Office tools: MS WORD, EXCEL and POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate and Convert data

Sort and filter data

Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)

Work with Lookup and reference formulae

Create and Work with different types of charts

Use pivot tables to summarize and analyze data

Perform data analysis using own formulae and functions

Combine data from multiple worksheets using own formulae and built-in functions to generate results

Export data and sheets to other file formats

Working with macros

Protecting data and Securing the workbook

MS POWERPOINT: **10 Hours**

Select slide templates, layout and themes

Formatting slide content and using bullets and numbering

Insert and format images, smart art, tables, charts

Using Slide master, notes and handout master

Working with animation and transitions

Organize and Group slides

Import or create and use media objects: audio, video, animation

Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES

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

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

Chairman - BoS

23ADT401 **ADVANCED NETWORKING AND PROTOCOL** L T P C

3 0 0 3

OBJECTIVES

- To familiarize the concepts, functions, and standards of the Physical and Data Link Layers in computer networks.
- To impart knowledge on network techniques, and Network Layer protocols used for data communication.
- To inclucate routing algorithms and routing protocols used to determine efficient network paths.
- To foster knowledge of Transport Layer protocols for reliable end-to-end data communication.
- To familiarize with Application Layer protocol and services.

UNIT I DATA LINK AND PHYSICAL LAYERS 9

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

Coding Exercises:

1. Implement a Python program to simulate framing techniques (byte stuffing, bit stuffing) for data transmission.
2. Write a program demonstrating CSMA/CD protocol collision detection and resolution.
3. Create a simulator for error detection using CRC (Cyclic Redundancy Check) with polynomial division.

Problem-solving Assignments:

1. Design a flow control mechanism using sliding window protocol with Go-Back-N error recovery.
2. Analyze and implement Ethernet frame format parsing and VLAN tagging for 802.1Q frames.

UNIT II NETWORK LAYER 9

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

Coding Exercises:

1. Implement IPv4 address subnetting calculator with CIDR notation support.
2. Write Python programs for ARP table management and ARP request/response packet simulation.
3. Create an ICMP ping implementation simulator with echo request/reply handling.

Problem-solving Assignments:

1. Design and implement IPv6 address conversion tools (hex to dotted decimal) and prefix calculation.
2. Simulate DHCP client-server interaction including IP address assignment and lease management.

UNIT III ROUTING 9

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

Coding Exercises:

1. Implement Distance Vector Routing algorithm (RIP) with routing table updates and convergence simulation.
2. Write a program for Link State Routing (OSPF) using Dijkstra's algorithm for shortest path computation.
3. Create a BGP path-vector routing simulator showing route advertisement and selection.

Problem-solving Assignments:

1. Design a multicast routing simulator implementing DVMRP with reverse path forwarding.
2. Analyze and implement PIM (Protocol Independent Multicast) sparse mode join/prune messages.

UNIT IV TRANSPORT LAYER 9

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

Coding Exercises:

1. Implement TCP three-way handshake and connection termination (four-way handshake) simulation.
2. Write a congestion control simulator demonstrating slow start, congestion avoidance, and fast recovery.
3. Create UDP packet simulator with checksum calculation and reliability enhancement using timers.

Problem-solving Assignments:

1. Design an SCTP (Stream Control Transmission Protocol) multi-homing and multi-streaming demonstration.
2. Implement Quality of Service (QoS) mechanisms like traffic shaping and leaky bucket algorithm.

UNIT V INTRODUCTION AND APPLICATION LAYER 9

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

Coding Exercises:

1. Create socket programming examples for TCP client-server communication and file transfer.
2. Implement HTTP request parser and simple web server responding to GET/POST requests.
3. Write DNS query simulator resolving domain names to IP addresses using UDP sockets.

Problem-solving Assignments:

1. Design an email client simulator implementing SMTP for sending and POP3/IMAP for receiving emails.
2. Create SNMP agent simulation with MIB (Management Information Base) walk and set operations.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the concepts and functions of data link and physical layers.
- Explain the mastery of IPV4,IPV6,Subnetting and key network layer protocols.
- Analysis different routing protocols such as RIP,OSPF and BGP.
- Analyze transport layer protocols including TCP,UDP and SCTP.
- Explain the functions of application layer protocols such as HTTP,FTP,and DNS.

TEXT BOOKS

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

REFERENCES

1. Larry L. Peterson, Bruce S. Davie," Computer Networks: A Systems Approach", Morgan Kaufmann Publishers Inc., Fifth Edition, 2012.
2. William Stallings, "Data and Computer Communications", Pearson Education Tenth Edition, 2013

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106091/ (Introduction to Computer Networks
2. https://nptel.ac.in/courses/106/105/106105082/ (Computer Networks)

Mapping of COs-POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	2	-	-	-	-	-	2	2
CO2	3	3	2	2	3	2	-	-	-	-	-	3	2
CO3	3	3	2	2	3	2	-	-	-	-	-	3	2
CO4	3	3	2	2	3	2	-	-	-	-	-	3	2
CO5	3	3	2	2	3	2	1	1	3	2	3	3	3
AVG	3	3	1.8	2	3	2	0.2	0.2	0.6	0.4	0.6	2.8	2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ITT401 OBJECT ORIENTED SOFTWARE DESIGN L T P C
3 0 0 3

OBJECTIVES

- To familiarize students with the concepts and life cycle models of software development.
- To train students in Software Requirement Specification and Use case model.
- To develop skills in software design, testing techniques, maintenance, and reengineering.
- To impart knowledge on Unified Process, use cases, and UML diagrams..
- To aquire knowledge on GRASP, software quality assurance, and object-oriented testing practices.

UNIT I INTRODUCTION 9

Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management

Coding Exercises:

1. Implement a Python program to simulate the Classical Waterfall model phases for a simple project.
2. Create a project scheduling tool using PERT/CPM algorithms to calculate critical path.
3. Write a configuration management system using Git commands to track software versions.

Problem-solving Assignments:

1. Develop a risk management tool that identifies, prioritizes, and tracks project risks with mitigation strategies.
2. Design an estimation model comparing COCOMO and Function Point Analysis for a sample project.

UNIT II SOFTWARE REQUIREMENT SPECIFICATION 9

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

Coding Exercises:

1. Create a Python program to generate UML Use Case diagrams from textual requirements.
2. Implement a Finite State Machine simulator for system behavior modeling.
3. Write a DFD (Data Flow Diagram) generator that parses process specifications into visual

diagrams.

Problem-solving Assignments:

1. Develop a complete SRS document for a Library Management System using UML diagrams.
2. Design a Petri Net model for a banking transaction system and simulate its execution.

UNIT III DESIGN, TESTING & MAINTENANCE 9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns –Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking-Maintenance and Reengineering-BPR model Reengineering process model-Reverse and Forward Engineering.

Coding Exercises:

1. Implement unit testing framework using JUnit/Pytest for a sample banking application.
2. Create a code coverage tool that measures statement, branch, and path coverage.
3. Write a symbolic execution engine for simple arithmetic expressions.

Problem-solving Assignments:

1. Design and implement black box and white box test cases for an e-commerce checkout module.
2. Develop a reengineering tool that converts procedural code to object-oriented design using BPR model.

UNIT IV UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics - Unified Process - UML diagrams - Use Case - Case study - the Next Gen POS system, Inception -Use case Modeling - Relating Use cases - include, extend and generalization - When to use Use-cases - Class Diagram- Aggregation and Composition - Relationship between sequence diagrams and use cases

Coding Exercises:

1. Implement a Use Case modeling tool supporting include, extend, and generalization relationships.
2. Create a sequence diagram generator from use case scenarios using PlantUML.
3. Write a class diagram validator checking aggregation, composition, and association rules.

Problem-solving Assignments:

1. Apply Unified Process to develop inception phase artifacts for NextGen POS system.
2. Design complete UML diagrams (use case, class, sequence) for an online booking system.

UNIT V DESIGN PATTERNS & TESTING 9

GRASP: Designing objects with responsibilities - Creator - Information expert - Low Coupling - High Cohesion - Controller Design Patterns - creational - factory method - structural - Bridge - Adapter -

behavioural - Strategy - observer - Applying GoF design patterns - Mapping design to code-object Oriented Methodologies - Software Quality Assurance - Impact of object orientation on Testing - Develop Test Cases and Test Plans

Coding Exercises:

1. Implement GRASP patterns (Creator, Information Expert, Low Coupling) in a sample inventory system.
2. Create Factory Method, Bridge, and Strategy design patterns for a graphics rendering application.
3. Develop Observer pattern for real-time stock price monitoring system.

Problem-solving Assignments:

1. Apply GoF design patterns to refactor a monolithic e-commerce system into modular architecture.
2. Create comprehensive test plans and test cases for an object-oriented banking application with 90% code coverage.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain software engineering concepts, development activities, and software lifecycle models..
- Design Software Requirement Specifications and develop use case models.
- Apply software design, testing, maintenance, and reengineering techniques.
- Apply the concept of Unified Process, use cases, and UML diagrams for software development.
- Analysis design pattern and testing practices.

TEXT BOOKS

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education ,Third Edition, 2005.
2. Bernd Bruegge, Alan H Dutoit, "Object-Oriented Software Engineering", Pearson Education, Second Edition, , 2004.
3. Len Bass, Ingo Weber and Liming Zhu," DevOps: A Software Architect's Perspective", Pearson Education, 2016

REFERENCES

1. Rajib Mall," Fundamentals of Software Engineering", PHI Learning Pvt. Ltd., Third edition, 2009.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Addison Wesley, Third edition, 2003.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105182 (Software Models)
2. https://onlinecourses.nptel.ac.in/noc20_cs84/preview (OO models)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CST301 OPERATING SYSTEMS L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the basic concepts and functions of operating systems.
- To enhance knowledge on CPU scheduling algorithms and process synchronization mechanisms.
- To impart understanding of memory management concepts including segmentation.
- To inculcate knowledge of storage management systems and file organization.
- To foster awareness on the fundamentals of virtual machines and mobile operating systems.

UNIT I INTRODUCTION 9

Computer System – Elements and organization; Operating System Overview – Objectives and Functions – Evolution of Operating System; Operating System Structures – Operating System Services – User Operating System Interface – System Calls – System Programs – Design and Implementation – Structuring methods

Coding Exercises:

1. Implement a simple system call simulator in Python that demonstrates user-kernel mode transitions.
2. Create a program simulating different OS structuring methods (e.g., monolithic kernel vs microkernel).
3. Write a shell program that demonstrates OS services like process creation, file operations, and system information.

Problem-solving Assignments:

1. Design and implement an OS bootstrap loader that initializes system services and user interface.
2. Develop a program comparing different OS evolution stages (batch, multiprogramming, time-sharing).

UNIT II PROCESS MANAGEMENT 9

Processes – Process Concept – Process Scheduling – Operations on Processes – Inter-process Communication; CPU Scheduling – Scheduling criteria – Scheduling algorithms: Threads – Multithread Models – Threading issues; Process Synchronization – The Critical-Section problem – Synchronization hardware – Semaphores – Mutex – Classical problems of synchronization – Monitors; Deadlock – Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

Coding Exercises:

1. Implement CPU scheduling algorithms: FCFS, SJF, Priority, and Round Robin with Gantt charts.
2. Create a multi-threaded program demonstrating thread creation, synchronization using

mutex/semaphore.

3. Simulate producer-consumer problem using semaphores and solve dining philosophers problem.

Problem-solving Assignments:

1. Design a deadlock detection and recovery system using Banker's algorithm for resource allocation.
2. Implement process synchronization for readers-writers problem with multiple readers allowed.

UNIT III MEMORY MANAGEMENT 9

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

Coding Exercises:

1. Implement paging simulator with page table management and TLB (Translation Lookaside Buffer).
2. Write page replacement algorithms: FIFO, LRU, Optimal with page fault calculations.
3. Create a memory allocation simulator for first-fit, best-fit, and worst-fit strategies.

Problem-solving Assignments:

1. Design a virtual memory manager handling demand paging, copy-on-write, and thrashing detection.
2. Implement segmentation with paging and demonstrate memory protection mechanisms.

UNIT IV STORAGE MANAGEMENT 9

Mass Storage system – Disk Structure – Disk Scheduling and Management; File-System Interface – File concept – Access methods – Directory Structure – Directory organization – File system mounting – File Sharing and Protection; File System Implementation – File System Structure – Directory implementation – Allocation Methods – Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem

Coding Exercises:

1. Implement disk scheduling algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK with seek time calculations.
2. Create a file system simulator with directory structure, file allocation (contiguous, linked, indexed).
3. Write a program demonstrating free space management using bitmaps and linked lists.

Problem-solving Assignments:

1. Design a complete file system implementation with mounting, sharing, and protection mechanisms.
2. Implement I/O subsystem with buffering, caching, and disk I/O optimization strategies.

UNIT V VIRTUAL MACHINES AND MOBILE OS 9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their

Implementations, Virtualization and Operating-System Components: Mobile OS – iOS and Android

Coding Exercises:

1. Create a simple virtual machine simulator with memory isolation and process migration.
2. Implement Android/iOS app lifecycle management and inter-process communication simulation.
3. Write a hypervisor basic implementation demonstrating VM creation and resource allocation.

Problem-solving Assignments:

1. Design a mobile OS power management system optimizing battery life with app scheduling.
2. Develop a containerization system using namespaces and cgroups for process isolation.

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the fundamental structure, objectives and evolution of operating systems.
- Analyze process management concepts including scheduling, synchronization and deadlock handling mechanisms.
- Apply memory management techniques to optimize system performance.
- Examine storage management concepts including file systems, disk scheduling and I/O systems.
- Describe the principles of virtualization and features of iOS and Android operating systems.

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley and Sons Inc., Tenth Edition, 2018
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, Fifth Edition, 2022

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", Prentice Hall, Seventh Edition, 2018.

E-RESOURCES

1. https://nptel.ac.in/courses/106105214(Operating system fundamentals)
2. https://nptel.ac.in/courses/106106144(Introduction to operating systems)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	-	-	-	-	-	-	2	2
2	3	3	3	3	3	-	-	-	-	-	-	3	3
3	3	3	3	3	3	-	-	-	-	-	-	3	3
4	3	3	3	3	3	-	-	-	-	-	-	3	3
5	3	3	3	2	3	2	-	-	-	-	-	3	3
Avg	3	2.6	2.6	2.6	2.8	1	-	-	-	-	-	2.8	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE401	DATA SCIENCE AND ANALYTICS	L T P C
	(Lab Embedded Theory Course)	3 0 2 4

OBJECTIVES

- To teach the concepts on data retrieval, cleaning, transformation, and analysis processes.
- To impart knowledge normal distributions and regression models in data analysis.
- To foster inferential statistical methods for data-driven decision making.
- To familizer hypothesis testing techniques for statistical modeling.
- To acquire knowledge on statistical methods for decision making and predictive modeling.
- To explore data science methodologies to solve real-world problems.

UNIT I INTRODUCTION 9

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

Coding Exercises:

1. Implement a complete data science pipeline using pandas: data retrieval, cleansing, transformation, and exploratory data analysis on a CSV dataset.
2. Write Python functions for data integration from multiple sources (CSV, JSON, API) and create summary statistics visualizations.
3. Develop a data preprocessing pipeline handling missing values, outliers, and feature scaling using scikit-learn.

Problem-solving Assignments:

1 Design an end-to-end data science project analyzing customer churn data from research goal setting to model deployment.

2. Create an exploratory data analysis dashboard for sales data using matplotlib/seaborn with key insights and recommendations.

UNIT II PROCESS MANAGEMENT 9

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean .

Coding Exercises:

1. Implement z-score calculations and normal distribution probability computations using scipy.stats.
2. Write functions to compute Pearson correlation coefficient and create scatter plots with regression lines using numpy/matplotlib.
3. Develop multiple linear regression model using statsmodels and interpret R^2, standard error of estimate.

Problem-solving Assignments:

1. Analyze relationship between house prices and features (size, location, age) using correlation and regression analysis.
2. Create a prediction model for student performance based on study hours, attendance, and prior grades.

UNIT III INFERENTIAL STATISTICS 9

Populations – samples – random sampling – probability and statistics Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations.

Coding Exercises:

1. Simulate sampling distributions and calculate standard error of the mean for different sample sizes using numpy.
2. Implement z-test procedure with null/alternate hypotheses, p-values, and decision rules for population proportion testing.
3. Write functions for hypothesis testing on means with confidence intervals and power analysis.

Problem-solving Assignments:

1. Conduct A/B testing analysis for website conversion rates using z-test and interpret statistical significance.
2. Analyze survey data to test if average customer satisfaction differs significantly between product versions.

UNIT IV T-TEST

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – t-test for two related samples 9

Coding Exercises:

1. Implement one-sample t-test and two-independent samples t-test using scipy.stats.ttest_1samp and ttest_ind.
2. Write functions calculating degrees of freedom, p-values, effect size (Cohen's d), and confidence intervals.
3. Develop paired t-test for before-after treatment analysis with data visualization.

Problem-solving Assignments:

1. Analyze drug efficacy study comparing treatment vs control group blood pressure readings using independent t-test.
2. Evaluate employee training program effectiveness using paired t-test on pre/post training performance scores.

UNIT V ANALYSIS OF VARIANCE 9

F-test – ANOVA – estimating effect size – multiple comparisons – case studies Analysis of variance with repeated measures Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA Introduction to chi-square tests

Coding Exercises:

1. Implement one-way ANOVA and two-way ANOVA using scipy.stats.f_oneway and statsmodels.
2. Write functions for post-hoc multiple comparisons (Tukey HSD) and effect size calculations (eta-squared).
3. Develop chi-square test implementation for categorical data independence testing.

Problem-solving Assignments:

1. Analyze crop yield differences across multiple fertilizer treatments using one-way ANOVA with post-hoc analysis.
2. Conduct two-factor ANOVA studying effects of teaching method and student background on exam scores.

LIST OF EXPERIMENTS

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions, Averages, Variability
5. Normal curves
6. Correlation and scatter plots
7. Correlation coefficient

8. Regression
9. Z-test case study
10. T-test case studies

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Explain data retrieval, cleaning, transformation, and analysis processes.
- Apply normal distributions and regression models for data analysis..
- Analysis inferential statistical methods for data-driven decision making.
- Apply hypothesis testing techniques for statistical modeling..
- Analysis statistical methods for decision-making and predictive modeling.
- Apply data science methodologies to solve real-world problems.

TEXT BOOKS

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

REFERENCES

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.

E-RESOURCES

1. https://nptel.ac.in/courses/108/105/106105219/ (Introduction data science)
2. https://nptel.ac.in/courses/108/102/106102132/ (time series)

Mapping of COs-POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	2	2	3	3	2
CO2	3	3	2	3	3	2	-	-	2	2	3	3	2
CO3	3	3	2	3	3	1	-	-	2	2	3	3	3
CO4	3	3	2	3	3	1	-	-	2	2	3	3	3
CO5	3	3	2	3	3	1	-	-	2	2	3	3	3
CO6	3	3	3	3	3	1	1	1	1	1	1	3	3
AVG	3	3	3	3	3	1.3	0.16	0.16	1.8	1.8	2.7	3	2.7

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE402	MACHINE LEARNING ESSENTIALS	L T P C
	(Lab Embedded Theory Course)	3 0 2 4

OBJECTIVES

- To impart fundamental concepts and principles of machine learning.
- To train students in supervised learning algorithms.
- To foster unsupervised learning and ensemble techniques for pattern discovery and prediction.

  To familiarize students with machine learning experimentation, cross-validation, performance evaluation, and statistical significance testing..
- To impart reinforcement learning concepts, algorithms, and learning strategies.
- To develop practical skills in implementing and evaluating machine learning algorithms using real-world datasets.

UNIT I MACHINE LEARNING BASICS 9

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

Coding Exercises:

1. Implement matrix operations (dot product, transpose, inverse) using NumPy for linear algebra review.
2. Write functions to calculate VC dimension for simple hypothesis spaces and plot PAC learning curves.
3. Create visualizations demonstrating bias-variance tradeoff using polynomial regression models.

Problem-solving Assignments:

1. Analyze and visualize inductive bias effects on different hypothesis spaces using synthetic datasets.
2. Implement and compare generalization performance across varying training set sizes.

UNIT II SUPERVISED LEARNING 9

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

Coding Exercises:

1. Implement linear regression from scratch using gradient descent and compare with sklearn implementation.
2. Write Perceptron algorithm and Naive Bayes classifier for binary classification on Iris dataset.
3. Implement SVM with kernel trick (linear, RBF) using sklearn and visualize decision boundaries.

Problem-solving Assignments:

1. Build and compare Decision Tree vs Random Forest models for customer churn prediction.
2. Implement Bayesian linear regression with prior distributions and posterior inference.

UNIT III UNSUPERVISED LEARNING 9

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

Coding Exercises:

1. Implement K-means clustering from scratch and compare with sklearn on synthetic datasets.
2. Write KNN classifier with different distance metrics (Euclidean, Manhattan, Minkowski).
3. Implement Gaussian Mixture Model using EM algorithm and visualize clusters.

Problem-solving Assignments:

1. Compare ensemble methods: Bagging, Boosting (AdaBoost), Stacking on UCI datasets.
2. Design customer segmentation system using K-means + GMM on retail transaction data.

UNIT IV DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

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

Coding Exercises:

1. Implement K-fold cross-validation, stratified K-fold, and bootstrap resampling techniques.
2. Write functions for classifier evaluation metrics (precision, recall, F1, ROC-AUC, confusion matrix).
3. Perform statistical tests: McNemar's test, paired t-test for comparing two classifiers.

Problem-solving Assignments:

1. Design complete ML experiment pipeline with hyperparameter tuning using GridSearchCV.
2. Analyze model performance across multiple datasets using proper statistical comparisons.

UNIT V REINFORCEMENT LEARNING 9

Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal- difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in

reinforcement learning

Coding Exercises:

1. Implement Q-Learning algorithm for FrozenLake environment and visualize learning curves.
2. Write Temporal Difference (TD) learning for predicting state values in GridWorld.
3. Create simple multi-armed bandit problem with epsilon-greedy and UCB exploration strategies.

Problem-solving Assignments:

1. Design and implement a reinforcement learning agent solving CartPole using Q-Learning + experience replay.
2. Compare policy gradient methods vs value-based methods (DQN) on Atari games simulation.

LIST OF EXPERIMENTS

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

TOTAL: 45+15= 60 PERIODS

OUTCOMES

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

- Explain fundamental machine learning concepts, hypothesis spaces, generalization, and bias-variance trade-off.

- Apply supervised learning algorithms for regression and classification problems.
- Apply unsupervised learning and ensemble techniques for pattern discovery and prediction.
- Evaluate machine learning models using cross-validation, performance measures, and statistical significance tests.
- Explain reinforcement learning concepts, algorithms, and learning strategies.
- Implement machine learning algorithms and evaluate their performance using real-world datasets..

TEXT BOOKS

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

REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, Third Edition, 2007.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105152/ (Different Types of Learning)
2. https://nptel.ac.in/courses/106/106/106106202/ (Learning Problem)

Mapping of COs-POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	3	2	-	2	2	1	3	3	3
CO2	2	2	3	2	2	3	2	2	3	2	2	3	2
CO3	3	3	3	3	3	2	-	2	2	2	3	3	3
CO4	3	3	3	3	3	2	-	2	2	2	3	3	3
CO5	3	3	3	3	3	2	-	2	2	2	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3
AVG	2.7	2.7	2.7	2.7	2.7	2.3	0.8	2.1	2.3	2	2.8	3	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSE402 **DATABASE MANAGEMENT SYSTEMS** L T P C
3 0 2 4

OBJECTIVES

The main objective of the course is,

- To impart the fundamentals of data models, relational algebra and SQL.
- To familiarize the database system using ER diagrams and normalization techniques.
- To develop the comprehensive knowledge of transaction processing, concurrency control techniques and recovery procedures.
- To enable the student to understand the internal storage structures using different file and indexing techniques for database design.
- To foster the knowledge on different database structures and information retrieval techniques.
- To provide practical exposure in relational database design, SQL programming and database connectivity for real world application development.

UNIT I: RELATIONAL DATABASES 9

Introduction: Database System Application-Purpose of Database System – Views of data -Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Embedded SQL– Dynamic SQL

Coding Exercises:

1. Create SQL scripts using DDL commands to create and modify relational tables.
2. Write SQL queries using DML commands to insert, update, delete, and retrieve data.
3. Implement basic relational algebra operations using SQL queries.

Problem-Solving Assignments:

1. Analyze a real-world application and design its relational schema with appropriate keys.
2. Convert given relational algebra expressions into equivalent SQL queries.

UNIT II : DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model –ER Design Issues - Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form- Join Dependencies and Fifth Normal Form

Coding Exercises:

1. Draw ER diagrams for given problem statements using database design tools.
2. Convert ER diagrams into relational schemas with constraints.
3. Normalize unnormalized tables up to 3NF and BCNF.

Problem-Solving Assignments:

1. Design a complete database schema for a real-world system (Library, Hospital, Banking).
2. Analyze functional dependencies and perform lossless decomposition.

UNIT III : TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – SQL Facilities for Concurrency and Recovery.

Coding Exercises:

1. Write SQL programs demonstrating COMMIT, ROLLBACK, and SAVEPOINT.
2. Simulate concurrent transactions and observe isolation issues.
3. Implement simple locking behavior using transaction blocks.

Problem-Solving Assignments:

1. Analyze given schedules and determine their serializability.
2. Identify deadlock scenarios and propose suitable prevention techniques.

UNIT IV : PHYSICAL STORAGE AND INDEXING TECHNIQUES 9

Overview of Physical Storage Media - Magnetic Disks - RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Measure the Cost Estimation.

Coding Exercises:

1. Create indexed tables and analyze query performance.
2. Implement SQL queries using indexed attributes and compare execution cost.
3. Simulate hashing techniques using simple programs.

Problem-Solving Assignments:

1. Compare different indexing techniques and justify their use in specific scenarios.
2. Estimate query execution costs for given query plans.

UNIT V : ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object- based Databases: Object Database Concepts, Object-Relational features - XML Databases: XML Hierarchical Model, purpose of XML -Information Retrieval: IR Concepts and Advantages.

Coding Exercises:

1. Write XML documents and query them using basic XML techniques.
2. Implement object-relational features using user-defined types.
3. Simulate distributed database queries using multiple schemas.

Problem-Solving Assignments:

1. Design a distributed database architecture for a multi-branch organization.
2. Compare relational, object-relational, and XML databases for specific applications.

LIST OF EXPERIMENTS

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Implement Relational model to entitle ann strong and weak entities.
3. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
4. Views, Sequences, Synonyms.
5. Database Programming: Implicit and Explicit Cursors.
6. Procedures and Functions.
7. Triggers.
8. Exception Handling.
9. Database Design using ER modelling, normalization and Implementation for any application.
10. Database Connectivity with Front End Tools.
11. Case Study using real life database applications.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Explain the fundamentals of data models, relational algebra and SQL.
- Apply ER diagrams and normalization techniques in database applications.
- Analyze transaction processing, concurrency control techniques and recovery procedures for database transactions.
- Analyze the internal storage structures and indexing techniques for improving the database design.
- Analyze the different database structures and information retrieval techniques for efficient data management.

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —Database System Concepts, Sixth Edition, Tata McGraw Hill,2011.
2. Ramez Elmasri, Shamkant B.Navathe,—Fundamentals of Database Systems, Sixth Edition, Pearson Education,2011.

REFERENCES

1. C.J.Date,A.Kannan,S.Swamynathan,"An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, McGraw–Hill College Publications, 2015.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105175/ (Introduction to DBMS)
2. https://nptel.ac.in/courses/106/106/106106093/ (Conceptual Designs)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	3	3
2	3	3	3	2	3	-	-	-	-	-	2	3	3
3	3	3	3	3	3	-	-	-	-	-	2	3	3
4	3	3	3	3	3	-	-	-	-	-	2	3	3
5	3	3	2	3	3	2	-	-	2	2	3	3	3
6	3	3	3	3	3	2	1	3	3	3	3	3	3
AVG	3	3	2.67	2.5	2.83	0.67	0.17	0.50	0.83	0.83	2.33	3	3

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEC401 **ONLINE COURSE COMPLETION** L T P C 3 0 0 3

Students may be permitted to study online courses (NPTEL, SWAYAM or any Proctored Assessment Certification Courses) with 3 credits during the 4th semester curriculum for all B.E./B.Tech. Programmes. Such courses offered to students shall be recommended by the Department Academic Committee (DAC). The DAC shall ensure that the courses offered are not core courses in their respective curriculum.

The number of credits and transfer of credits are based on the procedure explained in following Table. The mapping of marks with grades is applicable only if the student passes the course as per the guidelines of NPTEL.

S.No.	No. of Weeks	Credits
1	4	1
2	8	2
3	12	3
4	16	4

Chairman - BoS

23ADT501 **UI AND UX DESIGN** L T P C
3 0 0 3

OBJECTIVES

- To teach the fundamentals of design thinking.
- To familiarize the knowledge on UI design principles and elements.
- To foster UX design process and user research.
- To train the students in wireframing, prototyping, and usability testing.
- To impart the knowledge user stories, personas, and information architecture..

UNIT I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

Coding Exercises:

1. Conduct a brainstorming session using divergent and convergent thinking techniques and document the ideas.
2. Create an empathy map based on user observations of a real or hypothetical problem.
3. Write a report comparing UI vs UX design concepts in a chosen popular app.

Problem-solving Assignments:

1. Develop a design thinking plan applying core stages (empathize, define, ideate, prototype, test) on a daily life problem.
2. Analyze a case study to identify points where observational empathy can improve user engagement.

UNIT II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

Coding Exercises:

1. Create style guides including color palettes, typography, and UI element specifications for a sample brand.
2. Design a reusable UI component library (buttons, forms, navigation) with interaction behaviors.
3. Build wireframes for a simple app focusing on visual hierarchy and layout using a tool like Figma or Sketch.

Problem-solving Assignments:

1. Evaluate an existing app's UI design against UI principles and propose improvements.

2. Develop a branding strategy for a startup including logo design, color scheme, and style guide.

UNIT III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

Coding Exercises:

1. Conduct user interviews and synthesize research findings into user needs and goals.
2. Create personas and map user journeys focusing on pain points and opportunities.
3. Develop a UX process document outlining research methods, design, and testing plans.

Problem-solving Assignments:

1. Design a UX research plan including methodologies, sampling, and data analysis for a mobile app.
2. Analyze how business goals align or conflict with user needs in a real-world project.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

Coding Exercises:

1. Sketch low-fidelity wireframes and create a clickable prototype using design tools.
2. Conduct usability tests on prototypes and record metrics and feedback.
3. Iterate on the prototype incorporating test findings and design improvements.

Problem-solving Assignments:

1. Design a usability test plan for an e-commerce website including participant recruitment and tasks.
2. Analyze and present usability test findings to stakeholders with recommendations for iteration.

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Coding Exercises:

1. Write problem statements based on user research and business requirements.
2. Create flow diagrams and user stories for a task-oriented application.
3. Develop an information architecture sitemap for a content-rich website.

Problem-solving Assignments:

1. Conduct a card sorting exercise to improve website navigation and analyze results.
2. Design a scenario-based user story for an online booking system focusing on edge cases.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Explain the fundamentals of design thinking.
- Apply UI design principles to create effective user interfaces.
- Apply the UX design process, user research, and business goals.
- Analysis wireframing, prototyping, and usability testing techniques to design real world applications.
- Develop user stories, personas, and information architecture.

TEXT BOOKS

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", O'Reilly, 2021

REFERENCES

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface", O'Reilly, Third Edition, 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018

E-RESOURCES

1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	-	-	-	1	2	-	2	2
2	3	3	3	3	3	-	-	-	1	3	-	2	2
3	3	3	3	2	2	1	1	1	2	3	-	3	3
4	3	3	3	3	3	3	-	-	-	2	3	1	3
5	3	3	3	3	2	-	-	1	2	3	2	3	3
AVG	3	3	3	2.8	2.6	2	1	1	1.5	2.6	1	2.2	2.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE501	DEEP LEARNING	L T P C
		3 0 2 4

OBJECTIVES

- To impart the fundamental concepts of deep learning, neural networks, optimization, and regularization.
- To train students in convolutional neural networks for image processing and classification.
- To foster the use of recurrent neural networks and LSTM architectures for sequence modeling and text analysis.
- To familiarize students with deep learning model evaluation, hyperparameter tuning, and debugging techniques.
- To impart knowledge of autoencoders and generative models for representation learning and data generation.
- To develop practical skills in preprocessing, training, tuning, and evaluating deep learning models using real-world datasets.

UNIT I DEEP NETWORKS BASICS 9

Linear Algebra: Scalars - Vectors -- Matrices and tensors; Probability Distributions - Gradient-based Optimization – Machine Learning Basics: Capacity - Over fitting and under fitting - Hyper parameters and validation sets - Estimators - Bias and variance -Stochastic gradient descent - Challenges motivating deep learning: Deep Networks: Deep feed forward networks-Regularization - Optimization.

Coding Exercises:

1. Implement matrix and tensor operations (dot product, transpose) from scratch using NumPy.
2. Write Python code to simulate gradient descent optimization and visualize the loss curve.
3. Create functions to demonstrate bias-variance trade-off with polynomial regression models.

Problem-solving Assignments:

1. Analyze a dataset with overfitting and underfitting models, implementing techniques to mitigate.
2. Develop a neural network from scratch to classify a basic dataset like MNIST digits.

UNIT II CONVOLUTIONAL NEURAL NETWORKS 9

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

Coding Exercises:

1. Implement convolution, pooling operations manually on sample image matrices.
2. Build a CNN in TensorFlow/Keras for image classification using CIFAR-10 dataset.

3 Experiment with different convolution variants: strides, dilated, and transposed convolutions.

Problem-solving Assignments:

1. Design image augmentation and regularization strategies to improve model generalization.
2. Fine-tune a pre-trained CNN model using transfer learning for a custom dataset.

UNIT III RECURRENT NEURAL NETWORKS 10

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder--Transducer; Gradient Computation - Sequence Modeling Conditioned on Contexts -- Bidirectional RNN -- Sequence to Sequence RNN Deep Recurrent Networks - Recursive Neural Networks - Long Term Dependencies- Leaky Units: Skip connections and dropouts - Gated Architecture: LSTM.

Coding Exercises:

1. Implement simple RNN and LSTM cells using PyTorch or TensorFlow.
2. Create a character-level language model using RNNs to generate text sequences.
3. Build a bidirectional RNN for sentiment analysis on movie reviews.

Problem-solving Assignments:

1. Design a sequence-to-sequence model for machine translation tasks.
2. Analyze and address vanishing/exploding gradients in deep recurrent networks.

UNIT IV MODEL EVALUATION 8

Performance metrics - Baseline Models - Hyperparameters: Manual Hyper parameter --Automatic Hyperparameter -- Grid search -- Random search -- Debugging strategies.

Coding Exercises:

1. Implement k-fold cross-validation and grid search for hyperparameter tuning on model pipelines.
2. Write code to compute performance metrics: accuracy, precision, recall, F1 score, ROC-AUC.
3. Create visualization tools for confusion matrix, learning curves, and ROC curves.

Problem-solving Assignments:

1. Conduct comparative evaluation of two classifiers with McNemar's test and paired t-test.
2. Debug and optimize hyperparameter tuning strategy to improve classifier performance.

UNIT V AUTOENCODERS AND GENERATIVE MODELS 9

Autoencoders: Undercomplete autoencoders -- Regularized autoencoders -- Stochastic encoders and decoders -- Learning with autoencoders; Deep Generative Models: Variation autoencoders -Generative adversarial networks.

Coding Exercises:

1. Build basic autoencoder architecture and train on MNIST for dimensionality reduction.

2. Implement variational autoencoder and visualize latent space interpolations.
3. Create and train GAN (Generative Adversarial Network) to generate synthetic images.

Problem-solving Assignments:

1. Design experiments to compare performance of different types of autoencoders with various regularizations.
2. Develop a deep generative model pipeline for image synthesis and evaluate output quality.

LIST OF EXPERIMENTS

1. Solving XOR problem using DNN
2. Character recognition using CNN
3. Face recognition using CNN
4. Language modeling using RNN
5. Sentiment analysis using LSTM
6. Parts of speech tagging using Sequence to Sequence architecture
7. Machine Translation using Encoder-Decoder model
8. Image augmentation using GANs
9. Mini-project on real world applications

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of deep learning, neural networks, optimization, and regularization.
- Apply convolutional neural networks for image processing and classification.
- Apply recurrent neural networks and LSTM architectures for sequence modeling and text analysis.
- Analysis deep learning models using performance metrics, hyperparameter tuning, and debugging techniques.
- Explain autoencoders and generative models for representation learning and data generation.
- Implement deep learning models and evaluate their performance using real-world datasets..

TEXT BOOKS

1. Andrew Glassner, "Deep Learning: A Visual Approach", No Starch Press, 2021
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.

REFERENCES

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105152/ (Different Types of Learning)
2. https://nptel.ac.in/courses/106/106/106106202/ (Learning Problem)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	3	1	-	-	-	2	3	1	3	3
2	2	2	2	3	3	-	-	-	1	2	2	1	1
3	3	3	3	3	3	-	-	-	2	1	1	2	1
4	3	3	1	1	1	-	-	-	1	3	1	2	1
5	3	2	2	2	3	-	-	-	2	3	2	2	3
6	3	3	3	3	2	-	-	-	1	2	3	3	3
Avg	2.6	2.6	1.6	2	1.4	-	-	-	2	2.4	2.2	2.4	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE502 **IOT AND ITS APPLICATIONS** L T P C

3 0 2 4

OBJECTIVES

- To impart knowledge of IoT architectures, smart objects, sensors, actuators, and IoT functional components.
- To train students in IoT communication protocols, access technologies, networking, and security mechanisms.
- To develop skills in designing and programming IoT systems using Arduino, Raspberry Pi, and embedded technologies.
- To foster skills in IoT data analytics, edge and cloud computing, streaming technologies, and supporting services.
- To enable students to design and develop IoT solutions for smart cities, manufacturing, power utilities, and other industrial applications.

UNIT I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Coding Exercises:

1. Write a program to simulate data collection from multiple sensors and aggregate the readings.
2. Develop a Python script to represent IoT device states and transitions in a simplified IoT architecture.
3. Create a program to model communication between smart objects using MQTT protocol.

Problem-solving Assignments:

1. Design a fog computing model simulating data processing at edge and cloud layers for smart city sensors.
2. Analyze the functional blocks of an IoT ecosystem and propose enhancements for scalability.

UNIT II IoT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

Coding Exercises:

1. Implement a simulator for IEEE 802.15.4 MAC layer access mechanism with collision avoidance.
2. Develop a program demonstrating IPv6 addressing and routing optimized for low power networks.
3. Write a simple CoAP client-server interaction model to exchange sensor data.

Problem-solving Assignments:

1. Design a secure MQTT-based communication protocol for constrained IoT nodes.
2. Simulate routing over Low Power and Lossy Networks (RPL) to evaluate packet delivery efficiency.

UNIT III DESIGN AND DEVELOPMENT 9

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

Coding Exercises:

1. Write Arduino code to interface temperature and light sensors and send data over serial communication.
2. Implement a Raspberry Pi program using Python to read sensor data and activate actuators.
3. Develop embedded C code to control actuators based on sensor input with timing delays.

Problem-solving Assignments:

1. Design an IoT system using Raspberry Pi and Arduino modules to monitor and control home appliances remotely.
2. Develop an efficient embedded computing logic protocol for sensor data aggregation and transmission.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF – YANG.

Coding Exercises:

1. Write Python scripts to process structured and unstructured IoT data using Pandas and NumPy.
2. Implement a Kafka producer-consumer model to handle streaming IoT sensor data.
3. Develop a simple Django web application to visualize IoT data collected from sensors.

Problem-solving Assignments:

1. Design an edge analytics pipeline that filters and aggregates sensor data before cloud upload.
2. Implement a scalable IoT data storage solution integrating NoSQL databases and Hadoop

ecosystem.

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS **9**

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Coding Exercises:

1. Create a mock IoT system simulator for smart lighting control based on occupancy and ambient light.
2. Implement data ingestion and monitoring modules similar to IBM Watson IoT platform use cases.
3. Develop a smart parking lot management system using layered architecture and sensor networks.

Problem-solving Assignments:

1. Analyze the architecture of a smart city IoT deployment focusing on communication, data handling, and control.
2. Design a converged plant-wide Ethernet (CPwE) model for industrial Ethernet communication.

LIST OF EXPERIMENTS

1. Sense the Available Networks Using Arduino
2. Measure the Distance Using Ultrasonic Sensor and Make Led Blink using Ardunio
3. Detect the Vibration of an Object Using Arduino
4. Connect with the Available Wi-Fi Using Arduino
5. Sense a Finger When it is Placed on Board Using Arduino
6. Temperature Notification Using Arduino
7. LDR to Vary the Light Intensity of LED Using Arduino
8. MySQL Database Installation in Raspberry Pi
9. SQL Queries by Fetching Data from Database in Raspberry Pi
10. Switch light on and off based on the user using Raspberry

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the architectures, components, smart objects, sensors, and actuators of IoT systems.
- Apply IoT communication protocols, networking technologies, and security mechanisms for IoT applications.
- Design and implement IoT systems using Arduino, Raspberry Pi, and embedded technologies.

- Analyze IoT data using edge, cloud, streaming, and data analytics technologies.
- Develop IoT solutions for smart cities, manufacturing, power utilities, and other industrial applications.

TEXT BOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
2. ArshdeepBahga, Vijay Madisetti,"Internet of Things – A hands–on approach", Universities Press, 2015.

REFERENCES

1. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols". Wiley, 2012 .
2. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle,"From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105166/ (Introduction to IoT)
2. https://nptel.ac.in/courses/108/108/108108098/ (IoT Protocols)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	3	1	3	-	-	-	3	2	2	3	1
2	2	1	3	2	1	-	-	-	2	1	1	3	3
3	3	3	1	2	2	-	-	-	3	2	1	3	1
4	3	1	2	2	2	-	-	-	1	2	1	3	1
5	1	1	2	3	2	-	-	-	3	2	1	3	3
6	1	1	2	3	2	-	-	-	3	2	1	3	3
Avg	1.8	1.3	2.1	2.1	2	0	0	0	2.5	1.8	1.1	3	2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEC501 **INDUSTRIAL TRAINING** **L T P C**
0 0 4 2

Students shall undergo Industrial Training for duration of four weeks carrying 2 credits during the Fifth Semester for all B.E./B.Tech. Programmes. The industry/organization shall be selected with the approval of the Head of the Department. Alternatively, the concerned department may arrange industrial training through an industry expert relevant to the student's discipline of study.

A faculty member nominated by the Head of the Department shall act as the faculty coordinator and shall be responsible for the periodic monitoring and evaluation of the student's progress during the training period.

Duration of Industrial Training	Credits
2 Weeks	1
4 Weeks	2

*1 week of Industrial Training = 40 hours.

Chairman - BoS

SEMESTER - VI

23ADT601 **BUSINESS INTELLIGENCE** L T P C 3 0 0 3

OBJECTIVES

- To impart business analytics concepts and the complete analytics life cycle.
- To foster the process of acquiring, organizing, and managing data for business intelligence systems.
- To familiarize the various types of analytics used for business forecasting and decision support.
- To enhance analytical models for supply chain and logistics management.
- To acquire business analytics tools and techniques to real-world problems.

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

Coding Exercises:

1. Implement a complete Analytics Life Cycle using Python/Pandas: data collection (CSV/web API), cleaning, feature engineering, model building (regression/classification), and evaluation.
2. Create a script to classify analytics types (descriptive, diagnostic, predictive, prescriptive) based on sample business scenarios.
3. Write Develop a hypothesis testing module (t-test, chi-square) and apply it on sample business data for decision making.

Problem-solving Assignments:

1. Given a business scenario (e.g., customer churn), define the business problem, identify data sources, and propose an analytics approach.
2. Evaluate the performance of two different predictive models and justify which to select for deployment.

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

Coding Exercises:

1. Integrate BI dashboards using Python (Plotly/Power BI/Tableau Public) to visualize KPIs from a

sales dataset.

2. Write SQL-based OLAP queries (roll-up, drill-down, slice, dice) on a multi-dimensional dataset.
3. Implement a Decision Support System prototype that takes business inputs and suggests decisions using rules/analytics models.

Problem-solving Assignments:

1. Compare BI and DSS systems and propose a suitable system for three different industries.
2. Design KPIs and metrics for a company's BI dashboard (marketing, HR, supply chain).

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

Coding Exercises:

1. Implement time-series forecasting models (ARIMA, Prophet, LSTM) on sales or demand data.
2. Develop predictive analytics models (regression, decision trees, random forest) for business KPIs.
3. Build a data mining pipeline involving clustering (K-means), association mining (Apriori), and anomaly detection.

Problem-solving Assignments:

1. Forecast product demand for an e-commerce company using historical data and justify model selection.
2. Analyze forecasting errors (MAPE, RMSE) and propose improvements for accuracy.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

Coding Exercises:

1. Create HR analytics dashboards visualizing employee turnover, recruitment funnel, skill gaps.
2. Build a supply chain optimization model using Python (linear programming) for minimizing cost.
3. Implement demand forecasting for a supply chain dataset and plot inventory requirements.

Problem-solving Assignments:

1. Analyze recruitment bottlenecks using HR data and propose data-driven solutions.
2. Design an inventory management strategy using EOQ, safety stock, and forecasting techniques.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

Coding Exercises:

2. Build a recommendation engine (content-based or collaborative filtering) for product suggestions.
3. Develop a customer lifetime value (CLV) prediction model using regression/ML.

Problem-solving Assignments:

1. Analyze customer behavior patterns and propose targeted marketing strategies.
2. Design a marketing analytics framework for a new product launch.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine real-world business problems and model them using suitable analytical techniques.
- choose business processes and data requirements for effective business intelligence generation.
- Apply predictive analytics and forecasting models for informed business decisions.
- Determine supply chain and logistics operations using analytical and optimization methods.
- Use analytics tools and models to support marketing, sales, and human resource management decisions

TEXT BOOKS

1. R. Evans James, "Business Analytics", 2017
2. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2016

REFERENCES

1. Philip Kotler and Kevin Keller, "Marketing Management", Fifteenth edition, PHI, 2016
2. Mahadevan B, "Operations Management -Theory and Practice",Third Edition, Pearson Education, 2018.

E – RESOURCES

1. https://nptel.ac.in/courses/110105089 (Introduction)
2. https://archive.nptel.ac.in/courses/110/105/110105089/ (Descriptive Analytics , Inferential Analytics, Predictive Analytics, Prescriptive Analytics, Decision Analytics)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	0	1	2	2	1	3	2
2	3	3	3	2	3	1	0	1	2	3	2	3	3
3	3	3	3	3	3	1	0	1	2	2	2	3	3
4	2	2	3	2	2	1	1	1	3	2	2	3	3
5	2	2	3	2	3	1	1	1	2	3	2	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.6	2.6	3	2.6	2.6	1	1	1	2.6	2.4	1.8	3	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADE601	NATURAL LANGUAGE PROCESSING	L T P C
		3 0 2 4

OBJECTIVES

- To impart fundamental concepts, levels, ambiguities, and real-world applications of Natural Language Processing.
- To train students in text preprocessing, corpus analysis, and morphological processing techniques.
- To familiarize students with lexical processing, POS tagging, multi-word expressions, and language modeling techniques.
- To develop knowledge of syntactic and semantic analysis using parsing, chunking, word sense disambiguation, and semantic role labeling.
- To impart NLP application techniques for text summarization, sentiment analysis, machine translation, and question answering.
- To foster practical skills in implementing NLP techniques using real-world text data.

UNIT I INTRODUCTION 9

Introduction to various levels of natural language processing – Ambiguities and computational challenges in processing various natural languages – Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, question answering, and machine translation.

Coding Exercises:

1. Implement a Python program to identify and demonstrate lexical, syntactic, and semantic ambiguities present in a given English sentence.
2. Develop a basic spell checker using a dictionary-based approach.
3. Write a Python program to simulate a simple grammar checker by identifying basic grammatical errors

Problem-Solving Assignments:

1. Explain the various levels of Natural Language Processing and discuss their role in human–computer interaction.
2. Analyze different types of ambiguities in natural language with suitable examples.

UNIT II TEXT PROCESSING AND MOROPOLOGY 9

Character Encoding - Word Segmentation - Sentence Segmentation - Introduction to Corpora, Corpora Analysis - Inflectional and Derivation Morphology - Morphological Analysis and Generation using finite state transducers.

Coding Exercises:

1. Write a Python program for character encoding conversion and normalization of text.
2. Implement word segmentation and sentence segmentation for a given input document.
3. Create a corpus and perform corpus analysis such as token count, vocabulary size, and word frequency distribution.

Problem-Solving Assignments:

1. Explain the importance of text preprocessing in NLP.
2. Describe corpus creation and corpus analysis techniques.

UNIT III LEXICAL SYNTAX AND LANGUAGE MODELING 9

Introduction to Word Types - POS Tagging - Maximum Entropy Models for POS tagging - Multi-Word Expressions - The Role of Language Models - Simple N-gram Models - Estimating Parameters and Smoothing - Evaluating Language Models.

Coding Exercises:

1. Implement a Python program to identify word types and tokens from a given corpus.
2. Develop a POS tagger using Hidden Markov Models (HMM).
3. Implement Viterbi decoding for POS tagging.

Problem-Solving Assignments:

1. Explain the concept of POS tagging and its significance in NLP.
2. Describe Maximum Entropy models for POS tagging.

UNIT IV SYNTAX AND SEMANTICS 9

Introduction to Phrases - Clauses and Sentence Structure - Shallow Parsing and Chunking - Shallow Parsing with Conditional Random Fields (CRF) - Lexical Semantics - Word Sense Disambiguation - WordNet - Thematic Roles - Semantic Role Labelling with CRFs.

Coding Exercises:

1. Write a Python program to identify phrases and clauses in sentences.
2. Implement a rule-based shallow parser for chunking.
3. Develop a shallow parser using Conditional Random Fields (CRF).

Problem-Solving Assignments:

1. Explain phrase structure and sentence structure in natural language.
2. Describe shallow parsing and chunking with examples.

UNIT V APPLICATIONS OF NLP 9

NL Interfaces - Text Summarization - Sentiment Analysis - Machine Translation - Question answering - Recent Trends in NLP.

Coding Exercises:

1. Develop a text summarization system using extractive techniques.
2. Implement a sentiment analysis system using machine learning approaches.
3. Design a simple question answering system for a specific domain.

Problem-Solving Assignments:

1. Explain the architecture of Natural Language Interfaces.
2. Describe text summarization techniques and their applications.

LIST OF EXPERIMENTS

(Any Eight Experiments)

1. To write a python program for Word Analysis
2. To write a python program for Word Generation
3. To write a python program for morphology
4. To write a Python Program for N Grams
5. To write a Python Program for N Grams Smoothing
6. To write a Python for POS TAGGING: Hidden Markov model
7. To write a Python for POS TAGGING: Viterbi Decoding
8. To write a Python for Building POS Tagger
9. To write a Python for Chunking
10. To write a Python for Building Chunker

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the fundamental concepts, levels, ambiguities, and applications of Natural Language Processing.
- Apply text preprocessing, corpus analysis, and morphological processing techniques.
- Apply lexical processing and language modeling techniques for natural language analysis.
- Analyze syntactic and semantic structures using parsing, chunking, word sense disambiguation, and semantic role labeling.
- Apply NLP techniques for text summarization, sentiment analysis, machine translation, and question answering.
- Implement NLP techniques using real-world text data and evaluate their effectiveness.

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing", Third Edition, Prentice Hall, 2009.

2. NitinIndurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.

REFERENCES

1. James Allen, "Natural Language Understanding", Pearson Publication, Eight Edition, 2012.
2. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105158.html (Text Processing)
2. https://nptel.ac.in/courses/106/101/106101007.html (Part of Speech Tagging)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	-	1	-	1	1	1	2	2
2	3	3	2	3	3	1	1	-	2	1	2	3	2
3	3	3	3	3	3	1	1	-	2	2	2	3	3
4	3	3	3	3	3	1	1	-	2	2	2	3	3
5	3	3	3	3	3	1	1	-	2	2	2	3	3
6	3	3	3	3	3	3	3	3	3	3	3	3	3
AVG	3	3	2.7	3	3	1.1	1.3	0.5	2	1.8	2	2.8	2.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEJ601 **PROJECT WORK – PHASE I** L T P C
0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work may be assigned to a single student or to a group of students, not exceeding 4 per group.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester VI is 4.
- There shall be three reviews (Zeroth Review,(Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- Sixty percentage of Project work to be completed in this Project Work - Phase I.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

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

- Formulate real-world problems
- Design and express technical solutions using appropriate tools and techniques
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

Chairman - BoS

23HST701	HUMAN VALUES AND ETHICS	L T P C
		3 0 0 3

OBJECTIVES

- To introduce students to the core democratic values such as equality, liberty, justice, pluralism, and citizen participation through key world democratic movements.
- To familiarize students with the concept of secular values and the interpretation of secularism in the Indian context, emphasizing state neutrality and non-discrimination.
- To develop scientific values by introducing scientific thinking, methods of inquiry, hypothesis testing, skepticism, empiricism, and rationalism.
- To sensitize students to social ethics by applying ethical reasoning to issues such as gender bias, violence, social discrimination, and inclusive practices.
- To impart an understanding of scientific ethics by emphasizing transparency, fairness, and the social responsibility of scientists in the application of scientific inventions.

UNIT I DEMOCRATIC VALUES 9

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.

UNIT II SECULAR VALUES 9

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani.

UNIT III SCIENTIFIC VALUES 9

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism –Rationalism and Scientific Temper.

UNIT IV SOCIAL ETHICS 9

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.

UNIT V SCIENTIFIC ETHICS 9

Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.

TOTAL:45 PERIODS

OUTCOMES

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

- Explain fundamental democratic values and analyze their application in the French Revolution, American Independence, and Indian Freedom Movement.
- Explain secularism in India and demonstrate an understanding of religious neutrality, acceptance of all faiths, and non-discriminatory practices.
- Apply scientific methods and evidence-based reasoning to analyze problems, validate facts, and demonstrate scientific temper.
- Analyze social problems using ethical frameworks and identify constitutional protections and policies that promote equity and inclusion.
- Evaluate ethical issues in scientific practices and demonstrate responsible decision-making for the societal use of scientific advancements.

TEXT BOOKS

1. Luke W. Galen, "The Nonreligious: Understanding Secular People and Societies", Oxford University Press, 2016.
2. Bullivant, Stephen; Lee Lois, "Secularism: A Dictionary of Atheism", Oxford University Press, 2016.

REFERENCES

1. John R. Shook, "The Oxford Handbook of Secularism", Oxford University Press, 2017.
2. Gabriel A. Almond and Sidney Verba, "The Civic Culture: Political Attitudes and Democracy in Five Nations", Princeton University Press,2016.
3. Dr.E.Gnanasekaran, "Human values and ethics", Lakshmi Pubication, 2021

E-RESOURCES

1. https://nptel.ac.in/courses/109104068 (Exploring Human Values)
2. https://nptel.ac.in/courses/109106117 (Ethical Theory)

Mapping of COs-POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	3	3	-	2	-	2	1	1
2	-	-	-	-	-	3	3	-	2	-	2	1	1
3	2	3	-	3	-	-	-	-	-	-	2	1	1
4	-	2	-	-	-	3	3	1	1	-	1	1	1
5	-	2	-	-	-	3	3	1	1	-	1	1	1
AVG.	2	2.3	-	3	-	3	3	1	1.5	-	1.6	1	1

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BOS

23EEJ701 PROJECT WORK - PHASE - II L T P C
0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- Continuation of Project Work – Phase I.
- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks.
- The total credit for project work in semester VII is 4.
- There shall be two reviews (Review I and Review II, each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student is expected to submit the project report on or before the last working day of the semester. The project report shall be submitted as per the approved guidelines given by Controller of Examinations. The COE shall appoint an External Examiner for the ESE of the Project Work. The ESE for the project work shall be evaluated by both the external examiner and an internal examiner. The project coordinator shall be the internal examiner.

OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.

- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PC7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

Chairman - BoS

23EEJ801	PRODUCT DEVELOPMENT	L T P C 0 0 12 6

OBJECTIVES

- To convert the completed project into a functional product or working prototype.
- To improve the product by incorporating necessary modifications.
- To prepare the required technical documents for the developed product.
- To understand the basic aspects of product quality, usability and maintenance.
- To develop professional skills through product demonstration and presentation.

COURSE DESCRIPTION

This course is the continuation of the Capstone Project completed in Project Work – Phase II. Students shall enhance the completed project into a functional product or working prototype by improving its design, performance and usability wherever applicable. The course emphasizes testing, refinement, documentation and presentation of the developed product. Students are encouraged to demonstrate the final outcome before the evaluation committee.

PROCESS DESCRIPTION

- The Product Development course shall be based on the Capstone Project completed during Project Work – Phase II.
- Students shall improve the completed project by incorporating suitable modifications and documentation to develop a functional product or working prototype, wherever applicable.
- The work may be carried out individually or in groups not exceeding four students.
- The total credits for Product Development in Semester VIII shall be 6.
- For Product Development, the maximum marks shall be 100, of which Continuous Internal Assessment (CIA) carries 60 marks and the End Semester Examination (ESE) carries 40 marks.
- There shall be three reviews during the semester by a Review Committee constituted by the Head of the Department.
- The Review Committee shall consist of:
  - Supervisor
  - Product Development Coordinator

- One faculty member

Review I

- Progress of product development
- Design improvements
- Implementation status

Review II

- Performance improvements
- Error Correction
- Documentation progress

Review III

- Final product or prototype demonstration
- Technical documentation
- Presentation
- Students shall submit a Product Development Report as per the guidelines prescribed by the Controller of Examinations.
- The End Semester Examination shall consist of product/prototype demonstration, report evaluation and viva-voce examination.
- The End Semester Examination shall be jointly evaluated by both an External Examiner and an Internal Examiner.

OUTCOMES

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

- Develop a functional product or working prototype based on the completed project.
- Improve the product to meet the intended requirements.
- Prepare technical documentation for the developed product.
- Explain the basic aspects of product quality, maintenance and future improvements.
- Demonstrate the developed product effectively through presentation and viva-voce.

Assessment Scheme

- For Product Development, out of 100 marks, the maximum marks for Continuous Internal Assessment (CIA) is fixed as 60 and the End Semester Examination (ESE) carries 40 marks.

- Continuous Assessment shall be based on the progress of product development, technical contribution, documentation and presentations made during the three reviews conducted by the Review Committee constituted by the Head of the Department.
- The End Semester Examination shall consist of the evaluation of the Product Development Report, demonstration of the developed product/prototype or the work completed, and Viva-Voce Examination.
- The evaluation shall focus on the student's understanding of the work carried out, technical knowledge, documentation, presentation and overall contribution. The completion of a commercially deployable product shall not be a mandatory requirement for successful completion of the course.
- The End Semester Examination shall be jointly evaluated by an External Examiner appointed by the Controller of Examinations and an Internal Examiner nominated by the Head of the Department.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

Chairman - BoS

23EEC801 INTERNSHIP

L T P C
0 0 4 2

Students shall undergo internship of 4 weeks with 2 credits during 8th semester curriculum for all B.E. / B.Tech Programmes. The industry / organization is to be selected with the approval of Head of the Department. One faculty member approved by the Head of the department shall be responsible for the periodic monitoring and evaluation of the students' progress in the course.

Duration of Industrial Training	Credits
2 Weeks	1
4 Weeks	2

*1 week of Industrial Training = 40 hours.

Chairman - BoS

PROFESSIONAL ELECTIVE - I

PROFESSIONAL ELECTIVE - I

23ADP501	MOBILE APPLICATIONS AND ITS DEVELOPMENT	L T P C
		3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of mobile application development concepts, architectures, and platforms.
- To develop students' understanding of mobile application requirements analysis and suitable mobile development frameworks.
- To enable students to design and develop user-friendly mobile applications using appropriate design principles and frameworks.
- To train students to implement and test mobile application designs using specific mobile development frameworks.
- To provide exposure to mobile application deployment and publishing on marketplaces for real-world distribution.

UNIT I INTRODUCTION 9

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II BASIC DESIGN 9

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN 9

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV ANDROID 9

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V IOS 9

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating

calendar and address book with social media application – Using Wifi - iPhone marketplace.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the concepts of mobile application requirements, design challenges, development frameworks, and deployment platforms.
- Apply appropriate mobile application design principles and development frameworks to address specific application requirements.
- Analyze mobile application requirements and design suitable solutions for different application scenarios.
- Apply Android SDK and relevant development tools for mobile application designs.
- Analyze the futures of mobile applications using iOS and Android platforms for real-world distribution.

TEXT BOOKS

1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

REFERENCES

1. Reto Meier, "Professional android Development", Wiley-India Edition, 2012.
2. James Dovey and Ash Furrow, "Beginning Objective C", press, 2012.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/106/106106156/
2. https://onlinecourses.swayam2.ac.in/nou21_ge41/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	1	2	2	-	-	-	-	3	2	3	1	1
2	2	2	3	1	-	-	-	-	2	2	2	3	1
3	1	3	2	2	-	-	-	-	2	2	1	1	1
4	1	3	3	3	-	-	-	-	3	2	3	2	3
5	3	1	2	2	-	-	-	-	3	3	2	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2	2	2	1	-	-	-	-	2	2	2	2	1

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADP502 KNOWLEDGE ENGINEERING L T P C

3 0 0 3

OBJECTIVES

- To impart the fundamental concepts and principles of Knowledge Engineering, including its role and significance in knowledge-based systems.
- To develop students' proficiency in methodologies and modeling techniques for agent design and development.
- To enable students to design and develop ontologies for effective knowledge representation in specific domains.
- To provide knowledge of reasoning techniques using ontologies and rules for knowledge-based problem solving.
- To train students to analyze learning concepts, rule learning, and knowledge-based learning approaches for developing intelligent systems.

UNIT I REASONING UNDER UNCERTAINTY 9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING 9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV REASONIING WITH ONTOLOGIES AND RULES 9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING 9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts and principles of Knowledge Engineering
- Apply methodologies and modeling techniques for Agent Design and Development
- Design ontologies for effective knowledge representation.
- Apply reasoning techniques using ontologies and rules for knowledge-based problem solving
- Analyze learning concepts and rule learning techniques.

TEXT BOOKS

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016 (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018

REFERENCES

1. Ronald J. Brachman, Hector J. Levesque. Knowledge Representation and Reasoning. Morgan Kaufmann, 2004.
2. John F. Sowa. Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

E – RESOURCES

1. https://nptel.ac.in/courses/106106140
2. https://onlinecourses.nptel.ac.in/noc24_cs14/preview

Mapping of COs-POs& PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP503 RECOMMENDER SYSTEMS L T P C

3 0 0 3

OBJECTIVES

- To impart the basic techniques and problems in the field of recommender systems
- To develop students to understand the concepts of collaborative recommendation system and attacks on it
- To Enable students to understand and implement content-based recommendation techniques
- To Provide comprehensive understanding of knowledge-based recommendation system for developing intelligent solutions
- To Train students to design, implement, and evaluate recommender systems using appropriate performance metrics and real-world datasets

UNIT I INTRODUCTION 9

Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices. Recommender Systems Functions, Applications of recommendation systems, Issues with recommender system.

UNIT II COLLABORATIVE RECOMMENDATION 9

User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, model-based and preprocessing-based approaches. Attacks on collaborative recommender systems: Attack dimensions, Attack types, Countermeasures, Privacy aspects – distributed collaborative filtering.

UNIT III CONTENT- BASED RECOMMENDATION 9

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

UNIT IV KNOWLEDGE BASED RECOMMENDATION 9

Knowledge-based recommendation: Introduction, Knowledge representation and reasoning, interacting with constraint-based recommenders, Interacting with case-based recommenders. Hybrid recommendation approaches: Opportunities for hybridization, Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

UNIT V EVALUATING RECOMMENDER SYSTEM 9

Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centered metrics.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the mathematical foundations, applications, and challenges of recommender systems.
- Analyze collaborative recommendation techniques, security attacks, and suitable countermeasures in recommender systems.
- Apply content-based recommendation techniques by constructing user profiles using feature extraction and classification methods.
- Design knowledge-based and hybrid recommender systems for solving real-world recommendation problems.
- Analyze the performance of recommender systems using appropriate decision-support metrics and user-centered evaluation methods

TEXT BOOKS

1. Jannach D., Zanker M. and FelFering A., "Recommender Systems: An Introduction", Cambridge University, First Edition, 2011.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., "Recommender Systems Handbook", Springer, Tenth Edition, 2019.

REFERENCES

1. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems For Learning", Springer, First Edition, 2013.
2. Erwin Kreyzig, "Advanced Engineering Mathematics", Wiley, Tenth Edition, 2011.

E – RESOURCES

1. https://www.//tryolabs.com/blog/introduction-to-recommender-systems
2. https://www.//kaggle.com/code/iambideniz/hybrid-recommender-system

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	2	1	-	-	1	-	2	3	2
2	3	3	2	2	2	2	1	1	1	1	2	3	3
3	3	2	2	2	3	1	-	1	1	1	2	3	3
4	3	3	3	2	3	1	1	1	2	2	3	3	3
5	2	3	2	3	2	1	-	1	2	2	3	2	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.8	2.6	2.0	2.0	2.4	1.2	1.0	1.0	1.4	1.5	2.4	2.8	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP504 TEXT AND SPEECH ANALYSIS L T P C

3 0 0 3

OBJECTIVES

- To Impart the fundamental concepts of Natural Language Processing (NLP), text preprocessing techniques for text representation
- To Develop students' understanding of modern text classification techniques using word embeddings and deep learning models
- To Enable students to understand intelligent question-answering systems, chatbots, and dialogue systems using natural language processing techniques
- To Provide comprehensive knowledge of text-to-speech synthesis techniques, speech processing, and speech synthesis models
- To Train students to develop speech recognition and text processing applications using state-of-the-art deep learning techniques

UNIT I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure - Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – Fast Text model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems – evaluating dialogue systems

UNIT IV TEXT-TO-SPEECH SYNTHESIS 9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing – Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems.

UNIT V AUTOMATIC SPEECH RECOGNITION 9

Speech recognition. Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of Natural Language Processing, text preprocessing techniques for text analytics.
- Apply word embedding techniques and deep learning models for text classification, summarization, and topic modeling tasks.
- Analyze question-answering systems, chatbots, and dialogue systems using information retrieval and language modeling techniques.
- Apply text-to-speech synthesis techniques, including text normalization, prosody generation, and deep learning-based speech synthesis models.
- Develop automatic speech recognition systems using acoustic modeling, feature extraction approaches for speech processing applications.

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.
2. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress, 2018.

REFERENCES

1. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" Pearson, First Edition, 2009.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/117/105/117105145/
2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	3	1	-	--	1	1	3	3	3
2	3	3	2	2	3	1	-	1	1	1	3	3	3
3	3	2	1	1	2	1	-	-	1	-	2	3	2
4	3	3	3	3	3	1	-	1	2	2	3	3	3
5	3	3	2	2	3	1	-	1	1	1	3	2	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	2.6	2.0	2.0	2.8	1.0	-	1.0	1.2	1.3	2.8	2.8	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ITP501 IMAGE AND VIDEO ANALYTICS L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge of the fundamentals of image processing techniques for computer vision
- To inculcate image pre-processing techniques for image enhancement and analysis
- To familiarize students with various object detection techniques and machine learning approaches
- To equip students with knowledge of object recognition mechanisms for computer vision applications
- To foster students understanding video analytics techniques and their real-world applications

UNIT I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures

UNIT II IMAGE PRE-PROCESSING 9

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING 9

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition.

UNIT V VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course the Students will be able to

- Explain image processing techniques, image representations, and image data structures for computer vision applications
- Apply image pre-processing techniques such as smoothing, edge detection, image restoration, and frequency domain processing to enhance image quality
- Design object detection systems using machine learning and deep learning architectures such as R-CNN, Faster R-CNN, and YOLO.
- Develop face recognition and gesture recognition systems using DeepFace, FaceNet, and related computer vision techniques.
- Analyze deep learning-based video analytics techniques using ResNet, GoogleNet, Inception Networks, and video processing methods to solve real-world intelligent vision problems.

TEXT BOOKS

1. MilanSonka,VaclavHlavac,RogerBoyle,"ImageProcessing,Analysis,and Machine Vision", Fourth edition, Thomson Learning, 2019.
2. VaibhavVerdhan,(2021,ComputerVisionUsingDeepLearningNeuralNetwork Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

1. RichardSzeliski,"ComputerVision:AlgorithmsandApplications",SpringerThird Edition VerlagLondonLimited,2019.
2. CaifengShan,FatihPorikli,TaoXiang,ShaogangGong,"VideoAnalyticsforBusiness Intelligence",Second Edition, Springer, 2019.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://onlinecourses.nptel.ac.in/noc23_ee39/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	1	2	2	2	-	-	-	3	3	2	2	1
2	2	2	3	3	3	-	-	-	3	2	1	2	2
3	1	2	2	2	3	-	-	-	1	2	1	1	1
4	1	2	3	2	3	-	-	-	2	2	2	2	2
5	3	2	1	3	2	-	-	-	2	1	1	3	2
AVG	2	1.8	2.2	2.4	2.6	-	-	-	2.2	2	1.4	2	1.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP608 SOFT COMPUTING L T P C
3 0 0 3

OBJECTIVES

- To teach the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To acquire the mathematical background for carrying out the optimization associated with neural network learning.
- To impart the principles and applications of various evolutionary algorithms
- To foster the knowledge on neuro fuzzy modeling.
- To train students on case studies utilizing the Intelligent behavior of programs based on soft computing

UNIT I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets. Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V APPLICATIONS 9

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of soft computing and its significance in modern computing.
- Apply supervised learning techniques to train neural networks.

- Examine the fundamentals of genetic algorithms and their applications
- Analyse hybrid learning algorithms in ANFIS for system modeling.
- Apply soft computing methods to predict color recipes in various industrial applications

TEXT BOOKS

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,2015.
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python, 2020

REFERENCES

1. roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/105/106105173/
2. https://onlinecourses.nptel.ac.in/noc22_cs54/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	3	3	3	-	-	-	3	1	3	3	1
2	2	3	3	2	3	-	-	-	3	2	3	2	1
3	1	3	2	2	1	-	-	-	3	1	1	1	3
4	1	2	1	3	2	-	-	-	3	3	1	2	1
5	2	3	1	2	1	-	-	-	3	3	3	1	2
AVG	1.8	2.6	2	2.4	2	-	-	-	3	2	2.2	1.8	1.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

PROFESSIONAL ELECTIVE - II

PROFESSIONAL ELECTIVE - II

23ADP503 **CLOUD TECHNOLOGIES** L T P C
3 0 0 3

OBJECTIVES

- To familiarize the students with the fundamental concepts, principles, and models of cloud architecture, deployment, and infrastructure.
- To foster the knowledge of virtualization concepts and virtual machine technologies in cloud computing.
- To enhance the students' ability to analyze virtualization infrastructure components and their roles in cloud environments.
- To develop the students' understanding of various cloud deployment environments and service models through practical experimentation.
- To foster the students' knowledge of security issues, challenges, and best practices in cloud computing environments..

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage: Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the foundational concepts and design challenges associated with cloud computing environments
- Apply the concepts of virtualization and its different types
- Demonstrate the virtualization of hardware resources using virtual machines and Docker
- Develop and deploy cloud-based services and set up a cloud environment
- Analyze the security challenges and threats associated with cloud computing environments

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010

REFERENCES

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/105/106105167/
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	1	-	-	2	3	1	3	2	1
2	3	1	2	2	1	-	-	1	2	1	3	2	2
3	2	3	2	3	1	-	-	3	1	1	3	1	1
4	1	2	3	3	3	-	-	3	3	1	2	1	3
5	2	3	3	1	3	-	-	2	2	1	2	2	2
AVG	2.2	2.2	2.2	2	1.8	-	-	2.2	2.2	1	2.6	1.6	1.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADP504 APP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES

- To impart the fundamental concepts of mobile and web applications
- To familiarize the students with the development of native applications using basic GUI components
- To enable the students to explore cross-platform application development with event handling
- To develop the ability to create applications incorporating location services and data storage
- To familiarize the students with web application development and database access capabilities.

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

UNIT II NATIVE APP DEVELOPMENT USING JAVA 9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT 9

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 9

Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different Ap p frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Developmcnt, UI/UX, Reusability

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain web application development with cloud database access and native applications using GUI components.
- Apply event handling techniques in hybrid applications for developing interactive applications.

- Analyze cross-platform application development with location services and data storage capabilities.
- Develop mobile and web applications using suitable application frameworks.
- Analyze application frameworks based on their features, capabilities, and suitability for application development.

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, First edition, 2020
2. Apache Cordova in Action, Raymond K. Camden, Manning 2015

REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, Second Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/106/106106156/
2. https://onlinecourses.nptel.ac.in/noc20_cs52/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	1	2	3	-	-	1	1	2	1	2	3
2	2	1	3	2	2	-	-	3	2	2	3	3	2
3	2	2	2	1	2	-	-	1	1	1	1	1	1
4	1	3	1	1	3	-	-	1	1	3	2	1	3
5	1	1	3	1	3	-	-	1	1	3	1	3	2
AVG	1.6	1.8	2	1.4	2.6	-	-	1.4	1.2	2	1.6	2	2.2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP611 WEB APPLICATION SECURITY L T P C

3 0 0 3

OBJECTIVES

- To impart the fundamental concepts, principles, threats, and security mechanisms involved in securing web applications
- To Provide knowledge of secure software development life cycle models, security testing, and best practices for the secure development and deployment of web applications
- To Enable students to understand and implement secure API design, authentication, authorization, and microservice security techniques
- To Familiarize students with vulnerability assessment methodologies, penetration testing techniques used to identify and mitigate web application vulnerabilities
- To Develop students' understanding of web application attacks, ethical hacking techniques, and security tools for protecting web applications

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs, Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-toservice APIs, API Keys , OAuth2, Securing Microservice APIs, Service Mesh, Locking Down Network Connections, Securing Incoming Requests

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web ApplicationTesting, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session

Management. Cross-Site Request Forgery. Security Misconfiguration. Insecure Cryptographic Storage. Failure to Restrict URL Access. Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamentals of web application security, authentication, authorization, and common web security threats.
- Apply secure software development practices, security testing methods, and secure deployment frameworks to develop resilient web applications.
- Design secure APIs using appropriate authentication, authorization, and security controls for modern web and microservice applications
- Analyze web applications by performing vulnerability assessments and penetration testing using standard methodologies and security assessment tools.
- Analyze common web application attacks and utilize ethical hacking tools to identify, analyze, and recommend mitigation strategies for web security vulnerabilities

TEXT BOOKS

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", First Edition, 2020, O'Reilly Media, Inc.
2. Neil Madden, "API Security in Action", 2020, Manning Publications Co., NY, USA.

REFERENCES

1. Ravi Das and Greg Johnson, "Testing and Securing Web Applications", 2021, Taylor & Francis Group, LLC.
2. Prabath Siriwardena, "Advanced API Security", 2020, A press Media LLC, USA.

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_cs91/preview (Software Testing)
2. https://onlinecourses.nptel.ac.in/noc24_cs119/preview (Software Engineering)

Mapping of COs-POs& PSOs

3	2	2	2	2	1	2	1	1	2	1	3	2
3	3	3	2	2	1	2	1	2	2	2	3	3
3	2	3	3	3	1	2	1	1	2	2	3	3
2	3	2	3	3	2	2	2	1	2	2	3	3
3	2	2	2	2	2	2	2	1	2	2	3	3
-	-	-	-	-	-	-	-	-	-	-	-	-
2.8	2.4	2.4	2.4	2.4	1.4	2	1.4	1.2	2	1.8	3	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP508 CLOUD SERVICES MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

- To Introduce the fundamental concepts, service models, deployment models, and ecosystem of cloud service management
- To Develop students' understanding of cloud service strategies, capacity planning, and cloud service architecture for effective business adoption
- To train the students in cloud service lifecycle, service design, migration, deployment, and operational management in enterprise environments
- To provide comprehensive understanding of cloud service economics, pricing models, procurement strategies, and cost optimization techniques for cloud-based services
- To Equip students with the principles of cloud governance, value assessment, and performance measurement for effective management of cloud services

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard,

Total Cost of Ownership

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain cloud-design skills to build and automate business solutions using cloud technologies
- Describe theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
- Apply Cloud services and technologies to solve real world problems.
- Analyze and compare various cloud service pricing models.
- Analyze the Cloud Governance Framework, and evaluate the value of cloud services

TEXT BOOKS

1. Enamul Haque,"Cloud Service Management and Governance: Smart Service Management in Cloud" Era by, Enel Publications.

2. Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,"Cloud Computing: Concepts, Technology & Architecture" by 2013.

REFERENCES

1. Praveen Ayyappa "Economics of Cloud Computing", LAP Lambert Academic Publishing

2. Rajkumar Buyya, Christian Vechhiola, S.Thamarai Selvi,"Mastering Cloud Computing Foundations and Applications Programming".

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_cs118/preview (Cloud Computing)
2. https://nptel.ac.in/courses/106104182 (Cloud computing and Distributed system)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	1	1	-	1	1	2	3	3
2	2	2	2	2	2	2	1	-	1	1	2	2	2
3	2	2	3	3	3	2	1	-	2	1	2	3	3
4	2	3	3	3	3	1	1	-	2	1	2	3	2
5	2	2	2	2	2	3	2	2	2	2	2	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.2	2.4	2.6	2.6	2.6	1.8	1.2	2.0	1.6	1.2	2.0	2.6	2.4

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP510 SOFTWARE TESTING AND AUTOMATION L T P C

3 0 0 3

OBJECTIVES

- To Impart the fundamental concepts, principles, and life cycle of software testing to build a strong foundation in software quality assurance
- To Develop students' understanding of test planning, test strategies, resource management for effective software testing processes
- To Enable students to design, execute, and evaluate software test cases using appropriate testing techniques
- To Familiarize students with advanced software testing approaches, including performance, security, compatibility, Agile, web, and mobile application testing
- To Provide comprehensive knowledge of automated software testing using Selenium and automation frameworks for testing modern software applications

UNIT I FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing.

UNIT II TEST PLANNING 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamentals, principles, life cycle, and various levels of software testing used in software quality assurance.
- Develop comprehensive test plans, define testing strategies, prepare test schedules, and manage defect reporting using standard testing practices.
- Design, execute, and evaluate software test cases using valuate software test cases using appropriate testing techniques and methodologies..
- Apply advanced testing methodologies to assess software quality and Agile-based software development.
- Analyze automated testing of web applications using Selenium WebDriver and testing frameworks to improve software testing efficiency and reliability.

TEXT BOOKS

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018

REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of Software Testing", Third Edition, 2012, John Wiley & Sons, Inc.
2. Elfriede Dustin, Thom Garrett, Bernie Gaurf," Implementing Automated Software Testing", 2009. Pearson Education, Inc.

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_cs91/preview (Software Testing)
2. https://onlinecourses.nptel.ac.in/noc24_cs119/preview (Software Engineering)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	3	2	2	1	-	-	1	2	2	3	2
2	2	2	3	2	2	1	-	-	2	2	1	3	2
3	3	2	3	3	3	1	-	-	1	2	2	3	2
4	2	2	2	2	2	1	-	-	1	2	2	2	2
5	2	2	3	3	3	1	-	-	2	2	2	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.4	2	2.8	2.4	2.4	1	-	-	1.4	2.0	1.8	2.8	2.2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP506 BIG DATA ANALYTICS L T P C

3 0 0 3

OBJECTIVES

- To provide students with a comprehensive understanding of Big Data concepts, architectures, and emerging technologies used for large-scale data processing.
- To enable students to understand and apply NoSQL database models, distributed data management techniques, and scalable storage solutions for diverse datasets.
- To impart knowledge of Hadoop ecosystem, MapReduce programming paradigm, and YARN framework for distributed computing and analytics.
- To familiarize students with the architecture of Hadoop Distributed File System (HDFS), including data storage, retrieval, and processing mechanisms.
- To equip students with the skills to use Hadoop ecosystem tools such as HBase, Pig, and Hive for storing, querying, processing, and analyzing Big Data applications

UNIT I UNDERSTANDING BIG DATA 9

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence –

Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – key-value and document data models-relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency.

UNIT III MAP REDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface –data flow – Hadoop I/O – data integrity – compression – serialization.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats –

HiveQL data definition – HiveQL data manipulation – HiveQL queries

Total:45 Periods

OUTCOMES:

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

- Explain the concepts, technologies, and applications of Big Data and analyze its significance in solving real-world business problems.
- Apply NoSQL data management models and distributed database concepts to manage large-scale structured and unstructured data efficiently.
- Analyze the Hadoop ecosystem, MapReduce programming model, YARN architecture for distributed data analytics.
- Apply Hadoop Distributed File System (HDFS), Hadoop I/O mechanisms, and data processing techniques to store, retrieve, and manage Big Data efficiently.
- Develop Big Data analytical solutions using Hadoop ecosystem tools such as HBase, Pig, and Hive for data storage, querying, and analytics.

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:

1. Sadalage, Pramod J. "NoSQL distilled", 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

E – RESOURCES

1. https://onlinecourses.swayam2.ac.in/ntr24_ed70/preview (Data Analytics)
2. https://onlinecourses.nptel.ac.in/noc24_cs130/preview (Big Data Computing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	2	1	-	-	2	1	2	2	3
2	3	3	3	2	2	1	-	-	2	1	2	3	3
3	2	3	3	2	3	1	-	-	1	1	3	3	2
4	2	3	3	3	3	1	-	-	1	1	3	3	2
5	2	3	3	2	3	1	-	-	1	1	2	3	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.4	2.8	2.8	2.2	2.6	1.0	-	-	1.4	1.0	2.4	2.8	2.4

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

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PROFESSIONAL ELECTIVE - III

PROFESSIONAL ELECTIVE - III

23CSP616	SECURITY AND PRIVACY IN CLOUD	L T P C
		3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts, principles, and security services essential for securing cloud environments
- To provide knowledge of cloud security architecture, design principles, and data protection mechanisms in cloud infrastructures
- To enable students to understand identity management, authentication, authorization, and access control techniques for secure cloud environments
- To familiarize students with cloud security design patterns and secure deployment models for protecting cloud resources and services
- To develop students comprehensive knowledge on cloud security monitoring and security management techniques for ensuring compliance and operational security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies. Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource

Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of cloud security, and core security services used to protect cloud computing environments
- Analyze cloud security architectures, virtualization strategies, data protection mechanisms in cloud infrastructures
- Apply identity and access management techniques, including authentication, authorization, role-based access control, and identity federation, to secure cloud services
- Design secure cloud solutions by applying cloud security design patterns, resource access controls, and secure deployment practices
- Analyze cloud environments using monitoring, auditing, incident response, and security management mechanisms to ensure secure and reliable cloud operation

TEXT BOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, "Cloud Computing:", Wiley 2013
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.

REFERENCES

1. Mark C. Chu-Carroll "Code in the Cloud",CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelv

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_cs118/preview (Cloud Computing)
2. https://nptel.ac.in/courses/106105167 (Cloud Security)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	2	2	2	1	1	1	1	2	2
2	3	3	2	2	3	3	3	2	2	2	2	3	3
3	3	3	3	2	3	3	2	1	2	2	2	3	3
4	3	3	3	3	3	3	2	2	2	2	2	3	3
5	3	3	3	2	3	3	3	2	2	2	2	2	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	2.8	2.6	2.0	2.8	2.8	2.4	1.6	1.8	1.8	1.8	2.7	2.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP602 EXPLORATORY DATA ANALYSIS L T P C
3 0 0 3

OBJECTIVES

- To impart the fundamental concepts, principles, and significance of Exploratory Data Analysis (EDA) in data science and decision-making
- To develop students' proficiency in using Python libraries, particularly Pandas and Matplotlib, for data manipulation and visualization
- To enable students to perform univariate and bivariate exploratory data analysis using appropriate statistical and graphical techniques
- To provide knowledge of multivariate and time series data exploration methods to extract meaningful insights from complex datasets
- To train students to apply exploratory data analysis techniques and visualization tools for solving real-world data analytics problems

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques

UNIT II EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data–Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single variable Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality

UNIT IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling

Total:45 PERIODS

OUTCOMES:

- Explain the data transformation techniques and software tools used in Exploratory Data Analysis for effective data analysis.
- Apply Python libraries such as Pandas and Matplotlib for data manipulation, preprocessing, aggregation, and visualization of datasets.
- Perform univariate exploratory data analysis using descriptive statistics, distribution analysis, scaling, and standardization techniques.
- Analyze relationships between variables using bivariate analysis techniques
- Apply multivariate and time series exploratory data analysis techniques to visualize, interpret, and extract meaningful insights from real-world **datasets**

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",Packet Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017.

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.

E – RESOURCES

1. https://onlinecourses.swayam2.ac.in/cec24_ma20/preview (Data Analysis)
2. https://onlinecourses.nptel.ac.in/noc24_mg98/preview(Data analysis & Decision making)

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	2	1	-	-	1	-	2	2	2
2	3	2	2	2	3	1	-	1	1	1	3	3	3
3	3	3	2	2	2	1	-	-	1	1	2	3	2
4	3	3	2	2	2	2	-	-	1	1	2	3	2
5	3	3	3	2	3	2	-	1	2	2	3	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2.6	2	1.8	2.4	1.4	-	1	1.2	1.3	2.4	2.8	2.4

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

Chairman - BoS

23ADP508	DATA WAREHOUSING	L T P C 3 0 0 3

OBJECTIVES

- To impart fundamental concepts, components, architecture, and modern approaches of data warehouses.
- To train students in ETL/ELT processes, data warehouse design, modeling, and OLAP technologies.
- To familiarize students with metadata management, data marts, and data partitioning strategies.
- To develop knowledge of dimensional modeling, data cubes, and various data warehouse schemas.
- To impart knowledge of system managers and process managers involved in data warehouse operations.
- To foster skills in data warehouse configuration, scheduling, backup, query management, tuning, and testing.

UNIT I INTRODUCTION TO DATA WAREHOUSE 9

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

UNIT II ETL AND OLAP TECHNOLOGY 9

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III META DATA, DATA MART AND PARTITION STRATEGY 9

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT IV DIMENSIONAL MODELING AND SCHEMA 9

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Datawarehouse Tools

UNIT V SYSTEM & PROCESS MANAGERS 9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts, components, architecture, and modern approaches of data warehouses.
- Apply ETL/ELT processes, data warehouse design, modeling, and OLAP technologies.
- Analyze metadata, data marts, and data partitioning strategies for effective data management.
- Explain dimensional models, data cubes, and various data warehouse schemas.
- Explain the roles of system managers and process managers in data warehouse operations.
- Apply data warehouse configuration, scheduling, backup, query management, tuning, and testing techniques.

TEXT BOOKS

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2018.

2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2015.

REFERENCES

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.

2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

E – RESOURCES

1 https://archive.nptel.ac.in/courses/106/105/106105174/

2 https://onlinecourses.nptel.ac.in/noc21_cs06/preview

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	-	-	-	3	-	3	-	-
2	3	2	2	2	3	-	-	-	2	-	2	-	-
3	3	3	3	3	-	-	-	-	-	-	3	-	-
4	3	3	3	3	-	-	-	-	-	-	3	-	-
5	3	2	2	2	-	2	-	-	-	-	2	-	-
AVG	3	2.6	2.6	1.2	2.5	1	-	-	2.5	-	2.6	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ITP505 **STORAGE TECHNOLOGIES** L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge the fundamental concepts of Information storage and third platform technologies.
- To foster knowledge of intelligent storage systems, RAID configurations, and storage architectures.
- To train students in storage networking and virtualization technologies.
- To enable students to understand various backup and recovery strategies.
- To acquire knowledge of security and security controls in storage infrastructure.

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID 9

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scaleout storage Architecture.

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION 9

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V SECURING STORAGE INFRASTRUCTURE 9

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls

to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of Information storage and third platform technologies
- Analyze the intelligent storage systems, RAID configurations, and storage architectures
- Apply storage networking and virtualization technologies..
- Explain various backup and recovery strategies.
- Analyze security requirements and security controls for securing storage envirnoments

TEXT BOOKS

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
2. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2016.

REFERENCES

1. Chris Poelker and R. James MacDonald by "Storage Area Networks for Dummies".
2. Eric Hibbard and David W. Bowers by "Designing Storage Area Networks: A Practical Guide to Implementing Fibre Channel and IP SANs".

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/108/106108058/ (Storage System)
2. https://archive.nptel.ac.in/courses/102/106/102106022/(Downstream processing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	1	3	3	–	–	–	1	1	1	1	2
CO2	3	1	2	3	3	–	–	–	3	2	3	2	3
CO3	1	1	3	2	2	–	–	–	3	1	1	2	3
CO4	3	2	1	2	2	–	–	–	1	1	3	3	2
CO5	1	3	2	1	2	–	–	–	1	2	3	3	2
AVG	1.8	1.8	1.8	2.2	2.4	–	–	–	1.8	1.4	2.2	2.2	2.4

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP514 SOFTWARE DEFINED NETWORKS L T P C
3 0 0 3

OBJECTIVES

- To impart the concepts, architecture, and operational principles of Software Defined Networking (SDN).
- To provide knowledge of SDN data plane, control plane, OpenFlow protocol, and SDN controller architectures
- To enable students to understand the design and implementation of SDN-based network applications and services.
- To familiarize students with Network Function Virtualization (NFV) concepts, architectures, and deployment models.
- To develop students understanding of NFV infrastructure, orchestration, and real-world applications integrating SDN and NFV technologies

UNIT I SDN: INTRODUCTION 9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 9

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION 9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY 9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the concepts, architecture, and significance of Software Defined Networking (SDN
- Analyze the functions of SDN data plane, control plane, OpenFlow protocol, southbound and northbound interfaces, and SDN controllers.
- Design SDN-based network applications for traffic engineering, network monitoring, security, and data center networking.
- Apply Network Function Virtualization (NFV) concepts to implement virtualized network services and virtualization techniques.
- Analyze NFV infrastructure,orchestration, and real-world use cases by integrating SDN and NFV technologies.

TEXTBOOKS:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, First Edition, 2015.
2. Flavio Bonomi, Rodolfo D. R. C. G. E. de Oliveira by "Software Defined Networks: A Comprehensive Approach".

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", O'Reilly Media, Second Edition, 2017.

E – RESOURCES

1. https://archive.nptel.ac.in/courses/106/105/106105183/ (Computer Networks)
2. https://onlinecourses.nptel.ac.in/noc23_cs35/preview (Advanced Computer Networks)

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	2	1	1	-	1	1	1	3	2
2	3	3	3	2	2	1	1	-	1	1	1	3	3
3	3	3	3	3	3	1	1	1	2	2	2	3	3
4	3	2	2	2	2	2	2	1	2	2	2	3	2
5	3	2	2	2	2	2	2	1	2	2	2	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	2.4	2.4	2.2	2.2	1.4	1.4	1.0	1.6	1.6	1.6	3.0	2.6

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

Chairman - BOS

23CSP515	STREAM PROCESSING	L T P C
		3 0 0 3

OBJECTIVES

- To impart the fundamental concepts, architectures, and strategies of data processing and stream processing systems.
- To provide knowledge of real-time data processing techniques, streaming architectures, and analytics frameworks for processing continuous data streams
- To enable students to understand data models, query languages, and database technologies used for managing structured, semi-structured, and graph data.
- To familiarize students with event-driven stream processing using Apache Kafka and its APIs for developing scalable streaming applications..
- To develop students ability to provide real-time stream processing applications using Spark Streaming for analytics and decision-making

UNIT I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing,Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.

UNIT III DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to- One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language,Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics,

Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of data processing, data management strategies, and the differences between batch and stream processing systems.
- Analyze real-time data processing architectures, streaming models, and modern frameworks used for continuous data analytics.
- Apply appropriate data models and query languages to manage and retrieve data efficiently in relational, NoSQL, and graph databases.
- Develop event-driven data processing applications using Apache Kafka by implementing producers, consumers, and streaming APIs.
- Design real-time analytics applications using Apache Spark Structured Streaming and stream processing operations.

TEXT BOOKS

1. Tyler Akidau, Slava Chernyak, Reuven Lax, "Streaming Systems: The What, Where, When and How of Large-Scale Data Processing" by O'Reilly publication.
2. Flink, Storm and Kafka ,"Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing" using Apache Spark, , Packet Publishing.

REFERENCES

1. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media.
2. Chris Poelker and R. James MacDonald by "Resources for Learning Stream Data Processing".

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_bt27/preview (Stream Processing)
2. https://archive.nptel.ac.in/courses/102/106/102106022/(Downstream processing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	2	1	-	1	-	1	1	1	2	2
2	3	2	2	3	2	1	1	-	2	1	2	3	2
3	3	3	3	3	2	1	1	-	2	2	2	3	3
4	3	3	3	3	3	1	1	-	2	2	2	3	3
5	3	3	3	3	3	1	1	-	2	2	2	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	2.6	2.4	2.8	2.2	1.0	1.0	-	1.8	1.6	1.8	2.8	2.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

PROFESSIONAL ELECTIVE - IV

PROFESSIONAL ELECTIVE - IV

23ADP601	NETWORK SECURITY	L T P C
		3 0 0 3

OBJECTIVES

- To impart fundamental security concepts, threats, services, mechanisms, and security architectures.
- To familiarize classical and modern cryptographic techniques, including their mathematical foundations, block cipher designs, and key distribution mechanisms.
- To impart public key cryptography concepts, including RSA, Diffie–Hellman, ElGamal, and elliptic curve cryptography.
- To impart message authentication, hash functions, digital signatures, and authentication protocols.
- To familiarize students with system-level security practices, including email security, web security, IP security, and firewall mechanisms.

UNIT I INTRODUCTON 9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography) - Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid"s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine classical and modern encryption techniques used in securing network communication.
- Apply number theory concepts to understand and analyze symmetric key cryptographic algorithms.
- Analyze the public key cryptographic schemes and their role in secure key management and data exchange.
- Apply appropriate authentication mechanisms and hash functions for ensuring data integrity and authenticity.
- Analyze security mechanisms for electronic mail, web applications, and IP-based communication.

TEXT BOOKS

1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson, Eight Edition, 2020.
2. Bruce Schneier," Applied Cryptography" John Wiley & Sons Inc. Second Edition,2016.

REFERENCES

1. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill, 2007.
2. Niels Ferguson, "Cryptography Engineering:Design Principles and Practical Applications", Wiley, First Edition, 2010.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105162/ (Introduction to Cryptography)
2. https://nptel.ac.in/courses/106/105/106105031/ (Overview on Modern Cryptography)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	1	1	1	2	1	3	2
2	3	3	3	3	2	1	0	1	1	2	2	3	2
3	3	3	3	3	2	1	0	1	1	2	2	3	3
4	3	2	2	2	2	1	1	1	1	3	2	3	2
5	3	2	3	3	3	1	1	1	2	3	2	3	3
AVG	3	2.6	2	2.6	2.2	1	0.6	1	2.5	2.4	1.8	3	2.4

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP601	HACKING TECHNIQUES	L T P C
		3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of ethical hacking concepts, attacker methodologies and cyber threat landscapes.
- To familiarize the students in reconnaissance, scanning, exploitation, and post-exploitation techniques used by attackers.
- To develop the students' comprehensive understanding of various hacking methodologies and tools.
- To enable the students with the ability to analyze, detect, and mitigate common security vulnerabilities.
- To train the students in basic penetration testing, documentation and report the security assessments.

UNIT I INTRODUCTION TO ETHICAL HACKING 9

Hacker types, motives, and attack vectors - Ethical hacking process and phases - Cyber Kill Chain, MITRE ATT & CK basics - Information security principles : CIA, AAA, non- repudiation - Threats, vulnerabilities, exploits - Legal and ethical issues : IT Act, cyber laws, responsible disclosure.

UNIT II FOOTPRINTING, SCANNING & ENUMERATION 9

Footprinting & Reconnaissance : Passive & active information gathering - OSINT Techniques: search engines, social networks, WHOIS, DNS - Website & email footprinting. Network Scanning & Enumeration : Scanning types: port, network, vulnerability scanning - Enumeration methods: NetBIOS, SNMP, LDAP, DNS enumeration - Tools: Nmap, Zenmap, OpenVAS, Nessus.

UNIT III HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection - Cross — Site Scripting (XSS), Broken Authentication and Session Management. Cross-Site Request Forgery- Security Misconfiguration - Insecure Cryptographic Storage — Failure to Restrict URL Access, Tools: Comodo, Open VAS, Nexpose, Nikto, Burp Suite, etc.

UNIT IV WEB, NETWORK & WIRELESS ATTACKS 9

Web Application Hacking : OWASP TOP 10 overview - SQL Injection, XSS, CSRF - Session hijacking - File inclusion, command injection. Network & Wireless Attacks : Sniffing & MITM attacks - ARP spoofing, MAC spoofing - Wi-Fi security: WEP, WPA/WPA2/WPA3 - Wireless attacks: Evil Twin,

deauthentication - Tools: Wireshark, Ettercap, Aircrack-ng, Burp Suite.

UNIT V PENETRATION TESTING & REPORTING 9

Penetration testing process & methodologies (PTES, OSSTMM) - Vulnerability Assessment vs. Pen Testing - Phases of penetration testing - Exploitation with Metasploit basics - Security hardening: system, network, application - Reporting: documentation, risk assessment, CVSS scoring - Recommendations & mitigation techniques.

TOTAL : 45 HOURS

OUTCOMES

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

- Explain ethical hacking principles, attacker types, and phases of attacks.
- Analyze the foot printing and scanning activities using appropriate techniques and tools.
- Apply hacking techniques and tolls to identify the behavior of malware types including trojans, backdoors, worms, and rootkits.
- Examine the vulnerabilities in networks, wireless systems and web applications.
- Analyze penetration testing and generate security assessment reports using mitigation strategies.

TEXTBOOKS

1. Harold F.Tipton and Micki Krause, "Information Security Management Handbook", CRC Press, Sixth Edition, 2007.
2. Dafydd Stuttard & Marcus Pinto, "The Web Application Hacker's Handbook", Wiley, Second Edition, 2009.

REFERENCES

1. Stuart McClure, Joel Scambray, and George Kurtz, " Hacking Exposed: Network Security Secrets & Solutions" , McGraw-Hill, Seventh Edition, 2010.
2. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2012.

E - RESOURCES

1. https://nptel/courses/video/106105217 (Ethical Hacking)
2. https://nptel.ac.in/courses/106105162 (Network Security)

Mapping of COs – POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	3	3	2	-	3	2	1	-	2	1
2	2	3	2	3	3	1	-	1	2	1	-	3	2
3	3	3	2	2	3	2	-	2	1	1	-	3	2
4	3	3	2	2	3	2	-	2	2	1	-	3	3
5	2	3	3	3	3	2	-	3	3	3	-	3	3
AVG	2.6	2.8	2.2	2.6	3	1.8	-	2.2	2	1.4	-	2.8	2.2

1-Low, 2-Medium, 3-High, "-"– No Correlation

Chairman - BoS

23ITP601 DIGITAL FORENSICS L T P C
3 0 0 3

OBJECTIVES

- To gain knowledge about the fundamental concepts of digital forensics and digital evidence.
- To enable students to explore investigation methods used in digital crimes and procedures for collecting digital evidence.
- To inculate the knowledge of digital forensic readiness concepts and organizational practices
- To explore digital evidence from iOS devices using appropriate forensic procedures and tools.
- To enhance students with digital evidence techniques from Android devices using suitable forensic.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT IV iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – Mobil Edit – iCloud.

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – Mobil Edit – Android App Decompiling.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply the fundamental concepts of digital forensics.
- Understand the various types of digital crimes and investigation methods
- Analyze the digital forensic readiness practices, framework and standard.
- Analyze the digital evidence from iOS devices using appropriate forensic tools.
- Analyze the digital evidence from Android devices using suitable forensic procedures and tools.

TEXT BOOKS

1. Eoghan Casey, "Digital Evidence and Computer Crime", Academic Press,Third Edition ,2017.
2. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, Fourth Edition ,2016.

REFERENCES

1. Brian Carrier, "File System Forensic Analysis", Addison-Wesley, Fourth Edition 2015.
2. Nilanjan Dey et al.," Cyber Forensics", CRC Press, Second Edition 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/106/105/106105217/(Digital Forensics)
2. https://nptel.as.in/courses/167/108/165265456 (Digital Forensics)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	1	2	–	–	–	–	–	2	2
2	3	3	2	2	2	2	–	–	–	–	–	2	2
3	3	3	3	2	2	2	–	–	–	–	–	3	2
4	2	3	2	3	2	3	–	–	–	–	–	2	3
5	2	3	3	3	3	2	–	–	–	–	–	3	3
6	2	3	3	3	3	2	–	–	–	–	–	3	3
AVG	2.6	2.8	2.6	2.4	2.4	2.0	-	-	-	-	-	2.6	2.4

1-Low,2-Medium, 3-High,'-'-No correlation

Chairman - BoS

23CSP602 SOCIAL NETWORK SECURITY L T P C

3 0 0 3

OBJECTIVES

- To familiarize the students with fundamentals, and architecture of social networks, Semantic Web, and Social Network Analysis.
- To impart knowledge on privacy, security, and ethical issues in online social networks and associated threat models
- To inculcate data extraction, community detection, and mining techniques for social network analysis
- To explore human behavior prediction in social networks while addressing privacy and trust concerns.
- To familiarize the students with access control, authentication, and identity management frameworks to ensure security and privacy.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 9

Historical overview of privacy and security - Major paradigms for understanding privacy and security - Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis.

UNIT II SECURITY, PRIVACY & THREAT LANDSCAPE IN SOCIAL NETWORKS 9

Evolution of Privacy and Security in Online Social Systems – Threat Models in Social Networking – Contextual Influences on Privacy Attitudes and User Behaviour – Identity, Anonymity and De-Anonymization Issues – API Abuse and Third-Party Application Risks – Privacy Leakage, Metadata Harvesting – Ethical & Legal Challenges in Social Networks – Security Design Principles for Social Platforms.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Definition of community - Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities - social network infrastructures - Big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities - User data Management - Inference and Distribution - Enabling new human experiences - Reality mining - Context -

Awareness - Privacy in online social networks - Trust in online environment - Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT **9**

Understand the access control requirements for Social Network - Roles based Access Control - Host, storage and network access control options - Firewalls - Authentication and Authorization - Identity & Access Management - Single Sign–on - Identity providers and service consumers - The role of Identity provisioning

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, the Students will be able to:

- Explain the fundamentals, evolution, and architecture of social networks and Semantic Web.
- Classify the privacy, security, and ethical issues in social networks and related threat models.
- Analyze data extraction, community detection and mining techniques on social network datasets.
- Develop human behavior prediction and trust models in social networks while addressing privacy concerns.
- Analyze secure access control and identity management frameworks for social networking platforms.

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web", Springer, First Edition, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Application", Springer, First Edition, 2010.

REFERENCES

1. Alessandro Acquisti, "Digital Privacy: Theory, Technologies, and Practices", CRC Press, First Edition, 2007.
2. Mathew O. Jackson, "Social and Economic Networks", Princeton University Press, First Edition, 2008.

RESOURCES

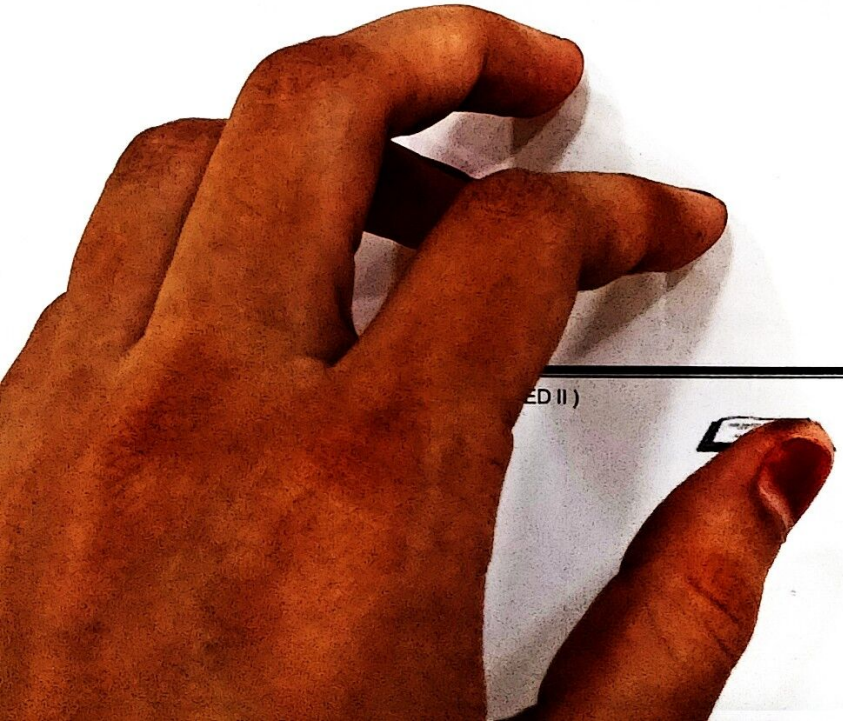
1. https://nptel.ac.in/courses/106106146 (Privacy and security)
2. http://nptel/courses/video/106106169 (social networks)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	1	1	-	1	1	-	2	1
2	3	3	2	2	2	3	3	-	2	2	-	2	2
3	3	3	3	2	3	1	1	-	2	1	-	3	3
4	3	3	2	2	2	2	2	-	2	1	-	2	2
5	3	2	3	2	2	2	2	-	2	1	-	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2.8	2.6	2	2.2	1.8	1.8	-	1.8	1.2	-	2.2	2

1-Low,2-Medium, 3-High, "-"- No Correlation

Chairman - BoS



23CSP603 **ENGINEERING SECURE SOFTWARE SYSTEMS** L T P C

3 0 0 3

OBJECTIVES

- To familiarize the students with secure software engineering principles and the importance of security across the software development lifecycle (SDLC).
- To enhance the students to identify, analyze, and mitigate software vulnerabilities in design, code, and deployment.
- To teach secure coding practices for preventing common software attacks such as injection, buffer overflow, and insecure API use.
- To impart hands-on exposure to threat modeling, static and dynamic code analysis tools.
- To train students to design, implement, and test secure software systems following industry standards and best practices.

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security – Threats to software security – Sources of software insecurity — Benefits of Detecting Software Security — Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack – Defense Against Memory-Based Attacks

UNIT II SECURE SOFTWARE DESIGN 9

Requirements Engineering for secure software – SQUARE process Model – Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages — Vulnerability Trends — Buffer Overflow — Code Injection – Session Hijacking. Secure Design.

UNIT III SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 9

Traditional Software Testing – Comparison – Secure Software Development Life Cycle – Risk Based Security Testing — Prioritizing Security Testing With Threat Modeling — Penetration Testing – Planning and Scoping – Enumeration – Remote Exploitation – Web Application Exploitation Exploits and Client Side Attacks.

UNIT V SECURE PROJECT MANAGEMENT 9

Governance and security – Adopting an enterprise software security framework – Security and project

management – Maturity of Practice

TOTAL : 45 HOURS

OUTCOMES

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

- Explain the fundamentals, evolution, and architecture of social networks and Semantic Web.
- Classify the privacy, security, and ethical issues in social networks and related threat models.
- Analyze data extraction, community detection and mining techniques on social network datasets.
- Develop human behavior prediction and trust models in social networks while addressing privacy concerns.
- Analyze secure access control and identity management frameworks for social networking platforms.

TEXT BOOKS

1. Julia H. Allen, "Software Security Engineering", Pearson Education, First Edition, 2008.
2. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", Syngress Publishing, First Edition, 2011.

REFERENCES

1. Robert C. Seacord, "Secure Coding in C and C++", Addison-Wesley Professional, First Edition, 2005.
2. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.

E – RESOURCES

1. https://nptel.ac.in/courses/106106199 (Secure Systems engineering)
2. https://nptel.ac.in/courses/noc26_cs 71 (Information Security)

Mapping of COs – POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	2	2	2	1	1	-	2	2
2	3	3	3	2	2	2	2	-	1	1	-	3	2
3	3	3	3	3	2	1	2	-	2	1	-	3	3
4	3	3	2	2	3	1	1	-	2	1	-	3	2
5	3	3	3	3	3	2	3	1	3	3	2	3	3
AVG	3	3	2.8	2.6	2.4	1.6	2	1.5	1.8	1.4	2	2.8	2.4

1-Low, 2-Medium, 3-High, "-"— No Correlation

Chairman - BoS

23ITP504 **HUMAN COMPUTER INTERACTION** L T P C

3 0 0 3

OBJECTIVES

- To gain knowledge about the foundations and principles of human computer interaction.
- To explore design technologies and accessibility techniques for individuals, including persons with disabilities.
- To develop knowledge of Human Computer Interaction (HCI) models and their applications.
- To enhance understanding of mobile Human Computer Interaction and its design principles.
- To explore user interface design guidelines and best practices for creating effective interactive systems.

UNIT I FOUNDATIONS OF HCI 9

The Human : I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies.

UNIT II DESIGN AND SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques - Universal Design.

UNIT III MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

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

- Demonstrate the fundamentals of Human Computer Interaction and interactive design principles for developing user-centered systems.
- Design accessible and effective human-computer interfaces for individuals, including persons with disabilities.
- **Analyze** HCI models, usability principles, and user feedback to evaluate interactive systems.
- **Apply** HCI concepts and design guidelines in developing multimedia, e-commerce, mobile, and e-learning applications.
- **Develop** intuitive and user-friendly interfaces by applying design principles, evaluation techniques, and usability standards.

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.
2. Brian Fling, "Mobile Design and Development", 1st Edition, O'Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", 1st Edition, O'Reilly, 2009.

REFERENCES

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human-Computer Interaction," 3rd Edition, Wiley, 2011.
2. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction," 5th Edition, Addison-Wesley, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/106103115
2. https://archive.nptel.ac.in/courses/106/106/106106177/

Mapping of COs-POs&PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	2	-	-	-	-	-	1	3	2
2	2	3	3	2	3	1	-	-	-	1	1	3	3
3	2	3	2	2	2	-	-	-	-	1	2	3	2
4	2	2	3	2	3	-	-	-	-	1	2	2	3
5	2	3	3	2	3	-	-	-	-	2	3	3	3
AVG	2.2	2.6	2.7	2.0	2.6	1.0	-	-	-	1.2	1.6	2.8	2.6

1-Low, 2-Medium, 3-High, '-'-No Correlation

Chairman - BoS

PROFESSIONAL ELECTIVE - V

PROFESSIONAL ELECTIVE – V

23CSP604	AUGMENTED REALITY / VIRTUAL REALITY	L T P C
		3 0 0 3

OBJECTIVES

- To impart the fundamental concepts, components, and technologies used in Virtual Reality (VR) and Augmented Reality (AR).
- To inculcate knowledge on geometric, physical, and behavioral modeling essential for VR applications.
- To train students in VR programming environments, toolkits, and scene-graph-based development.
- To introduce learners to various real-world applications of VR across medicine, military, manufacturing, robotics, business, and entertainment.
- To foster with AR fundamentals, computer vision methods, interaction techniques, and wearable AR devices.

UNIT I INTRODUCTION 9

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR- AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II VR MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS 9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications–

Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics– Information Visualization – VR in Business

UNIT V AUGMENTED REALITY 9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices.

TOTAL : 45 HOURS

OUTCOMES

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

- Explain the principles of VR/AR, their components, input/output devices and human sensory interfaces.
- Apply geometric, kinematic, and physical modeling concepts to construct VR scenes and environments.
- Develop simple VR applications using standard VR toolkits and scene-graph programming frameworks.
- Analyze the role of VR in various fields such as healthcare, military, manufacturing, robotics, entertainment, and education.
- Analyze AR technologies, computer-vision methods, interaction techniques and wearable AR systems.

TEXTBOOKS

1. Grigore Burdea & Philippe Coiffet, "Virtual Reality Technology", John Wiley & Sons, Second Edition, 2003.
2. Alan Craig, William Sherman, Jeffrey Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, First Edition, 2009.

REFERENCES

1. John Vince, "Virtual Reality Systems", Pearson Education, First Edition, 2011.
2. Jason Jerald, "The VR Book: Human - Centered Design for Virtual Reality", CM Books, First Edition, 2015.

E - RESOURCES

1. https://nptel.ac.in/courses/106/106/106106131/(Computer Graphics and Virtual Reality)
2. https://nptel.ac.in/courses/106/107/106107168/(Virtual Reality (VR) and Augmented Reality (AR)

Mapping of COS – POS & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	2	1	3	1	1	-	2	1
2	3	3	3	2	2	1	-	-	2	1	-	3	2
3	3	3	3	2	3	1	-	-	3	2	-	3	3
4	3	3	2	2	2	3	2	3	2	2	-	1	2
5	3	3	2	3	3	2	1	-	2	1	-	3	2
AVG	3	3	2.6	2.4	2.4	1.8	1.3	3	2	1.4	-	2.4	2

1-Low, 2-Medium, 3-High, "-" – No Correlation

Chairman - BoS

23ITP603 **GAME DEVELOPMENT** L T P C

3 0 0 3

OBJECTIVES

- To enable students to understand the basics of 2D and 3D graphics for game development.
- To familiarize the students with stages of game development and design principle.
- To foster the students to understand the game engine design & rending techniques.
- To train students to develop the gaming environment .
- To acquire knowledge on Pygame to develop game environment

UNIT I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation– Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development–Unity–Unity Scripts –Mobile Gaming,Game Studio, Unity Single player and Multi-Player games.

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcadeGames – Puzzle Games.

TOTAL: 45 PERIODS

OUTCOMES

Upon the completion of the course, the Students will be able to:

- Understand the concepts of 2D and 3d Graphics

- Apply the various game design documents using gaming design principles.
- Apply the gaming engines design and rending techniques using game environment.
- Apply recent gaming environments using development frameworks.
- Analyze a simple game application using Pygame

REFERENCES

1.Sanjay Madhav,"Game Programming Algorithms and Techniques:A Platform Agnostic Approach", Addison Wesley, Fourth Edition 2015.

2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress, Second Edition 2016.

TEXTBOOKS

1. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", CRC Press, Second Edition 2015.

2. JungHyunHan,"3D Graphics for Game Programming", Chapman and Hall/CRC, Fourth Edition 2016.

E RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs77/preview (Gaming Development)
2. https://onlinecourses.nptel.ac.in/noc24_cs109/previewn (Gaming Design

Mapping of COs-POs & PSOs:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	2	-	-	-	-	-	-	2	2
2	1	2	2	1	2	-	-	-	-	-	-	2	2
3	1	1	1	2	1	-	-	-	-	-	-	2	2
4	3	3	1	3	3	-	-	-	-	-	-	2	3
5	3	3	2	1	3	-	-	-	-	-	-	2	3
Avg.	**2.2**	**2.2**	**1.6**	**1.6**	**2.2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2.2**

1-Low 2-Medium 3-High'-'–No Correlation

Chairman - BoS

23ADP602 **NEURAL NETWORKS AND DEEP LEARNING** L T P C

3 0 0 3

COURSE OBJECTIVES:

- To impart basic knowledge of deep neural networks.
- To foster knowledge of associative memory and unsupervised learning networks.
- To train students to use CNN architectures for different applications.
- To enable students to analyze the basic computations used in deep learning and train neural networks.
- To acquire knowledge of autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION 9

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS 9

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV DEEP FEEDFORWARD NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

UNIT V RECURRENT NEURAL NETWORKS 9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural

Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

- Apply Convolution Neural Network for image processing.
- Understand the basics of associative memory and unsupervised learning networks.
- Apply CNN and its variants for suitable applications.
- Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
- Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.

E-RESOURCES

1. https://nptel.ac.in/courses/108108148
2. https://nptel.ac.in/courses/106106184

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	3	2	3	1	-	-	2	1	-	2	2
2	3	1	2	1	-	-	-	-	-	1	2	-	1
3	3	3	3	3	3	1	-	-	2	1	-	2	2
4	3	3	3	3	3	-	-	-	2	-	2	2	2
5	1	1	3	2	3	-	-	-	2	-	-	1	1
AVG	2.6	2	2.8	2.2	2.4	0.4	0	0	1.6	0.6	0.8	1.4	1.6

- 1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADP603 **AGILE METHODOLOGIES** L T P C

3 0 0 3

OBJECTIVES

- To impart Agile software development principles, values, and management theories.
- To familiarize Agile process models such as Scrum, Extreme Programming, Feature Driven Constructment, and Crystal.
- To foster Agile approaches for knowledge management and effective knowledge sharing in software engineering environments.
- To develop understanding the Agile requirements engineering techniques for handling evolving and unstable requirements.
- To familiarize students with Agile quality assurance practices, metrics, and global software development challenges.

UNIT I AGILE METHODOLOGY 9

Theories for Agile Management - Agile Software Development - Traditional Model vs. Agile Model - Classification of Agile Methods - Agile Manifesto and Principles - Agile Project Management - Agile Team Interactions - Ethics in Agile Teams - Agility in Design, Testing - Agile Documentations - Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES 9

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview - Lifecycle - Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9

Agile Information Systems - Agile Decision Making - Earl'S Schools of KM - Institutional Knowledge Evolution Cycle - Development, Acquisition, Refinement, Distribution, Deployment , Leveraging - KM in Software Engineering - Managing Software Knowledge - Challenges of Migrating to Agile Methodologies - Agile Knowledge Sharing - Role of Story-Cards - Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9

Impact of Agile Processes in RE-Current Agile Practices - Variance - Overview of RE Using Agile - Managing Unstable Requirements - Requirements Elicitation - Agile Requirements Abstraction Model - Requirements Management in Agile Environment, Agile Requirements Prioritization - Agile Requirements Modeling and Generation - Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE 9

Agile Product Development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile Approach to Quality Assurance - Test Driven Development - Agile Approach in Global Software Development.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain Agile principles, manifesto values, and their application in modern software development projects.
- Use Agile process models for iterative and incremental software development.
- Apply Agile process models in iterative and incremental software development.
- Analyze software requirements in Agile environments with frequent changes and stakeholder involvement..
- Apply agile approaches to support enterprise-level software development.

TEXT BOOKS

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2020.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2019.

REFERENCES

1. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Addison-Wesley, 2020.
2. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2017.

E – RESOURCES

1. https://elearn.nptel.ac.in/shop/completed-courses/short-term-programs-completed/agile-testing-methodology-and-project-management-test-automation/?v=13b5bfe96f3e
2. https://nptel.ac.in/courses/110104073

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	1	1	2	3	3	2	2	2
2	3	3	3	3	2	1	1	2	3	3	3	3	2
3	3	3	2	3	2	1	1	1	2	2	2	3	2
4	3	3	3	3	3	1	1	1	2	2	2	3	3
5	3	2	3	3	3	2	1	2	3	3	3	3	3
AVG	3	2.8	2.8	3	2.6	1.5	1	1.6	2	2.6	2.4	2.8	2.4

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CCP605	CYBER PHYSICAL SYSTEM SECURITY	L T P C
		3 0 0 3

OBJECTIVES

- To impart the fundamental concepts and principles of Cyber Physical Systems.
- To acquire knowledge about the cyber physical system components.
- To familiarize students with synchronous and asynchronous models used in Cyber Physical Systems.
- To impart knowledge of the security challenges and protection mechanisms in Cyber Physical Systems.
- To equip students with essential tools to implement CPS for different application domain.

UNIT I INTRODUCTION 9

Introduction: Cyber-Physical System, Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS

UNIT II CYBER PHYSICAL SYSTEM PLATFORM 9

CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model

UNIT III SYNCHRONOUS AND ASYNCHRONOUS MODEL 9

Reactive Components, Components Properties, Components Composing, Synchronous Designs and Circuits, Asynchronous Processes and operations, Design Primitives in Asynchronous Process, Coordination Protocols in Asynchronous Process, Leader Election.

UNIT IV SECURITY OF CYBER-PHYSICAL SYSTEMS 9

Introduction to CPS Securities, Basic Techniques in CPS Securities, Cyber Security Requirements, Attack Model and Countermeasures, Advanced Techniques in CPS Securities

UNIT V CPS APPLICATION 9

Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber Physical Systems, WSN based Cyber-Physical Systems, Smart Cities.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the fundamental concepts, principles, and architecture of Cyber Physical Systems.
- Analyze the components and functional architecture of Cyber Physical Systems.
- Analyze the synchronous and asynchronous models used in the design and operation of Cyber Physical Systems..
- Analyze the security challenges, vulnerabilities, and protection mechanisms in Cyber Physical Systems.
- Examine the selection of appropriate tools and technologies for implementing Cyber Physical System solutions in different application domains.

TEXTBOOKS

1. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2011.
2. R. Alur, "Principles of Cyber-Physical Systems," MIT Press, 2015 Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber-Physical Systems", Addison-Wesley,2017

REFERENCES

1. Rajeev Alur, "Principles of Cyber-Physical Systems", MIT Press, 2015.
2. Fei Hu, "Cyber-Physical Systems", CRC Press 2013.

E-REFERENCE

1. https://onlinecourses.nptel.ac.in/noc23_cs62/preview(Foundation of cyber physical system)
2. https://nptel.ac.in/courses/106106199 (Secure system engineering)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P08	PO9	PO10	PO11	PSO1	PSO2
1	3	2	–	–	–	–	–	–	–	–	2	2	1
2	3	3	2	2	3	–	–	–	–	–	2	3	2
3	3	3	2	2	2	–	–	–	–	–	2	2	2
4	2	3	2	2	3	2	3	–	–	–	2	3	3
5	2	3	3	2	3	3	–	–	2	2	3	2	3
AVG	**2.6**	**2.8**	**2.25**	**2.0**	**2.75**	**2.5**	**3.0**	**–**	**2.0**	**2.0**	**2.2**	**2.4**	**2.2**

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23CSP609 COGNITIVE SCIENCE L T P C

3 0 0 3

OBJECTIVES

- To familiarize the students with theoretical background of cognition.
- To foster the knowledge on cognition and computational intelligence.
- To enhance the students to explore probabilistic programming language.
- To develop the students' understanding on computational inference models of cognition.
- To foster the computational learning models of cognition .

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEURO SCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing --Cognitive Neuroscience – Perception – Decision – Learning and Memory- Language understanding and Processing

UNIT II COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Learning – Language-Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 9

Web PPL Language – Syntax – Using Java script Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Co routines: Functions that receive continuations –Enumeration

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional Dependence-Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models–Learning (Deep) Continuous Functions – Mixture Models.

TOTAL:45 PERIODS

OUTCOMES:

Upon successful completion of the course, the students will able to:

- Explain the foundational concepts of cognition with insights from philosophy, psychology and neuroscience.
- Analyze the relationship between cognition and computational intelligence through AI architectures, reasoning and knowledge systems.
- Apply probabilistic programming languages in modeling cognitive processes.
- Analyze the computational inference models such as generative models, conditioning and causal inference to perform cognitive tasks.
- Examine the learning models of cognition including hierarchical models, mixture models, and continuous deep function learning.

TEXTBOOKS

1. Jose Luis Bermudez, "Cognitive Science: "An Introduction to the Science of the Mind", Cambridge University Press, Second Edition, 2019.
2. Neil Stillings , "Cognitive Science: An Introduction", MIT Press, Second Edition, 1995.

REFERENCES

1. Michael Gazzaniga, Richard Ivry, George Mangun, "Cognitive Neuroscience: The Biology of the Mind", W.W. Norton & Co., Fifth Edition, 2014.
2. Daniel Dennett, "Consciousness Explained", Penguin Books, First Edition, 2015.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc25_hs40/preview(computational intelligence)
2. https://onlinecourses.nptel.ac.in/noc22_hs97/preview(learning models)

Mapping of COs – POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	3	3	3	1	1	-	1	1
2	3	2	1	1	2	3	3	2	2	2	-	2	2
3	3	3	3	2	2	3	3	2	2	2	2	3	2
4	2	2	1	-	-	3	3	3	1	1	-	1	1
5	2	2	2	1	1	3	3	2	3	2	2	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.6	2.4	1.8	1.5	1.8	3	3	2.4	1.8	1.6	2	1.8	1.6

1-Low, 2-Medium, 3-High, "-"– No Correlation

Chairman - BoS

OPEN ELECTIVES – I

OPEN ELECTIVE - I

23CEO607	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L T P C
		3 0 0 3

OBJECTIVES

- To explore the Rio principles of environmental impact assessment.
- To enhance the screening and scoping in EIA.
- To develop the environmental monitoring plan and EIA report preparation.
- To inculcate the baseline monitoring of socio economic environment.
- To instruct the EIA case studies pertaining to infrastructure projects.

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems- Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the impacts of development on environment.
- Analyze the scoping and screening of developmental projects for environmental and social assessments.
- Construct the environmental management plans and EIA reports.
- Apply the economic valuation of environmental impacts and cost benefit analysis.
- Identify the EIA case studies pertaining to Infrastructure Projects.

TEXT BOOKS

1. Canter, R.L. "Environmental Impact Assessment ", Second Edition, McGraw Hill Inc, New Delhi,1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.
3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, First Edition, 2009.

REFERENCES

1. Becker H. A., Frank Vanclay,"The International handbook of social impact assessment" Conceptual and Methodological Advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.

E-RESOURCES

1. https://nptel.ac.in/courses/124107160 (Environmental Impact Assessment)
2. https://onlinecourses.nptel.ac.in/noc25_ch24/preview (Environmental Quality Monitoring & Analysis)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	–	2	3	–	–	–	–	-	-
2	3	3	2	2	–	2	3	–	–	–	–	-	-
3	3	3	3	2	2	2	3	–	–	–	2	-	-
4	3	3	2	2	–	2	3	–	–	–	3	-	-
5	3	3	3	2	2	3	3	–	–	–	2	-	-
AVG	3.0	3.0	2.4	2.0	2.0	2.2	3.0	–	–	–	2.3	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ADP604 **ETHICS OF ARTIFICIAL INTELLIGENCE** L T P C

3 0 0 3

OBJECTIVES

- To familiarize the students with the fundamentals of morality, ethics, and ethical principles in Artificial Intelligence.
- To impart knowledge on ethical initiatives, guidelines, and responsible AI practices in the field of Artificial Intelligence.
- To familiarize the students with AI standards, regulations, policies, and governance frameworks.
- To inculcate awareness of social and ethical issues associated with Robot Ethics and autonomous systems.
- To explore the challenges and opportunities of AI and Ethics in developing responsible and trustworthy AI systems.

UNIT I INTRODUCTION

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II ETHICAL INITIATIVES IN AI

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT III AI STANDARDS AND REGULATION

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

TOTAL : 45 PERIODS

OUTCOMES

PROFESSIONAL ELECTIVE VI

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

- Explain the fundamental concepts of morality, ethics, and ethical principles in Artificial Intelligence.
- Classify real-time ethical issues, challenges, and concerns associated with AI applications.
- Analyze ethical harms, ethical initiatives, and responsible AI practices in the field of Artificial Intelligence.
- Apply AI standards and regulations to the safe design of autonomous and semi-autonomous systems.
- Analyze the concepts of Roboethics, morality, and professional responsibilities in the development and deployment of AI systems.

TEXT BOOK:

1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

E – RESOURCES

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/
3. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4. https://sci-hub.mksa.top/10.1159/000492428

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	3	3	1	-	-	-	1	2	1	3	1
2	2	1	1	2	1	-	-	-	1	2	1	3	3
3	2	3	1	1	3	-	-	-	2	1	1	3	2
4	3	1	3	3	2	-	-	-	2	2	3	2	1
5	3	1	1	3	3	-	-	-	2	3	3	1	3
AVG	2.6	1.6	1.8	2.4	2	-	-	-	1.6	2	1.8	2.4	2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSP607 QUANTUM COMPUTING L T P C 3 0 0 3

OBJECTIVES

- To introduce the fundamental principles and mathematical foundations of quantum mechanics and their role in quantum computation and information.
- To provide an understanding of quantum circuit models, universal gate sets, quantum parallelism, and the role of entanglement and non-locality in quantum algorithms.
- To introduce the principles of the quantum Fourier transform, phase estimation, and their applications, along with fundamentals of quantum-based machine learning.
- To provide an understanding of major quantum algorithms and their extensions for solving search and computational problems.
- To introduce the principles, protocols, and security foundations of quantum cryptography, quantum communication, and related applications.

UNIT I INTRODUCTION TO QUANTUM MECHANICS 9

History of quantum Computation and quantum information - Linear algebra: Dirac notation, Hilbert spaces, Unitary, Hermitian Operator, and Normal matrices, Inner product, Outer product, Tensor product, Postulates of Quantum Mechanics.

UNIT II CIRCUIT MODEL OF QUANTUM COMPUTING 9

Quantum Computation: Classical Circuits, Quantum Circuits, Universality of various sets of elementary gates. Quantum parallelism: Deutsch-Jozsa algorithm, Bernstein-Vazirani algorithm. Entanglement and Non–Locality: Quantum non-locality, CHSH-Clauser-Horne-Shimony-Holt, Magic square game, A non-local version of distributed Deutsch-Jozsa.

UNIT III QUANTUM FOURIER TRANSFORM 9

The quantum Fourier transform, Quantum Phase Estimation, Applications: order-finding and factoring, General applications of the quantum Fourier transform. Quantum Machine Learning: Supervised learning from quantum data – Unsupervised learning from quantum data.

UNIT IV QUANTUM ALGORITHMS 9

Simple algorithms: Deutsch's algorithm, Simon's algorithm, Shor's algorithm, Grover's search algorithm, G-BBHT algorithm, Minimum- finding algorithm, Generalizations and modifications of Search problems.

UNIT V QUANTUM CRYPTOGRAPHY 9

Quantum Key Generation: Basic ideas of two parties quantum key generation, Security issues of QKG protocols, Quantum key generation protocols BB84 and B92, Multiparty key

generation. Quantum Cryptographic Protocols: Quantum coin-flipping and bit commitment protocols. Quantum oblivious transfer protocols. Security of the quantum protocols. Security limitations of the quantum cryptographic protocols. Quantum Teleportation and Superdense Coding: Basic principles. Teleportation circuit. Quantum secret sharing. Superdense coding.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply core quantum mechanical concepts such as Dirac notation, operators, tensor products, and postulates to basic quantum computation frameworks.
- Explain the structure of quantum circuits, basic quantum algorithms, and the significance of entanglement and non-locality in computation.
- Apply the quantum Fourier transform, its applications, and basic approaches to quantum machine learning.
- Analyze the structure and working principles of quantum algorithms and their generalizations for various computational tasks.
- Explain quantum key generation, cryptographic protocols, teleportation, and superdense coding.

TEXT BOOKS

1- Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2010.

2- J.Gruska, "Quantum Computing", McGraw-Hill, 1999.

REFERENCES

1. Ronald de Wolf, "Quantum Computing", CWI and University of Amsterdam,2023.

2. Thomas G.Wong, "Introduction to Classical and Quantum Computing", Rooted Grove, 2022.

E-RESOURCES

1. https://nptel.ac.in/courses/106106232 (Quantum Algorithm)
2. https://onlinecourses.nptel.ac.in/noc23_cs04 (Quantum Cryptography)

Mapping of COs-POs & PSOs

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

1-Low, 2-Medium, 3-High, "-" - No Correlation

Chairman - BoS

23CCP602 **CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES** L T P C

3 0 0 3

OBJECTIVES

- To explore the core concepts and architecture of Blockchain technology.
- To acquire knowledge of crypto currencies such as Bitcoin and Ethereum, including their transactions, mining, smart contracts, and decentralized applications.
- To impart knowledge about digital tokens, blockchain wallets, and development frameworks.
- To acquire knowledge about the role of Linux and Unix environments in deploying and managing enterprise blockchain networks.
- To explore modern blockchain platforms and frameworks and their applications.

UNIT I OVERVIEW OF BLOCKCHAIN 9

Why Blockchain – The Structure of Blockchain – Data Structure of Blockchain – Data Distribution in Blockchain – Block Validation. Block Validators: Consensus – Proof of Work – Proof of Stake – Proof of Activity – Proof of Elapsed Time – Proof of Burn.

1. Compare major consensus mechanisms (PoW, PoS, PoA, PoET, and PoB).
2. Select an appropriate consensus mechanism for different blockchain applications.

UNIT II CRYPTOCURRENCY 9

Bitcoin: Bitcoin Working – Bitcoin Transactions – Bitcoin Mining – Value of Bitcoin – Community, Politics and Regulations – Advantages – Disadvantages. Ethereum: Overview – Decentralized Application. Components of Ethereum: Smart contracts – Ether – Ethereum Clients – Ethereum Virtual Machine – Ether scripter

UNIT III DEVELOPMENT FRAMEWORKS 9

Digital Tokens: Overview – Initial Coin Offering – OmiseGO – EOS – Tether. Meta Mask: Wallet Seed – Meta Mask Transactions. Mist: Overview – Mist wallet. Truffle: Features of Truffle – Development Truffle boxes – Community truffle box.

UNIT IV HYPERLEDGER 9

Linux& Unix: Hyper ledger Fabric: Introduction – Fabric v/s Ethereum – Hyper ledger Iroha – Features of Iroha. Hyper ledger Sawtooth: Components of sawtooth – Proof of Elapsed time.

UNIT V BLOCKCHAIN PLATFORMS 9

Multichain – HydraChain. Future Blockchain: IOTA – Corda – Chain Core.Block chain Framework: CoCo Framework – Tierion – BigchainDB

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the architecture, components, and consensus mechanisms of Blockchain technology.
- Analyze the working of Bitcoin and Ethereum, including cryptocurrency transactions, mining, smart contracts, and decentralized applications.
- Develop blockchain applications using digital tokens, blockchain wallets, and development frameworks.
- Analyze Linux and Unix environments for enterprise blockchain platforms for secure blockchain deployment.
- Examine modern blockchain platforms and frameworks for real-world blockchain applications.

TEXTBOOKS

1. Josh Thompson, "'Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, 1st Edition, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Gold feder. "Bitcoin and cryptocurrency technologies: a comprehensive introduction". 1st Edition, Princeton University Press, 2016.

REFERENCES

1. Antony Lewis, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Mango Publishig group, 2018
2. Tiana Laurence, Introduction to Blockchain Technology, 1st Edition, Van Haren Publishing, 2019.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 1st Edition, 2015.

E-REFERENCE

1. https://nptel.ac.in/courses/106105235
2. https://nptel.ac.in/courses/106105184

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P08	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	1	–	1	–	2	2	2
2	3	3	3	2	3	2	1	–	2	–	2	3	2
3	3	2	3	3	3	1	1	2	2	2	2	3	3
4	3	3	2	3	3	2	1	2	2	2	2	3	3
5	3	3	3	3	3	2	2	2	2	2	3	3	3
AVG	3	2.8	2.6	2.6	2.8	1.6	1.2	2	1.8	2	2.2	2.8	2.6

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23CSP610 **OPTIMIZATION TECHNIQUES** L T P C

3 0 0 3

OBJECTIVES

- To impart the fundamentals of optimization and develop the ability to formulate mathematical optimization problems.
- To familiarize the students with linear programming techniques for solving real-world optimization problems.
- To enable students to apply single-variable optimization methods for efficient solution search.
- To develop skills in solving multivariable and constrained optimization problems using classical and numerical techniques.
- To familiarize students with intelligent optimization methods like GA, PSO, SA, and GP for solving complex engineering problems.

UNIT I INTRODUCTION TO OPTIMIZATION 9

Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers

UNIT II LINEAR PROGRAMMING PROBLEM 9

Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

UNIT III SINGLE VARIABLE OPTIMIZATION PROBLEMS 9

Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method.

UNIT IV MULTIVARIABLE AND CONSTRAINED OPTIMIZATION TECHNIQUES 9

Multi Variable and Constrained Optimization Technique, Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve's pattern search method, Powell's conjugate direction method, Gradient based method, Cauchy 's Steepest descent method, Newton 's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangianmultiplier, Complex search method, Random search method

UNIT V INTELLIGENT OPTIMIZATION TECHNIQUES 9

Introduction to Intelligent Optimization, Genetic Algorithm: Types of reproduction

operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO), Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP- Virtual Functions.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain optimization problems using classical methods and linear programming concepts.
- Apply linear programming techniques such as simplex, duality, and dynamic programming to solve decision-making problems.
- Analyze modular solutions using functions, recursion, and pointers.
- Solve multivariable and constrained optimization problems using direct search, gradient-based, and advanced numerical techniques.
- Analyze intelligent optimization algorithms such as GA, PSO, SA, and GP for complex real-world optimization tasks.

TEXT BOOKS

1. S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley India Pvt. Ltd., Ninth Edition, 2020.
2. F. S. Hillier and G. J. Lieberman, "Introduction to Operations Research", McGraw-Hill Education, Tenth Edition, 2019.

REFERENCES

1. Xin-She Yang, "Nature-Inspired Optimization Algorithms", Elsevier Academic Press, Second Edition, 2020.
2. James Kennedy and Russell Eberhart, "Particle Swarm Optimization", Morgan Kaufmann Publishers, Second Edition, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/106105173 (Engineering Optimization)
2. https://nptel.ac.in/courses/112104031 (Operations Research)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	-	3	1	1	-	2	1
2	3	3	2	2	2	1	-	-	2	1	-	3	2
3	3	3	3	1	2		-	-	2	1	-	3	3
4	3	3	2	3	3	1	-	-	2	1	-	3	2
5	3	3	3	3	3	2	1	1	3	2	2	3	3
AVG	3	3	2.4	2.2	2.4	1.3	1	2	2	1.2	2	2.8	2.2

1- Low, 2-Medium, 3-High, "-" – No Correlation

Chairman - BoS

23ITP604 INFORMATION ASSURANCE AND SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To inculcate knowledge in the basics of Information Security
- To impart knowledge in legal, ethical and professional issues in Information Security
- To familiarize the principles and applications aspects of risk management
- To equip students with aware of various standards in this area.
- To expose students to recent technological aspects of Information Security

UNIT I INTRODUCTION 9

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

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access ControlDevices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand and explain the fundamental concepts, principles, and mechanisms of Information Security to protect information assets effectively.
- Analyze and apply legal, ethical, and professional practices related to Information Security in real-world organizational scenarios.
- Identify, assess, and manage risks by applying appropriate risk management frameworks and security controls.
- Apply internationally recognized Information Security standards and best practices to support compliance and governance.
- Analyze emerging Information Security technologies and trends to assess their impact on modern security challenges.

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", VikasPublishing House, New Delhi, 2015
2. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1- 3CRCPress LLC, 2017.

REFERENCES

1. Stuart McClure, Joel Scrambray, George Kurtz," Hacking Exposed", Tata McGraw-Hill, 2017
2. Matt Bishop," Computer Security Art and Science", Pearson/PHI, 2018.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106129/ (Information Security Technologies)
2. http://www.nptelvideos.com/course.php?id=427 (Information Security.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	-	-	-	-	-	2	3	3
2	3	3	3	3	2	-	-	-	-	-	2	3	3
3	3	3	3	3	3	-	-	-	-	-	2	3	3
4	3	3	3	3	3	-	-	-	2	2	3	3	3
5	3	3	3	3	3	3	-	2	2	2	3	3	3
6	3	3	3	3	3	2	1	2	2	2	3	3	3
AVG	3	3	3	2.83	2.67	0.83	0.17	0.67	1	1	2.5	3	3

1- Low, 2-Medium, 3-High, "-" – No Correlation

Chairman - BoS

23CST401 **DISTRIBUTED COMPUTING** L T P C

3 0 0 3

OBJECTIVES

- To impart the knowledge on the computation and communication models of distributed systems.
- To familiarize the students about the issues of synchronization and collection of information in distributed systems.
- To equip the students in the distributed mutual exclusion and distributed deadlock detection techniques.
- To expose the agreement protocols and fault tolerance mechanisms in distributed systems.
- To explore the cloud computing models and the underlying concepts.

UNIT I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing,Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.

UNIT III DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to- One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language,Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation,

Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts and components of distributed systems
- Analyze logical time, synchronization and global state in distributed systems
- Apply algorithms for mutual exclusion, deadlock detection and fault tolerance in distributed environments.
- Analyze consensus algorithms and recovery mechanisms for fault tolerance in distributed systems.
- Analyze cloud computing models, architecture and apply virtualizations.

TEXT BOOKS

1. Tyler Akidau, Slava Chernyak, Reuven Lax, "Streaming Systems: The What, Where, When and How of Large-Scale Data Processing" by O'Reilly publication.

2. Flink, Storm and Kafka ,"Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing" using Apache Spark, , Packet Publishing.

REFERENCES

1. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media.

2. Chris Poelker and R. James MacDonald by "Resources for Learning Stream Data Processing".

E – RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_bt27/preview (Stream Processing)
2. https://archive.nptel.ac.in/courses/102/106/102106022/(Downstream processing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	-	1	-	1	1	1	2	2
2	3	3	3	3	3	1	1	-	2	1	2	3	2
3	3	3	3	3	3	1	1	-	2	2	2	3	3
4	3	3	3	3	3	1	1	-	2	2	2	3	3
5	3	3	3	3	3	1	1	-	2	2	2	3	3
AVG	3	3	3	3	3	1	1	0	1.8	1.6	1.8	2.8	2.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

OPEN ELECTIVES – I

OPEN ELECTIVE - I

23CEO607 **ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT** LT P C

3 0 0 3

OBJECTIVES

- To explore the Rio principles of environmental impact assessment.
- To enhance the screening and scoping in EIA.
- To develop the environmental monitoring plan and EIA report preparation.
- To inculcate the baseline monitoring of socio economic environment.
- To instruct the EIA case studies pertaining to infrastructure projects.

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems- Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the impacts of development on environment.
- Analyze the scoping and screening of developmental projects for environmental and social assessments.

- Construct the environmental management plans and EIA reports
- Apply the economic valuation of environmental impacts and cost benefit analysis
- Identify the EIA case studies pertaining to Infrastructure Projects

TEXT BOOKS

1. Canter, R.L. "Environmental impact Assessment ", Second Edition, McGraw Hill Inc, New Delhi,1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.
3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, First Edition, 2009.

REFERENCES

1. Becker H. A., Frank Vanclay,"The International handbook of social impact assessment" Conceptual and Methodological Advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.

E-RESOURCES

1. https://nptel.ac.in/courses/124107160 (Environmental Impact Assessment)
2. https://onlinecourses.nptel.ac.in/noc25_ch24/preview (Environmental Quality Monitoring & Analysis)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	–	2	3	–	–	–	–	-	-
2	3	3	2	2	–	2	3	–	–	–	–	-	-
3	3	3	3	2	2	2	3	–	–	–	2	-	-
4	3	3	2	2	–	2	3	–	–	–	3	-	-
5	3	3	3	2	2	3	3	–	–	–	2	-	-
AVG	3.0	3.0	2.4	2.0	2.0	2.2	3.0	–	–	–	2.3	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSO610 DRONE TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts, vocabulary, and historical evolution of drone technology.
- To impart the process of assembling a multirotor drone using appropriate components and tools.
- To familiarize the students with drone flight operations, management tools, and the role of sensors in UAV systems.
- To impart the application of drones in filming and panoramic imaging.
- To foster the principles of drone swarm technology in drone applications.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept-Vocabulary Terminology-History of drone-Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Drone business through entrepreneurship-Opportunities/applications for entrepreneurship and Employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program – Install program on computer-Running Programs-Multi rotor stabilization-Flight modes-Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment-Drone controls Flight operations –management tool –Sensors-Onboard storage capacity-Removable storage devices-Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS 9

Choosing a drone based on the application-Drones in the insurance sector-Drones in delivering mail, parcels and other cargo-Drones in agriculture-Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks-Guidelines to fly safely –Specific aviation regulation and standardization-Drone

License-Miniaturization of drones-Increasing autonomy of drones-The use of drones in swarms.

Total: 45 Periods

OUTCOMES

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

- Understand the fundamental concepts, terminology, and historical development of drone technology.
- Design a multirotor drone using appropriate components and tools.
- Analyze the drone flight operations and UAV management tools.
- Utilize the drones for effective filming and panoramic photography through appropriate flight and camera control.
- Apply the principles of drone swarm technology to evaluate coordinated control and collaborative UAV applications.

TEXTBOOKS

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, First Edition, 2021
2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones, Maker Media,Inc.", Sheroff Publishers and Distributors Pvt Ltd, First Edition, 2015

REFERENCES

1. John Baichtal,"Building Your Own Drones:A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, First Edition, 2016
2. Zavrsnik," Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, First Edition, 2018.

E-RESOURCES

1. http://www.digimat.in/nptel/courses/video/101108661/L50.html (Fundamentals of Drone Technologies)
2. http://www.digimat.in/nptel/courses/video/101108661/L38.html (Drone Technology Commercial Application)

Mapping of COs-POs &PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	3	-	-	-	-	-	3	-	-
2	3	3	3	2	3	-	-	-	-	-	3	-	-
3	3	3	2	2	3	-	-	-	-	-	3	-	-
4	2	3	2	2	3	-	-	1	-	-	2	-	-
5	2	3	3	2	3	-	-	2	-	-	2	-	-
Avg	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-

1-Low 2-Medium 3-High "-" - No Correlation

Chairman - BoS

23ECO602 FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS L T P C

3 0 0 3

OBJECTIVES

- To introduce fundamental knowledge of semiconductors and devices and its applications
- To discuss the operation and characteristics of Bipolar Junction Transistor
- To expose the various types of oscillators and FET.
- To inculcate the operation of power semiconductor devices.
- To impact knowledge on optoelectronic devices and wave shaping circuits

UNIT I SEMICONDUCTOR AND DIODES 9

Semiconductor - Definition, classification, intrinsic and extrinsic N type & p type – drift current &diffusion current diodes – PN junction diode – forward and reverse bias characteristics –specification – zener diode construction & working Principle - characteristics - zener break down - avalanche break down.**Rectifier** – introduction-classification of rectifiers-half wave rectifier-full wave Rectifier (center tapped, bridge) - (no mathematical equations) – comparison – Applications - filters-C, LC and PI filters.

UNIT II BIPOLAR JUNCTION TRANSISTOR 9

Transistor – NPN and PNP transistor – operation-transistor as an amplifier- transistor as a switch – CB,CE,CC configurations – characteristics - comparison between three configurations in terms of input impedance, output impedance, current gain, voltage gain – negative feedback Concept, effect of negative feedback – types of negative feedback connections.

UNIT III TRANSISTOR OSCILLATORS AND FET 9

Transistor oscillators – Classifications – Condition for oscillations (Barkhausen criterion) – General form of Hartley Oscillator – Colpitts Oscillator – RC Phase shift oscillator. Field Effect Transistor – construction – working principle of FET – difference Between FET and BJT – classification of FET – characteristics of FET – Applications.

UNIT IV SCR, DIAC, TRIAC 9

SCR – introduction – working – VI-characteristics -comparison between SCR and transistor – SCR as a switch, controlled rectifier. TRIAC working principle, Characteristics –DIAC –characteristics –DIAC as bi- directional switch. Applications of SCR,TRIAC and DIAC.

UNIT V OPTOELECTRONIC DEVICES AND WAVE SHAPING CIRCUITS 9

Classification of optoelectronic devices – symbols. Characteristics, working of LDR, LED, 7 segment LED and LCD– opto coupler - Photo transistor. Clipper, Clamper Circuits and waveforms only – Astable, Monostable Multivibrators and Schmitt trigger using transistors.

TOTAL : 45 PERIODS

OUTCOMES

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

- Understand the concept of semiconductor, diodes and its applications.
- Discuss the various biasing circuits using BJT.
- Explain the oscillator circuits and Field Effect Transistor.
- Analyze the operation of power semiconductor devices and its applications.
- Explain the operation of optoelectronic devices and wave shaping circuits.

TEXT BOOKS

1. Robert L. Boylestad, Louis Nashelsky "Electronic Devices and Circuits Theory", Prentice Hall Publications, Tenth Edition, 2009.
2. S.Salivahanan,N.Suresh kumar, , "Electronic Devices and Circuits", McGraw Hill, Fifth Edition, 2022.

REFERENCE

1. G.S.N. Raju, "Electronic Devices and Circuits", I.K. International Publications, New Delhi,
First Edition, 2006.
2. A.P Godse, U.A Bakshi , "Electronic Devices and Circuits", Technical Publications, 2010.

E-*RESOURCES*

1. https://nptel.ac.in/courses/108108122 - (Fundamentals of Semiconductor Devices).
2. https://onlinecourses.nptel.ac.in/noc21_ee86 - (Microelectronics: Devices To Circuits).

Mapping of COs - POs & PSOs

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

1- Low, 2 - Medium, 3 - High, '-' – No correlation

Chairman - BoS

23EEO603 ELECTRIC VEHICLE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge on the basic concepts and working of electric vehicles.
- To familiarize with battery types, parameters, and battery pack design for electric vehicles.
- To instruct on DC and AC electrical machines used in electric vehicle applications.
- To develop understanding of electric vehicle drive train components and regenerative braking.
- To foster awareness of hybrid electric vehicle types, configurations, and component sizing.

UNIT I ELECTRIC VEHICLES 9

Introduction - Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics Dynamics of vehicle motion Propulsion System Design

UNIT II BATTERY 9

Basics - Types - Parameters Capacity, Discharge rate, State of charge, state of discharge, Depth of discharge - Technical characteristics - Battery pack design Properties of batteries

UNIT III DC & AC ELECTRICAL MACHINES 9

Motor and engine rating - Requirements - DC machines - Three phase AC machines- Induction machines - Permanent magnet machines - BLDC Motor Switched reluctance machines

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN 9

Transmission configuration - Components - Gears - Differential - Clutch - Brakes Regenerative braking - Motor sizing

UNIT V HYBRID ELECTRIC VEHICLES 9

Types - Series - Parallel and series - Parallel configuration - Design - Drive train Sizing of components.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Analyze the basic concepts and working of electric vehicles.
- Apply the battery types, parameters inbattery pack design.
- Explain the DC and AC electrical machines used in electric vehicles.
- Identify the electric vehicle drive train components and regenerative braking.

- Examine the hybrid electric vehicle types, configurations, and component sizing.

TEXT BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, Second Edition, 2017.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, First Edition, 2015.

REFERENCES

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC press, Second Edition, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, Second Edition, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/108103009 - (Hybrids and Electric Vehicle)
2. http://nptel.ac.in/courses/108103009/ - (Electric Vehicle)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEO604 **RENEWABLE ENERGY SYSTEMS** L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on renewable energy sources and their role in sustainable energy development.
- To familiarize with the working and applications of wind energy systems.
- To develop understanding of solar photovoltaic and solar thermal energy systems.
- To instruct on biomass, geothermal, and hydroelectric energy systems.
- To get knowledge on other renewable energy sources and energy storage systems.

UNIT I RENEWABLE ENERGY SOURCES 9

Environmental consequences of fossil fuel use - Importance of Renewable Sources (RE) of energy - Sustainable design and development - Types of RE sources - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Power in the wind - Types of wind power plants(wpps) - Components of wpps - Working of wpps - Siting of wpps - Grid integration issues of wpps.

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar radiation - Radiation measurement - Solar thermal power plant - Central receiver power plants - Solar ponds - Thermal energy storage system with pcm - Solar photovoltaic systems - Basic principle of spv conversion - Types of pv systems -Maximum power point tracking - Best free solar pv system simulation.

UNIT IV BIOMASS ENERGY 9

Introduction - Bio mass resources - Energy from bio mass - Conversion processes - Biomass cogeneration - Environmental benefits - Geothermal energy - Basics - Direct use - Geothermal electricity - Mini/micro hydro power - Classification of hydropower schemes - Classification of water turbine - Turbine theory - Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES 9

Tidal energy - Energy from the tides - Barrage and non barrage tidal power systems - Wave energy - Energy from waves - Wave power devices - Ocean thermal energy conversion (OTEC) - Hydrogen production and storage - Fuel cell - Principle of working - Various types - Construction and applications - Energy storage system - Hybrid energy systems.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the importance and types of renewable energy sources.
- Analyze the working and components of wind energy systems.
- Discuss how solar photovoltaic and solar thermal systems work.
- Determine biomass, geothermal, and hydroelectric energy systems.
- Examine tidal, wave, ocean thermal, fuel cell, and hybrid energy systems.

TEXT BOOKS

1. Scott Grinnell, "Renewable Energy & Sustainable Design", Cengage Learning, USA, Second Edition, 2016.
2. Richard A. Dunlap, "Sustainable Energy", Cengage Learning India Private Limited, Second Edition, 2015.

REFERENCES

1. ShobhNath Singh, "Non-conventional Energy resources", Pearson Education India, Second Edition, 2015.
2. Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis, "Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, First Edition, 2016.

E-RESOURCES

1. https://nptel.ac.in/courses/108/108/108108078/ - (Renewable Energy Systems)
2. https://nptel.ac.in/courses/108/105/108105058/ - (Non-Conventional Energy resources)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
1	3	3	3	3	3	1	1	-	1	-	2	-	-
2	3	3	3	3	3	1	1	-	1	-	2	-	-
3	3	3	3	3	3	1	1	-	1	-	2	-	-
4	3	3	3	3	3	1	1	-	1	-	2	-	-
5	3	3	3	3	3	1	1	-	1	-	2	-	-
AVG	3	3	3	3	3	1	1	-	1	-	2	-	-

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23MEO601 INTRODUCTION TO INDUSTRIAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES

- To enable students to grasp the fundamental concepts, scope, and role of Industrial Engineering in manufacturing and service systems.
- To expose students to plant location, facility layout, and production planning concepts relevant to real-world industries.
- To develop analytical ability to apply work study, method study, and ergonomics principles in industrial environments.
- To equip students with foundational knowledge of statistical quality control and its application in process improvement.
- To prepare the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.

UNIT I INTRODUCTION 9

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT 9

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN & ERGONOMICS 9

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study –Work sampling- Ergonomics and its areas of application in the work system - Physical work load and energy expenditure. Anthropometry – measures – design procedure. Work postures-sitting, standing.

UNIT IV STATISTICAL QUALITY CONTROL 9

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling- O.C curve –Single sampling plan- Double sampling plan.

UNIT V PRODUCTION PLANNING AND CONTROL 9

Forecasting –Techniques – Types of production – Process planning – Economic Batch Quantity– Loading – Scheduling and control of production.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Apply the concepts of productivity and productivity measurement approaches.
- Examine appropriate location models for various facility types and design various facility layouts.
- Analyze and conduct method study and time study to improve the efficiency of the system.
- Examine the quality of processes using control charts in manufacturing/service industries.
- Apply knowledge and skills for planning strategies and preparing a Material Requirement Plan (MRP).

TEXTBOOKS

1. Marta
2. nd Telsang,2016, "Industrial Engineering and Production Management", S. Chand and Company.
3. Khanna O. P., and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2020,
4. George Kanwaty, "Introduction to Work Study ", ILO, Geneva, 2016.

REFERENCES

1. Ravi Shankar, 2019, "Industrial Engineering and Management", Galgotia Publications & Private Limited.
2. Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 2018,
3. Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd.,2019.

E-RESOURCES

1. https://nptel.ac.in/courses/112107292 (Principles of Industrial Engineering)
2. https://onlinecourses.nptel.ac.in/noc25_me181/preview- (Industrial Engineering and Operations Research)

Mapping of COs-POs &PSOs

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

1-Low 2-Medium 3-High '-' –No Correlation

Chairman - BoS

23MEO605 CNC MACHINING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of computer graphics, CAD systems, geometric transformations, and viewing techniques used in computer-aided design.
- To provide knowledge on geometric modeling techniques, assembly modeling, graphics standards, and product data exchange standards used in CAD applications.
- To explain the construction, components, control systems, and operational features of CNC machines and advanced machining centres.
- To familiarize students with manual and computer-aided CNC part programming techniques using APT, CAM packages, and canned cycles.
- To develop an understanding of Computer-Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) manufacturing concepts.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9

Product cycle - Design process - sequential and concurrent engineering - Computer-aided design - CAD system architecture - Computer graphics - coordinate systems - 2D and 3D transformations homogeneous coordinates - Line drawing - Clipping - viewing transformation.

UNIT II GEOMETRIC MODELING 9

Geometric Modeling - types - Wireframe, surface and solid modeling - Boundary Representation, constructive solid geometry - Graphics standards - assembly modeling - use of software packages - Data exchange standards - IGES, STEP, CALS, etc. - communication standards.

UNIT III CNC MACHINES 9

NC, CNC & DNC - types of CNC - constructional features - drives and control systems - feedback devices - Interchangeable tooling system - preset & qualified tools - ISO specification - Machining center - Turning center - CNC EDM - CNC wire cut EDM.

UNIT IV CNC PROGRAMMING 9

Manual part programming - steps involved - sample program in lathe & milling. - Computer-aided part programming - APT - CAM package - canned cycles - Programming.

UNIT V FUNDAMENTALS OF CAM 9

Brief introduction to CAM - Manufacturing Planning, Manufacturing control - Concurrent Engineering - CIM concepts - Computerized elements of CIM system - Types of production

Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the principles of computer graphics, CAD system architecture, coordinate systems, geometric transformations, and viewing techniques used in computer-aided design.
- Examine geometric modeling techniques, assembly modeling approaches, graphics standards, and data exchange standards for engineering design applications.
- Compare the constructional features, control systems, tooling arrangements, and operational characteristics of CNC machines and advanced machining centres.
- Classify CNC programming techniques, including manual part programming, computer-aided part programming, APT, CAM packages, and canned cycles for manufacturing applications.
- Differentiate the concepts of CAM, CIM, manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) production in modern manufacturing systems.

TEXTBOOKS

1. Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education", Fifth Edition, 2023.
2. Ibrahim Zeid, "Mastering CAD/CAM", McGraw-Hill Education, Third Edition, 2021.
3. P. N. Rao, "CAD/CAM: Principles and Applications", McGraw-Hill Education (India), Fourth Edition, 2022.

REFERENCES

1. M. P. Groover and Emory W. Zimmers Jr., "CAD/CAM: Computer-Aided Design and Manufacturing", Pearson Education, Second Edition (Reprint), 2020
2. M. P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Eigth Edition, 2025
3. Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM: Theory and Practice", McGraw Hill Education, Second Edition, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/112102103 (Overview of CNC machines)
2. http://www.digimat.in/nptel/courses/video/112104289/L20.html (CNC Part Programming)

Mapping of COs-POs &PSOs

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

1-Low 2-Medium 3-High '-' –No Correlation

Chairman - BoS

23MDO611 HOSPITAL MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the fundamentals of hospital administration and management.
- To impart knowledge on human resource management practices in healthcare organizations.
- To explore marketing research processes and consumer behavior in healthcare services.
- To introduce hospital information systems and supportive healthcare services.
- To inculcate awareness of quality assurance, accreditation standards, and patient safety practices.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management –Telemedicine - Bio-Medical Waste Management..

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

Principles of HRM — Functions of HRM — Profile of HRD Manager — Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS 9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations — Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior — Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement - Clinical

Information Systems - Administrative Information Systems - Support Service Technical Information Systems — Medical Transcription, Medical Records Department – Central Sterilization and Supply Department– Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the principles and functions of hospital administration in healthcare organizations.
- Analyze human resource management practices and their role in hospital operations.
- Apply marketing research techniques for healthcare service management.
- Utilize hospital information systems and supportive services for decision-making.
- Develop quality assurance and patient safety strategies in healthcare settings.

TEXT BOOKS

1. Gupta Joydeep Das, "Hospital Administration and Management: A Comprehensive Guide", Third Edition, 2023.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi, Fifth Edition,Reprint 2018.

REFERENCES

1. Bruce J. Fried and Myron D.Fottler, "Human Resources in Healthcare Managing for Success",Fourth Edition, 2020.
2. James R. Langabeer, "Handbook on Health Care Operations Management",Jones & Bartlett Publishers, 2020.

E-RESOURCES

1. https://www.youtube.com/watch?v=2J-F4Fi2VRQ – (Introduction to Human

Resource Management in Healthcare Settings)

2. https://www.youtube.com/watch?v=dXHJemWm1xI&pp=ygUVI2hvc3BpdGFsX2luZm9ybWF0aW9u – (Hospital Information Management Software (HIMS))

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	3	1	-	-	2	1	-	-	1	1	-	-
2	1	2	2	1	-	1	2	1	1	2	1	-	-
3	1	2	3	1	1	1	1	-	1	2	1	-	-
4	1	2	2	2	3	1	1	-	1	1	2	-	-
5	1	3	2	2	2	3	2	1	1	2	2	-	-
AVG.	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Chairman - BoS

23RAO609 FUNDAMENTALS OF ROBOTICS L T P C

3 0 0 3

OBJECTIVES

- To introduce the basics of robots, including anatomy, types, specifications, and applications.
- To impart knowledge on robot kinematics, including forward/inverse kinematics and transformation matrices for manipulators.
- To familiarize with robot drive systems and end effectors, including types, features, applications, and design considerations.
- To discuss sensors in robotics, including force, tactile, proximity, and their applications and safety aspects.
- To enhance understanding of robot programming and its applications in industrial and specialized fields.

UNIT I BASICS OF ROBOT 9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT KINEMATICS 9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS 9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism

UNIT V PROGRAMMING AND APPLICATIONS OF ROBOT 9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effectors Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS

OUTCOMES

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

- Identify robot types, anatomy, specifications, and applications.
- Illustrate forward and inverse kinematics of manipulators using transformation matrices.
- Analyze and select appropriate drive systems and end effectors for robotic applications.
- Apply sensor technologies and safety systems to robotic cells for reliable detection, hazard prevention, and compliant operation.
- Apply robot programming techniques and analyze their applications in industrial and specialized fields.

TEXTBOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, Second Edition, 2015.
2. Mikell.P.Groover, "Industrial Robotics–Technology, Programming and applications", McGraw Hill, Second Edition , 2017.

REFERENCES

1. Fu K.S. Gonalz R.C. and ice C.S.G.,"Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co., Second Edition, 2007.
2. John. J.Craig, "Introduction to Robotics: Mechanics and Control", Fourth Edition, 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me37/preview- (Fundamentals of Robotics)
2. https://archive.nptel.ac.in/courses/112/108/112108298 (Basics of Robotics)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	3	3	-	1	-	2	-	1	-	-
2	3	2	-	3	3	-	-	-	2	-	2	-	-
3	3	2	-	3	3	-	-	2	2	2	2	-	-
4	3	2	-	3	3	2	-	2	2	2	2	-	-
5	3	2	-	2	3	2	-	2	2	3	3	-	-
AVG	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-

1.Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23CSO612 CYBER FORENSICS AND ETHICAL HACKING L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge about the cyber crime and forensics.
- To acquire knowledge about forensic tools used for evidence acquisition and analysis.
- To familiarize with skills to collect, analyse, and present digital evidence following accepted forensic procedures and legal requirements.
- To impart the fundamental concepts, principles, and scope of ethical hacking in cyber security.
- To acquire the ethical hacking principles and security best practices to identify, analyze, and mitigate vulnerabilities in web applications

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody- Forensic Tools

UNIT III VALIDATING FORENSICS DATA 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India.

UNIT IV ETHICAL HACKING 9

Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking .

UNIT V ETHICAL HACKING IN WEB 9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, students will be able to:

- Understand the basics of cyber crime and computer forensics
- Apply the forensic tools for acquiring, preserving, and analyzing digital evidence
- Analyze and validate digital evidence by applying standard forensic procedure
- Apply ethical hacking methodologies to perform reconnaissance, scanning, enumeration, and vulnerability
- Analyze the security vulnerabilities in web applications, wireless networks, and mobile platform.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Christopher Stuart, "Guide to Computer Forensics and Investigations", Cengage Learning, India, Sixth Edition, 2019.
2. CEH official "Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 2021.
3. Dejey, S. Murugan, "Cyber Forensics", Oxford University Press, India, 2018

REFERENCES

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005
2. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", Third Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking", Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications, Taylor &Francis Group–2008.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	1	1	-	-	-	1	-	-
CO2	3	2	1	2	3	1	2	1	1	-	2	-	-
CO3	3	3	1	3	3	2	3	1	2	-	2	-	-
CO4	3	3	2	2	3	2	2	1	1	-	2	-	-
CO5	3	3	3	2	3	2	3	1	2	1	3	-	-
AVG	3	2.6	1.7	2.2	2.6	1.6	2.2	1	1.5	1	2	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23PMO608 **PHARMACEUTICAL NANOTECHNOLOGY** L T P C

3 0 0 3

OBJECTIVES

- To introduce the evolution, principles, and applications of nanotechnology in drug delivery.
- To familiarize students with the principles of biopharmaceutics and pharmacokinetics.
- To provide knowledge of the principles, preparation, characterization, evaluation, and pharmaceutical applications of closed bilayered drug delivery systems.
- To develop a comprehensive understanding of programmed drug delivery systems, drug targeting strategies,
- To enhance understanding of the interactions of nanomaterials with biological systems, nanotoxicity.

UNIT I FUNDAMENTALS OF NANOTECHNOLOGY IN DRUG DELIVERY 9

Nanotechnology in Drug Delivery- Past, Present and Future- Conventional delivery of pharmaceuticals and its limitations, Significance of nano-size in Pharmacy, biotechnology and medicine, Physicochemical Principles of nano-sized Drug Delivery Systems, Biopharmaceutical, Physiological, and Clinical Considerations for Nanotechnology in Drug Delivery.

UNIT II PHARMACOKINETICS AND BIO DISTRIBUTION 9

Introduction- Definitions, concepts of Absorption, Distribution, Metabolism and excretion, concentration time profile, Bioavailability, bio pharmaceutics and pharmacokinetics in drug research. Biotransformation of drugs- Drug metabolizing enzymes, chemical pathways of Drug transformation, Phase-I and Phase-II reactions, Factors affecting drug transformation Prodrugs- Application of produg design.

UNIT III NANO CARRIERS FOR DRUG DELIVERY 9

Closed bilayered system- Introduction, structural aspects, preparation, characterization, evaluation and applications of liposomes, niosomes, erythrosomes. Polymeric Nanoparticles- Introduction, preparation, characterization, evaluation and pharmaceutical applications.

UNIT IV CONTROLLED AND TARGETED DRUG DELIVERY 9

Programmed Drug Delivery Systems- principles of sustained, controlled, pulsatile and triggered release of drug from nanoparticles. Concept of targeting- Targeting Approaches, Transport Across Biological Barriers, mechanisms of drug targeting, Ideal carrier system and approach Disease-Related Approaches by Nanotherapeutics- nanoparticles for Cancer, Skin Diseases, Bacterial, Diseases, Parasites Diseases and Inflammatory Disease.

UNIT V NANO TOXICOLOGY AND REGULATORY ISSUES 9

Human health and safety- Interaction of nanomaterials with biological systems, Toxicology of nanoparticles- in-vitro and in-vivo, Complications with Nanotoxicity studies, environmental impact of nano-materials, Regulatory Toxicology.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the physicochemical principles governing nano-sized drug delivery systems.
- Explain the role of biopharmaceutics and pharmacokinetics in drug discovery, development, and therapeutic optimization.
- Analyze the physicochemical properties and performance of liposomes, niosomes, erythrosomes, and polymeric nanoparticles for pharmaceutical applications.
- Explain the principles of programmed drug delivery systems, including sustained, controlled, pulsatile, and triggered drug release from nanoparticles.
- Apply appropriate approaches to assess the toxicological effects and safety of nanomaterials using in-vitro and in-vivo studies.

TEXT BOOKS

- Padma Devarajan, Sanyog Jain, "Targeted Drug Delivery : Concepts and Design", Springer publisher, First Edition , 2015.
- M. A. Mateescu P. Ispas-Szabo E. Assaad, "Controlled Drug Delivery", Woodhead Publishing , Second Edition, 2014

REFERENCES

- Michael E. Aulton ,"Pharmaceutics", Churchill Livingstone Publisher , Second Edition, 2013.
- Philippe Houdy, Marcel Lahmani, "Nanoethics and Nanotoxicology", Springer-Verlag Publisher, Second edition, 2011.

E-RESOURCES

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9783527800681
2. https://www.scribd.com/document/742651789/Nano-Technology-1

Mapping of COs-POs & PSOs

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

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MAO606	GRAPH THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts of graph theory.
- To explain the properties of trees, spanning trees, and fundamental circuits.
- To explain the concepts of connectivity and planarity.
- To provide knowledge of graph coloring, covering and partitioning.
- To introduce the concepts of directed graphs and Euler digraphs.

UNIT I INTRODUCTION, PATHS AND CIRCUITS 9

Graphs introduction – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendant vertex and Null graph – Isomorphism – Sub graphs – Walks, Paths and Circuits – Connected graphs, disconnected graphs and components – Euler graphs – Hamiltonian paths and circuits.

UNIT II TREES AND FUNDAMENTAL CIRCUITS 9

Trees – Properties of trees – Pendant vertices in a tree – Distance and centers in tree – Rooted and binary trees – Spanning trees – Fundamental circuits – Spanning trees in a weighted graph.

UNIT III CONNECTIVITY AND PLANARITY 9

Connectivity and separability – Network flows – 1-isomorphism – 2-isomorphism – Combinational and geometric graphs – Planer graphs – Kuratowski's two graphs – Different representation of a planer graph.

UNIT IV COLORING, COVERING AND PARTITIONING 9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem

UNIT V DIRECTED GRAPH 9

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler digraphs

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the fundamental concepts of graphs, paths, circuits, Euler and Hamiltonian graphs.
- Apply tree properties and fundamental circuits to solve engineering problems.
- Analyze graph connectivity, network flows and planar graphs for modeling real-world systems.

- Apply graph coloring, matching, covering, and partitioning techniques to optimization and scheduling problems.
- Analyze directed graph and Euler digraphs in engineering applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Narsingh Deo., " Graph theory with applications to engineering and computer Science ". Prentice-Hall of India Pvt.Ltd, Fifth Edition, 2016.
2. L.R.Foulds , "Graph Theory Applications", Springer LTD, Seventh Edition, 2016.

REFERENCES

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill Education (India) Private Ltd., Seventh Edition,, 2011.
2. Ralph P Grimaldi and B.V Ramana., "Discrete and Combinatorial Mathematics", Pearson Education limited, Fifth Edition, 2014.

E-RESOURCES

1. https://nptel.ac.in/courses/111106102 (Graph theory)
2. https://nptel.ac.in/courses/128106001 (Graph theory)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	1	-	-
2	3	3	2	-	-	-	-	-	-	-	1	-	-
3	3	3	2	1	-	-	-	-	-	-	1	-	-
4	3	3	3	1	-	-	-	-	-	-	2	-	-
5	3	3	2	1	-	-	-	-	-	-	2	-	-
AVG	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

OPEN ELECTIVE - II

23CEO704 **REMOTE SENSING CONCEPTS** L T P C
3 0 0 3

OBJECTIVES

- To inculcate the concepts of remote sensing processes.
- To impart knowledge on applications of standard atmospheric profile and earth material.
- To familiarize with the orbits and platforms.
- To Instruct the various remote sensing techniques
- To enhance the elements of data interpretation.

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS 9

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit.

UNIT IV SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept: spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors –microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites.

UNIT V DATA PRODUCTS AND INTERPRETATION 9

Photographic and digital products – Types, levels and open-source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys -

Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the concepts and laws related to remote sensing.
- Analyze the interaction of electromagnetic radiation with atmosphere and earth material.
- Develop the satellite orbits and different types of satellites.
- Classify the different types of remote sensors.
- Construct the concepts of interpretation of satellite imagery.

TEXT BOOKS

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, "Remote Sensing and Image interpretation", John Wiley and Sons, Nineth Edition,2019.
2. George Joseph and C Jeganathan, "Fundamentals of Remote Sensing", Universities Press (India) Private limited, Third Edition, 2020.
1. Janza, F.Z., Blue H.M. and Johnson, J.E. "Manual of Remote Sensing. Vol. I", American Society of Photogrametry, Virginia, Fifth Edition, 2021.

REFERENCES

1. Verbyla, David, "Satellite Remote Sensing of Natural Resources", CRC Press, Third Edition, 2019
2. Paul Curran P.J. "Principles of Remote Sensing. Longman", RLBS, Eighth Edition, 2022.
3. Charles Elachi and JacobVan Zyl, "Introduction to Physics and Techniques of Remote Sensing", Wiley Publication,Second Edition, 2020.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview (Remote Sensing and GIS)
2. https://onlinecourses.nptel.ac.in/noc20_ce29/preview (Remote Sensing Essentials)

Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
1	3	-	1	1	2	-	-	-	2	1	1	-	-
2	3	-	1	1	2	-	-	-	2	1	1	-	-
3	3	-	1	1	2	-	-	-	2	1	1	-	-
4	3	-	1	1	2	-	-	-	2	1	1	-	-
5	3	-	1	1	2	-	-	-	2	1	1	-	-
AV G	3	-	1	1	2	-	-	-	2	1	1	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23ECO708 Energy Technology L T P C

3 0 0 3

OBJECTIVES

- To acquire knowledge of the basic concepts of energy, energy resources, and energy consumption.
- To familiarize the working principles of conventional power plants such as thermal, hydel, and nuclear power plants.
- To impart knowledge on the principles and applications of renewable energy sources like solar, wind, tidal, ocean, and geothermal energy.
- To enhance understanding of biomass energy conversion methods, fuel cells, and energy storage systems.
- To foster awareness of energy conservation techniques and energy auditing for improving industrial energy efficiency

UNIT I INTRODUCTION 9

Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II CONVENTIONAL ENERGY 9

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY 9

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY 9

Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cell and its types, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V ENERGY CONSERVATION 9

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers,

distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL : 45 PERIODS

OUTCOMES

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

- Apply conversion factors in solving energy-related numerical problems.
- Analyze merits, demerits and combustion processes of conventional plants.
- Examine about solar, wind, tidal, wave and geothermal energy sources.
- Identify the technological basis for harnessing renewable energy sources.
- Analyze energy losses in heat exchangers, boilers and furnaces.

TEXT BOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCES

1. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
2. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.

E-Sources

1.https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ch27 - (Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems)

2.https://nptel.ac.in/courses/121106014?utm_source=chatgpt.com - (NOC-Conventional Sources)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	3	2	3	3	-	-	1	1	-	3	-	-
2	3	1	3	3	-	-	1	1	-	3	3	-	-
3	2	2	2	3	3	1	-	1	1	-	3	-	-
4	2	2	1	3	3	1	1	1	-	1	3	-	-
5	2	2	1	3	3	1	1	1	-	1	3	-	-
AVG	2.2	2	1.8	3	3	1	1	1	1	1.6	3	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEO709 **SENSORS, ACTUATORS AND ITS APPLICATION** L T P C

3 0 0 3

OBJECTIVES

- To familiarize common types of sensor andactuators used in automotive vehicles.
- To enhance measuring equipment's for the measurement of pressure force, temperature and flow.
- To acquire new ideas in designing the sensors and actuators for automotive application
- To inculcate the operation of the sensors, actuators and electronic control.
- To develop temperature control actuators for vehicles.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs .

UNIT II VARIABLE RESISTANCE AND INDUTANCE SENSORS 9

Principle of operation – construction details – Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT.

UNIT III VARIABLE AND OTHER SPECIAL SENSORS 9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS 9

Electromechanical actuators - Fluid-mechanical actuators - Electrical machines- Direct-current machines - Three-phase machines - Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS 9

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Apply common types of sensor and actuators used in vehicles.
- Examine measuring equipment's for the measurement of pressure force, temperature and flow.
- Analyze the sensors and actuators for automotive application.
- Analyze the operation of the sensors, actuators and electronic control.
- Apply temperature control actuators for vehicles.

TEXT BOOKS

1. Ernest O. Doebelin Dhanesh N.Manik, "Doebelin's Measurement Systems", McGraw Hill Publishers, Seventh Edition, 2019.
2. Bosch, "Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive", Fifth Edition, 2007.

REFERENCES

1. William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," Elsevier Butterworth-Heinemann Publishers, Seventh Edition, 2012.
2. James D Halderman, "Automotive Electrical and Electronics", Prentice Hall, USA, 2013.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview - (Sensors and Actuators)
2. https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee41/ - (Sensors and Actuators)

Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
1	3	3	3	3	3	-	-	-	-	-	2	-	-
2	3	3	3	3	3	-	-	-	-	-	2	-	-
3	3	3	3	3	3	-	-	-	-	-	2	-	-
4	3	3	3	3	3	-	-	-	-	-	2	-	-
5	3	3	3	3	3	-	-	-	-	-	2	-	-
AV G	3	3	3	3	3	-	-	-	-	-	2	-	-

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23MEO703 **FUNDAMENTALS OF MECHATRONICS** L T P C

3 0 0 3

OBJECTIVES

- To train students in the basic concepts of mechatronics and explain the working principles of commonly used sensors and transducers.
- To teach the architecture, instruction set, and operation of the 8085 microprocessor for control applications.
- To explain and train students in interfacing techniques using 8255 PPI for applications such as ADC/DAC, temperature control, motor control, and traffic control.
- TO familiarize students with the fundamentals of Programmable Logic Controllers (PLC), including I/O processing, timers, and counters used in industrial automation.
- To train students on actuators and mechatronics system design, supported by real-time case studies.

UNITI INTRODUCTION AND SENSORS 9

Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor –Temperature Sensors – Light Sensors.

UNIT II 8085 MICROPROCESSOR 9

Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 9

Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 9

Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN 9

Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply basic mechatronics concepts and select suitable sensors and transducers for simple engineering applications.
- Develop basic control and interfacing programs using the 8085 microprocessor instruction set and addressing modes.
- Design real-time interfacing applications using 8255 PPI, ADC/DAC, and display devices.
- Apply PLC programming concepts with timers, counters, and I/O modules for industrial automation tasks.
- Analyze actuator performance and integrate mechatronics system designs through practical case studies such as pick-and-place robots and engine management systems.

TEXTBOOKS

1. Bolton W., "Mechatronics", Pearson Education, Seventh Edition, 2019.
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publishing Private Limited, Sixth Edition, 2013.
3. Dr. JayashreeDeka, Mayuri Sanjay Mhaske, Ajeet Bhagwat Bhane, Kiran C,"Mechatronics", Quill Tech Publications, First Edition, 2025

REFERENCES

1. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", Cengage Learning, 2019.
2. NitaigourPremchandMahalik, "Mechatronics Principles, Concepts and Applications", McGraw Hill Education, 2020.
3. Smaili.A and Mrad. F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2018.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me27/preview - (Mechatronics)
2. https://onlinecourses.nptel.ac.in/noc25_me179/preview- (Design of Mechatronics Systems)

Mapping of COs-POs &PSOs

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

1-Low 2-Medium 3-High '-' –No Correlation

Chairman - BoS

23MEO704 NANOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To provide an understanding of the types of nanostructures and their electronic properties
- To introduce the principles and operational aspects of high-energy ball milling and post-oxidation processes.
- To describe the role of surfactants in controlling the formation and stability of nanoparticles.
- To provide an understanding of thermal analysis methods for assessing the properties of nanomaterials.
- To focus on the emerging applications of nanomaterials in science and engineering.

UNIT I TYPES OF NANOMATERIALS 9

Zero dimensional, one-dimensional and two dimensional nanostructures, Graphene, Fullerene, Carbon nano tubes and, Quantum Dots, Nanoclusture, Zeolites minerals, Nanowires, Block Copolymers, Properties of nanomaterials - Surface properties, Electrical properties, Magnetic properties.

UNIT II PHYSICAL ROUTES 9

High energy ball mill - Chemical Vapour Deposition – Physical Vapour Deposition – Laser ablation - Pulsed laser deposition – Rapid solidification – Arc discharge method- photolysis – radiolysis - Fabrication of nanostructures and microfabrication using wet and dry etching-Lithography.

UNIT III CHEMICAL METHODS 9

Colloidal precipitation – Sol-Gel process– Chemical precipitation: Normal and Reverse reactions-Hydrothermal – Solvothermal – Sonochemical – DC and Pulsed electrodeposition and Electroless deposition – Combustion route.

UNIT IV NANOMATERIAL ANALYSIS 9

Photoluminescence Spectroscopy, Raman Spectroscopy, X-Ray Photoelectron Spectroscopy (XPS), Thermal analysis – Differential Scanning Calorimetry (DSC) – Thermogravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) –Mechanical Testing- Nano Indentation -Vibrating Sample Magnetometer, Zeta Potential and Particle size measurement.

UNIT V APPLICATION OF NANOMATERIALS 9

Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications – Quantum Devices – Nanomechanics - Carbon Nanotube – Photonics- Nano structures as single electron transistor –principle and design.

OUTCOMES:

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

- Analyze the structure, classification, and size-dependent properties of nanostructures.
- Apply wet and dry etching techniques for the fabrication of nanostructures and microfabricated devices.
- Analyze chemical synthesis techniques to prepare nanomaterials and evaluate the influence of processing parameters on their properties.
- Explain the principles of nanomaterial characterization techniques.
- Apply the principles and applications of nanomaterials.

TEXT BOOKS:

1. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties &Applications", Imperial College Press, 2015.
2. T. Pradeep, "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education, 2019.

REFERENCE BOOKS

1. B.Bhushan, "Springer Handbook of Nanotechnology", Springer-Verlag Berlin Heidelberg, 2020.
2. G.A. Ozin and A.C. Arsenault, "Nanochemistry : A chemical approach to nanomaterials", Royal Society of Chemistry, 2015.

E-RESOURCES

1. https://libguides.utdallas.edu/nanotechnology-nanoscience-nanomaterials-guide/sources/books
2. https://libguides.lib.msu.edu/nanotechnology/online

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	1	2	1	1	2	1	-	-	-
2	3	2	3	2	1	2	1	1	2	1	-	-	-
3	3	2	3	3	1	2	3	1	3	2	-	-	-
4	3	2	3	3	1	2	2	1	3	1	-	-	-
5	3	1	2	2	1	2	2	1	2	2	-	-	-
AVG	3	1.8	2.6	2.4	1	2	1.8	1	2.4	1.4	-	-	-

2- **Low 2-Medium 3-High '-' – No Correlation**

Chairman - BoS

23MEO712 SMART MANUFACTURING L T P C
3 0 0 3

OBJECTIVES

- To familiarize with the concepts, architecture, and components of Smart Manufacturing systems.
- To provide knowledge of sensing, monitoring, and data acquisition technologies used in modern manufacturing environments.
- To enable application of Industrial IoT and Cyber-Physical Systems for smart manufacturing applications.
- To develop the ability to analyze manufacturing data for process monitoring and predictive maintenance.
- To equip with the knowledge of advanced Industry 4.0 technologies and their applications in smart factory implementation.

UNIT I INTRODUCTION TO SMART MANUFACTURING 9

Evolution of Manufacturing Systems, Conventional Manufacturing vs Smart Manufacturing, Industry 4.0 Concepts, Smart Factory Architecture, Digital Transformation in Manufacturing, Components of Smart Manufacturing, Intelligent Production Systems, Applications and Case Studies.

UNIT II SENSORS AND DATA ACQUISITION 9

Sensors in Manufacturing Automation, Electrical, Optical, Acoustic and Vision Sensors, Smart Sensors and Intelligent Sensors, Machine Vision Systems, Condition Monitoring, Data Acquisition Systems, Sensor Networks for Manufacturing, Shop Floor Data Collection.

UNIT III INDUSTRIAL IoT AND CYBER PHYSICAL SYSTEMS 9

Introduction to IoT and IIoT, IoT Architecture, Smart Connected Manufacturing, Cyber Physical Systems (CPS), Cloud Manufacturing, Fog and Edge Computing, Communication Protocols in Manufacturing, Cyber Security in Smart Factories.

UNIT IV DATA ANALYTICS AND DIGITAL MANUFACTURING 9

Manufacturing Data Analytics, Big Data in Manufacturing, Machine Learning Fundamentals, Predictive Maintenance, Quality Monitoring and Process Optimization, Digital Twin Concepts, Real-Time Monitoring Systems, Decision Support Systems.

UNIT V ADVANCED SMART MANUFACTURING TECHNOLOGIES 9

Additive Manufacturing and 3D Printing, Collaborative Robots (Cobots), Automated Guided Vehicles (AGVs), Flexible Manufacturing Systems, Autonomous Manufacturing, Sustainable Smart Manufacturing, Smart Supply Chain and Logistics, Future Trends in Industry 5.0

TOTAL=45 PERIODS

OUTCOMES

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

- Apply the concepts, architecture, and components of Smart Manufacturing systems to manufacturing scenarios.
- Analyze the role of smart and intelligent sensors in enhancing manufacturing efficiency, process monitoring, and decision-making.
- Apply the Industrial IoT and Cyber-Physical Systems to smart manufacturing applications.
- Analyze manufacturing data for process monitoring and predictive maintenance.
- Examine advanced smart manufacturing technologies for modern industrial applications.

TEXT BOOKS

1. Gilchrist, A., "Industry 4.0: The Industrial Internet of Things", Apress, First Edition, 2016.
2. Ustundag, A. and Cevikcan, E., "Industry 4.0: Managing the Digital Transformation", Springer, First Edition, 2018.
3. Jeschke, S., Brecher, C., Song, H. and Rawat, D.B., "Industrial Internet of Things: Cyber manufacturing Systems", Springer, First Edition, 2017.

REFERENCES

1. Song, H., Rawat, D.B., Jeschke, S. and Brecher, C., "Cyber-Physical Systems: Foundations, Principles and Applications", Academic Press, First Edition, 2016.
2. Buyya, R. and Dastjerdi, A.V., "Internet of Things: Principles and Paradigms", Morgan Kaufmann, First Edition, 2016.
3. Locher, D.A., "Smart Manufacturing: The Lean Six Sigma and Systems Engineering Approach", CRC Press, First Edition, 2017.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_cs95/preview (Industrial Internet of Things, Cyber Physical Systems and Data Analytics)
2. https://onlinecourses.nptel.ac.in/127101872 (Industry 4.0: Managing the Digital Transformation)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	1	-	-	-	-	-	1	-	-
2	2	3	-	1	3	-	-	-	-	-	-	-	-
3	2	3	2	2	3	-	-	-	-	-	1	-	-
4	2	3	-	3	3	-	1	-	-	-	2	-	-
5	1	2	3	2	3	-	2	-	-	-	2	-	-
AVG	2.0	2.6	2.5	2.0	2.6	-	1.5	-	-	-	1.5	-	-

1 - Low, 2 - Medium, 3 - High, '-"- No correlation

Chairman - BoS

23RA0707 MOBILE ROBOTS L T P C
3 0 0 3

OBJECTIVES

- To introduce locomotion principles and control of mobile robots.
- To focus on kinematic modeling and constraints in mobile systems.
- To provide an understanding of robot maneuverability, holonomic constraints, and trajectory-following control strategies.
- To inculcate the principles of dynamic modeling for differential-drive and omni directional mobile robots using Lagrange methods.
- To develop the ability to classify sensors, characterize performance, and represent environmental uncertainty using statistical methods.

UNIT I INTRODUCTION TO MOBILE ROBOTS 9

Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Roots – Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues – Unmanned Aerial and Underwater Vehicles – Teleportation and Control

UNIT II MOBILE ROBOT KINEMATICS 9

Introduction; kinematic models and constraints: representing robot position, forward kinematic models, wheel kinematic constraints: fixed, caster and omni wheels, robot kinematic constraints, examples: robot kinematic models and constraints.

UNIT III MOBILE ROBOT MANEUVERABILITY 9

Degree of mobility, degree of steerability, robot maneuverability; mobile robot workspace: degrees of freedom, holonomic robots, path and trajectory considerations; motion control (kinematic control): open loop control (trajectory following), feedback control.

UNIT IV MOBILE ROBOT DYNAMICS 9

Introduction, general robot dynamic modeling - Newton-Euler and Lagrange, differential-drive Wheeled mobile robot, three-Wheel omni directional mobile robot, four mecanum-wheel omni directional robot.

UNIT V SENSORS FOR MOBILE ROBOTS 9

Sensor classification, characterizing sensor performance, wheel/motor sensors, heading sensors, ground-based beacons, active ranging, motion/speed sensors, visionbased sensors; representing uncertainty: statistical representation.

TOTAL: 45 PERIODS

OUTCOMES

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

- Classify various locomotion mechanisms, including legged, wheeled, and aerial configurations, based on stability and design constraints.
- Construct forward kinematic models for mobile robots by accounting for fixed, caster, and omni-wheel constraints.
- Compare holonomic and non-holonomic maneuverability to implement effective trajectory-following and feedback motion control.
- Analyze the dynamic behavior of differential-drive and Mecanum-wheel robots using Newton-Euler and Lagrange formulations.
- Examine sensor performance and statistical uncertainty to determine the most effective sensing suite for robot localization.

TEXT BOOKS

1. Roland Siegwart, Illah R. Nourbakhsh, "Introduction to Autonomous Mobile Robots", MIT Press, Second Edition, 2011.
2. Spyros G. Tzafestas, "Introduction to Mobile Robot Control", Elsevier, Second Edition, 2014.

REFERENCES

1. Gregory Dudek, Michael Jenkin, "Computational Principles of Mobile Robotics", Cambridge University Press, Third Edition, 2023..
2. George A. Bekey, "Autonomous Robots", MIT Press, First Edition,2005..

E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/106/112106298/ -(Wheeled mobile Robots)
2. https://www.mathworks.com/help/robotics/- (Robotics System Toolbox)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	1	1	1	-	1	-	-
2	3	3	3	2	3	1	1	1	1	-	1	-	-
3	3	3	3	3	3	1	1	1	2	-	2	-	-
4	3	3	3	3	3	1	1	1	2	-	2	-	-
5	3	3	3	3	3	2	1	1	2	-	2	-	-
AVG	3	3	2.8	2.6	2.8	1.2	1	1	1.6	-	1.6	-	-

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman BoS

23CSO711 **INTRODUCTION TO CYBER SECURITY** L T P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of cyber security concepts, cyber threats and risk management frameworks.
- To provide knowledge about computer networking fundamentals, secure protocols, and defensive mechanisms.
- To impart understanding of cryptographic techniques, hashing, digital signatures, PKI, and data security practices.
- To develop students understanding on common cyber threats, malware, web-based attacks, and appropriate mitigation approaches
- To familiarize the students with regulatory compliance standards, security practices and cloud security.

UNIT I FUNDAMENTALS OF CYBER SECURITY 9

Introduction to Cyber Security - Information Security - CIA Triad - Cyber Space - Digital Identity - Threats and Vulnerabilities - Risk Management - Types of Hackers - Cyber Crimes - Security Policies.

UNIT II NETWORK SECURITY 9

Computer Networks - OSI Model - TCP/IP Model - IP Addressing - DNS and DHCP - Firewalls - IDS and IPS - VPN - Secure Communication Protocols - Network Attacks - Wireless Security.

UNIT III CRYPTOGRAPHY AND DATA SECURITY 9

Introduction to Cryptography - Encryption and Decryption - Symmetric Cryptography - Asymmetric Cryptography - AES - RSA - Hash Functions - Digital Signatures - Public Key Infrastructure (PKI) - Data Security.

UNIT IV CYBER THREATS AND MALWARE 9

Cyber Attacks - Malware - Viruses - Worms - Trojans - Ransomware - Phishing - Social Engineering - SQL Injection - Cross-Site Scripting (XSS) - DoS and DDoS Attacks.

UNIT V CYBER LAWS AND SECURITY PRACTICES 9

Cyber Ethics - Information Technology Act, 2000 - Cyber Laws - Digital Privacy - Password Security - Multi-Factor Authentication - Incident Response - Disaster Recovery - Cloud Security - Artificial Intelligence in Cyber Security.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, students will be able to:

- Explain fundamental cyber security concepts and apply basic risk management frameworks to identify security risks.
- Apply computer networking fundamentals, secure protocols, and defensive mechanisms to protect networked systems.
- Apply cryptographic techniques, hashing mechanisms, and data security methods to ensure information and ensure data security
- Analyze malware infections, system vulnerabilities, and web-based attacks and recommend appropriate mitigation measures.
- Analyze regulatory compliance requirements, Cyber Laws, and cloud security practices for securing digital environments.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 8th Edition, 2020.
2. AnandShinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.

REFERENCES

1. Chwan-Hwa (John) Wu and J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press, 2016.
2. Nina Godbole and SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India, 2011.

E-RESOURCES

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou19_cs08

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	2	-	2	1	2	-	-	-
CO2	3	3	3	2	3	-	-	-	2	2	-	-	-
CO3	3	3	3	2	2	-	-	-	1	1	-	-	-
CO4	3	3	3	3	3	1	-	-	2	2	-	-	-
CO5	3	2	2	2	2	3	2	3	2	3	2	-	-
AVG	3.0	2.6	2.4	2.2	2.5	2.0	2.0	2.5	1.6	2.0	2.0	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23PMO706 INTELLECTUAL PROPERTY RIGHTS FOR PHARMA INDUSTRY **L T P C 3 0 0 3**

OBJECTIVES

- To introduce the basic concepts of Intellectual Property Rights (IPR), their protection mechanisms, and their significance in the pharmaceutical industry.
- To familiarize students with patent laws, copyright regulations, international treaties, and their role in protecting intellectual property in the pharmaceutical sector.
- To provide knowledge of patent filing, prior art search, patent applications, and international patenting for pharmaceutical innovations.
- To develop an understanding of patent administration and legal aspects of patent protection in the pharmaceutical industry.
- To enhance understanding of patent ownership, publication ethics, copyright protection, and intellectual property management in research and academia.

UNIT I INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS **9**

Concept of Intellectual Property Right , The World Intellectual Property Organization, Intellectual property protection (IPP) and intellectual property rights (IPR),Economic importance, mechanisms for protection of intellectual property-patents, copyrights, trademark, Factors affecting choice of IP protection, Penalties for violation, Role of IPR in pharmaceutical industry, Global ramifications and financial implications.

UNIT II RULES AND REGULATIONS **9**

The Patents (Amendment) Act, 2002 and The Patents (Amend ment) Act, 2005, Rationale of Patent & License, Application for Patents, Rights of Patentee, Compulsory Licenses, Surrender and Revocation of Patents, Infringement of Patents, Amendments, Registration of Lapsed Patents, Patent Agent , Overview of global patents and US,Indian Copyright Law and digital technologies-Beme convention, WIPO copyright treaty (WCT), WIPO performance and Phonogram Treaty (WPPT).

UNIT III PATENT FILING **9**

Precautions before patenting-disclosures / non-disclosures, publication-article / thesis , Prior art search-published patents, internet search patent sites, specialized services-search requests, costs, Patent application-forms and guidelines, fee structure, time frames, jurisdiction aspects, Types of patent applications- provisional, non-provisional, PCT and convention patent applications, International patenting-requirement procedures and costs.

UNIT IV FINANCIAL ASSISTANCE FOR PATENTING **9**

Introduction to schemes by NRDC and TIFAC ,Publication of patents-gazette of India, status in

Europe and US . Patent annuity. Patent attorneys-technical aspects, criteria for selection, addresses, fee, rights and responsibilities of a patentee. Patent infringement- meaning, scope, litigation, case studies and examples.

UNIT V RESEARCH, PATENTS, COPYRIGHT, AND TECHNOLOGY TRANSFER 9

Patenting by research students, lecturers and scientists University / organisational rules in India and abroad. Thesis research paper publication, credit sharing by workers, financial incentives. Useful information sources for patents related information-internet sites and periodicals Significance of copyright protection for researchers, Protection for computer data bases, multimedia works.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Apply the principles of IPR to identify appropriate protection mechanisms based on the nature of pharmaceutical innovations and factors influencing IP protection.
- Analyze the patent systems of India and the United States, and evaluate the impact of amendments on patent protection and innovation.
- Describe the methods for conducting prior art searches using patent databases and online search resources.
- Explain the objectives of NRDC and TIFAC schemes and the patent publication process in India, Europe, and the United States.
- Implement patenting procedures and institutional policies in academic and research environments.

TEXT BOOKS

1. Bayya subba rao . V. Appaji, "Intellectual Property Rights in Pharmaceutical Industry" PharmaMed Press, Second Edition ,2025.
2. Prof. Rupinder Tewari Ms. Mamta Bhardwaj," Intellectual Property", Publication Bureau Panjab University , Forth Edition ,2019.

REFERENCES

1. Harshal Ashok Pawar," Intellectual Property Rights and Patents in Pharmacy" Everest Publishing House , First Edition , 2025
2. Anasuya Patil," textbook on Pharmaceutical Intellectual Property Rights", shashwat publication , First Edition, 2016.

E-RESOURCES

1. https://www.lexology.com/library/detail.aspx?g=0588408f-f7e2-4c00-aa50-76fcb455b12c
2. https://www.lingayasvidyapeeth.edu.in/the-vital-role-of-intellectual-property-rights-ipr-in-pharmacy/

Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
1	3	2	2	1	3	1	1	-	-	1	1	-	-
2	2	2	2	1	3	2	2	-	1	-	-	-	-
3	3	1	2	1	2	1	1	-	-	-	2	-	-
4	2	3	3	2	2	2	1	2	-	1	2	-	-
5	2	3	2	1	1	3	3	2	-	-	2	-	-
Avg	2.4	2.2	2.2	1.2	2.2	1.8	1.6	2	1	1	1.75	-	-

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MAO710 **OPERATIONS RESEARCH** L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of linear programming.
- To provide knowledge of duality and network models.
- To explain the concepts of integer programming.
- To explore the techniques of classical optimization theory.
- To develop an understanding of the Critical path method and the Program evaluation and review technique.

UNIT I LINEAR PROGRAMMING 9

Principal components of decision problem – Modeling phases – Linear Programming Formulation and graphic solution – Simplex method.

UNIT II DUALITY AND NETWORKS 9

Definition of dual problem — Primal — Dual relationships — Dual simplex methods — Post optimality analysis – Transportation and assignment model – Shortest route problem

UNIT III INTEGER PROGRAMMING 9

Cutting plan algorithm– Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV CLASSICAL OPTIMISATION THEORY 9

Unconstrained external problems, Newton – Raphson method– Equality constraints– Jacobean methods – Lagrangian method–Kuhn–Tucker conditions–Simple problems.

UNIT V OBJECT SCHEDULING 9

Network diagram representation – Critical path method – Time charts and resource leveling– Programme evaluation review technique.

TOTAL: 45 PERIODS

OUTCOMES

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

- Solve Linear Programming Problems using graphical and simplex methods.
- Apply duality concepts and network optimization techniques to solve transportation, assignment, and shortest path problems.
- Solve Integer Programming and Dynamic Programming problems using appropriate optimization techniques.
- Analyze unconstrained and constrained optimization problems using classical optimization methods.
- Apply project scheduling techniques such as CPM and PERT for planning, scheduling,

and resource optimization.

TEXT BOOKS

1. H.A. Taha, "Operation Research", Prentice Hall of India, Eighth Edition, 2002
2. Paneer Selvam, „Operations Research", Prentice Hall of India, Second Edition, 2002

REFERENCES

1. Vohra, "Quantitative Techniques in Management", Tata Mc Graw Hill, Second Edition, 2002
2. Winston "Operation Research", Thomson Learning, Fourth Edition, 2003

E-RESOURCES

1. https://nptel.ac.in/courses/111/102/111102012/ (Operation Research)
2. https://freevideolectures.com/course/4737/nptel-project-management/21(Operation Research)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

OPEN ELECTIVE III

23CEO717 GEOGRAPHICAL INFORMATION SYSTEM L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts and components of GIS.
- To impart knowledge on spatial data models and database structures.
- To familiarize students with data acquisition, input, and management techniques.
- To instruct GIS analysis and modeling techniques.
- To enhance skills in spatial data interpretation and real-world applications.

UNIT I - INTRODUCTION TO GIS 9

Definition and components of GIS - History and evolution of GIS - Basic concepts of spatial information - Elements of GIS - Hardware, software, data, people and methods - GIS vs conventional mapping - Coordinate systems and map projections - Types of maps - Overview of GIS applications in engineering and resource management.

UNIT II - SPATIAL DATA MODELS AND DATA STRUCTURES 9

Spatial data types - Raster and Vector data models - Comparison between raster and vector models - Spatial data structures - Topology concepts - Attribute data and database management systems - Relational database model - Data storage and retrieval - Metadata concepts - Data quality and accuracy.

UNIT III - DATA ACQUISITION AND INPUT TECHNIQUES 9

Sources of spatial data - Maps, aerial photographs and satellite imagery - GPS data collection - Surveying data integration - Digitization and scanning - Georeferencing - Data editing and transformation - Error sources and correction - Data integration techniques - Spatial data standards.

UNIT IV - GIS ANALYSIS AND MODELING 9

Spatial analysis concepts - Query operations - Buffering and overlay analysis - Network analysis - Terrain analysis and Digital Elevation Model (DEM) - Interpolation techniques - Spatial modeling - Multi-criteria decision analysis - GIS-based modeling applications in urban planning and environmental management.

UNIT V - GIS OUTPUT, VISUALIZATION AND APPLICATIONS 9

Cartographic visualization - Map layout and design - Thematic mapping - Data visualization techniques - Web GIS concepts - Open-source GIS platforms - GIS applications in water resources, transportation, disaster management, urban planning and environmental monitoring - Introduction to GIS project workflow.

TOTAL: 45 PERIODS

OUTCOMES

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

- Construct the fundamental concepts and components of GIS.
- Analyze spatial data models and database structures.
- Apply data acquisition and preprocessing techniques in GIS.
- Examine the spatial analysis and GIS modeling.
- Analyze GIS outputs, effective spatial visualizations and GIS techniques.

TEXT BOOKS

1. Kang-tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Education, Ninth Edition, 2022.
2. Ian Heywood, Sarah Cornelius and Steve Carver, "An Introduction to Geographical Information Systems", Pearson Education, Fifth Edition, 2019.
3. Tor Bernhardsen, "Geographic Information Systems: An Introduction", Wiley India, Third Edition, 2018.

REFERENCES

1. Paul A. Longley, Michael F. Goodchild, David J. Maguire and David W. Rhind, "Geographical Information Systems and Science", Wiley, Fourth Edition, 2021.
2. Burrough, P.A. and McDonnell, R.A., "Principles of Geographical Information Systems", Oxford University Press, 2015.
3. Lo, C.P. and Yeung, A.K.W., "Concepts and Techniques of Geographic Information Systems", Prentice Hall, 2018.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview (GIS and Remote Sensing)
2. https://onlinecourses.nptel.ac.in/noc20_ce29/preview (GIS Applications)

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' - No Correlation

Chairman - BoS

23CSO715 **FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY** LT P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of blockchain technology, distributed ledger concepts, and decentralized systems.
- To develop students' understanding of cryptographic techniques, consensus mechanisms, and blockchain architecture.
- To train students in designing and implementing smart contracts using Ethereum and Solidity.
- To familiarize students with blockchain platforms, decentralized applications (DApps), and enterprise blockchain frameworks.
- To expose students to blockchain applications, security challenges, emerging trends, and real-world case studies through practical implementation.

UNIT I INTRODUCTION TO BLOCKCHAIN TECHNOLOGY 9

Introduction to Blockchain – Evolution of Blockchain – Distributed Ledger Technology (DLT) – Characteristics of Blockchain – Blockchain Architecture – Types of Blockchain (Public, Private, Consortium, Hybrid) – Blockchain Components – Blocks, Transactions and Hashes – Merkle Tree – Blockchain Lifecycle – Benefits and Limitations – Blockchain Applications in Various Industries.

UNIT II CRYPTOGRAPHY AND CONSENSUS MECHANISMS 9

Cryptographic Hash Functions – Digital Signatures – Public Key Infrastructure – Elliptic Curve Cryptography – Wallets – Consensus Algorithms – Proof of Work (PoW) – Proof of Stake (PoS) – Delegated Proof of Stake (DPoS) – Proof of Authority (PoA) – Byzantine Fault Tolerance (PBFT) – Mining Process – Blockchain Security.

UNIT III ETHEREUM AND SMART CONTRACTS 9

Ethereum Architecture – Ethereum Virtual Machine (EVM) – Accounts – Gas – Ether – Smart Contracts – Solidity Programming – Variables - Functions – Modifiers – Events – Error Handling – Smart Contract Deployment – Remix IDE – MetaMask – Web3 Basics.

UNIT IV DECENTRALIZED APPLICATIONS AND ENTERPRISE BLOCKCHAIN 9

Decentralized Applications (DApps) – DApp Architecture – IPFS – Hyperledger Fabric – Hyperledger Composer – Corda – Quorum – Blockchain APIs – Blockchain as a Service (BaaS) – Identity Management – Supply Chain Management – Healthcare Applications.

UNIT V BLOCKCHAIN APPLICATIONS AND EMERGING TRENDS 9

Cryptocurrency – Bitcoin Architecture – NFTs – Decentralized Finance (DeFi) – Central Bank Digital Currency (CBDC) – Blockchain in IoT – Blockchain in Artificial Intelligence – Web3 – DAO –

Blockchain Scalability – Layer-2 Solutions – Security Challenges – Regulatory Issues – Future Trends – Industry Case Studies.

TOTAL : 45 HOURS

OUTCOMES

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

- Explain blockchain fundamentals, distributed ledger concepts, blockchain architecture, and applications.
- Analyze cryptographic techniques, digital signatures, wallets, and consensus mechanisms used in blockchain systems.
- Develop smart contracts using Solidity and deploy decentralized applications on Ethereum.
- Analyze enterprise blockchain platforms, decentralized applications, and blockchain integration for real-world business solutions.
- Apply blockchain technologies to develop secure, scalable, and decentralized solutions for modern computing applications

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain", Packt Publishing, Fourth Edition, 2023.
2. Arshdeep Bahga and Vijay Madisetti, "Blockchain Applications: A Hands-on Approach", VPT Publications, Second Edition, 2017.

REFERENCES

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly Media, First Edition, 2015.
2. Andreas M. Antonopoulos and Gavin Wood, "Mastering Ethereum: Building Smart Contracts and DApps", O'Reilly Media, First Edition, 2018.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	–	2	–	–	–	1	–	2	-	-
2	3	3	2	2	3	–	–	–	1	–	2	-	-
3	3	3	3	2	3	–	–	–	1	–	2	-	-
4	3	2	3	2	3	–	–	–	1	–	2	-	-
5	2	2	2	2	3	–	–	–	1	–	2	-	-
6	3	3	3	2	3	1	1	2	3	2	3	-	-
AVG	2.8	2.5	2.3	2	2.8	1	1	2	1.3	2	2.1	-	-

1-Low, 2-Medium, 3-High, "-" – No Correlation

Chairman - BoS

23ECO718 VLSI Design L T P C
3 0 0 3

OBJECTIVES

- To explain the fundamentals of CMOS circuits and their characteristics.
- To realize MOS based circuits using different design styles
- To impart knowledge on adder, multiplier, and shifter circuits for realizing data path design.
- To understand memory architectures, peripheral circuits and SRAM/DRAM design concepts for high-speed VLSI memory systems.
- To gain knowledge of the testing processes of CMOS circuits.

UNIT I MOS TRANSISTOR 9

MOS operating modes, Pass transistors, Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Elmore's constant.

UNIT II MOS CIRCUIT DESIGN STYLES 9

Static: Static CMOS, Pass transistor, Transmission gate, Pseudo NMOS design Styles, Dynamic: C2MOS, Dynamic, Domino, NORA, and Zipper design styles.

UNIT III DATA PATH DESIGN 9

Adder: CLA adder, MODL, Manchester carry chain, High-speed adders: carry skip, carry select and carry save, Multipliers and shifter: Array multiplier and barrel shifter.

UNIT IV MEMORY DESIGN AND PERIPHERAL CIRCUITS 9

Memory architectures- ROM, 6T SRAM, 1Tand 3T DRAM. Memory Peripheral Circuits Address Decoder, Sense Amplifier, Voltage References, Timing and Control, Drivers, Case Study – 4Mbit SRAM.

UNIT V CMOS TESTING 9

CMOS Testing, Need for Testing, Test Principles, Design Strategies for Test, Chip Level and Board Level Test Techniques.

OUTCOMES

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

- Explain pass transistor operation, propagation delay and Elmore's constant.
- Analyze different MOS circuit design styles.
- Design adder, multiplier and shifter circuits using MOS logic.
- Examine the memory peripheral circuits in SRAM and DRAM design.
- Analyze the design strategies and concepts of testing.

TEXT BOOK

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI DESIGN", A system PerspectiveAddision Wesley , Second Edition, 2004.
2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated circuits: A Design Perspective", Prentice Hall of India, Second Edition, 2003.

REFERENCES

1. A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Prentice Hall of India, Third Edition, 2007.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley India Pvt. Ltd.

E-Sources

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee09 - (CMOS digital VLSI design)
2. https://nptel.ac.in/courses/117101004?utm_source=chatgpt.com – (ADVANSED VLSI DESIGN)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	1	1	-	1	1	1	-	-
2	3	3	3	2	2	1	1	-	1	1	1	-	-
3	3	3	3	2	2	2	1	-	1	1	1	-	-
4	3	3	3	2	2	2	1	-	1	1	1	-	-
5	3	3	3	2	2	2	1	-	1	1	1	-	-
AVG	3	3	3	2	2	1.6	1	-	1	1	1	-	-

2-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEO716 **ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS** L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on dielectric materials and their electrical properties.
- To familiarize with magnetic materials and their characteristics for electrical applications.
- To acquire knowledge on semiconductor materials and superconductivity concepts.
- To enhance understanding of materials used in electrical engineering applications.
- To foster awareness of optical and optoelectronic materials and their applications.

UNIT I DIELECTRIC MATERIALS 9

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS 9

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS 9

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS 9

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V OPTICAL AND OPTOELECTRONIC MATERIALS 9

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials - photo detectors - applications of optoelectronic materials - optical fibres and materials - electro

optic modulators - Kerr effect - Pockels effect.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the properties and behavior of dielectric materials.
- Apply the characteristics of magnetic materials in electrical applications.
- Analyze semiconductor materials and superconducting phenomena.
- Examine the selection of materials for electrical engineering applications.
- Analyze the principles and applications of optical and optoelectronic materials.

TEXT BOOKS

1. Pradeep Fulay, "Electronic, Magnetic and Optical materials", CRC Press, taylor and Francis, Second Edition, 2017.
2. R K Rajput, "A course in Electrical Engineering Materials", Laxmi Publications, 2009.

REFERENCES

1. T K Basak, "A course in Electrical Engineering Materials", New Age Science Publications, 2009.
2. S. P. Seth, P. V. Gupta, "A course in Electrical Engineering Materials", Dhanpat Rai & amp; Sons, 2011.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/108/104/108104087/ - (Electromagnetic Theory).
2. https://onlinecourses.nptel.ac.in/noc24_ee125/preview - (A Basic Course on Electric and Magnetic Circuits).

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23MEO720 **MARINE VEHICLES** L T P C

3 0 0 3

OBJECTIVES

- To introduce the classification, functions, and applications of various marine vehicles, including commercial vessels and submersibles.
- To provide knowledge on the design, construction, operational principles, and applications of manned and unmanned submersible systems.
- To explain the design concepts, components, control systems, stability, and industrial applications of Remotely Operated Vehicles (ROVs).
- To familiarize students with the design, navigation, sensing technologies, control strategies, and applications of Autonomous Underwater Vehicles (AUVs).
- To develop an understanding of the design considerations, pressure hulls, maneuvering, life-support systems, safety requirements, and certification procedures of manned submersibles.

UNIT MARINE VEHICLES 9

Types – general – by function – commercial marine vehicles- submersibles types – applications

UNIT II SUBMERSIBLES 9

Manned and unmanned submersibles – towed vehicles – gliders – crawler – Design and construction

UNIT III REMOTELY OPERABLE VEHICLE (ROV) 9

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV - applications

UNIT IV AUTONOMOUS UNDERWATER VEHICLE (AUV) 9

AUV – Design and construction – components – sensors – Navigation -control strategies – applications

UNIT V MANNED SUBMERSIBLE 9

Introduction – Design and operational consideration – pressure hulls and exostructures – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the classification, functions, and operational characteristics of different marine vehicles and submersibles for various underwater applications.
- Examine the design features, construction methods, and operational capabilities of manned and unmanned submersible systems.

- Compare the design principles, stability, control mechanisms, and functional components of Remotely Operated Vehicles (ROVs) for underwater operations.
- Classify Autonomous Underwater Vehicles (AUVs) based on their design, navigation systems, sensing technologies, control strategies, and marine applications.
- Differentiate the design considerations, life-support systems, maneuvering mechanisms, safety features, and certification requirements of manned submersibles for reliable underwater operations.

TEXTBOOKS

1. Jonathan M. Ross, "Human Factors for Naval Marine Vehicle Design and Operation", CRC Press, First Edition, 2020.
2. Tien Anh Tran, Kolla Bhanu Prakash, Subrata Chowdhury, and Ivan C.K. Tam, "Underwater Vehicle Control and Communication Systems Based on Machine Learning Techniques", CRC Press, First Edition, 2024.
3. Paul A. Russell, Reeds, "General Engineering Knowledge for Marine Engineers" , Bloomsbury Publishing (Reeds Marine Engineering and Technology Series), Seventh Edition, 2024.

REFERENCES

1. Ferial L. Hawry (Ed.), "The Ocean Engineering Handbook", CRC Press, First Edition, 2020.
2. Richard A. Geyer (Ed.), Submersibles and Their Use in Oceanography and Ocean Engineering, Elsevier, Revised Edition, 2019
3. Sabiha A. Wadoo and Pushkin Kachroo, "Autonomous Underwater Vehicles: Modeling, Control Design and Simulation", CRC Press, First Edition, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/114105030 - (Components of Resistance - I)
2. hhttp://www.digimat.in/nptel/courses/video/114105030/L22.html - (Regular Sea Waves - II)

Mapping of COs-POs &PSOs

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

1-Low 2-Medium 3-High '-' –No Correlation

Chairman - BoS

23MDO719 **WEARABLE TECHNOLOGY** LTPC

3 0 0 3

OBJECTIVES

- To introduce the concepts and applications of wearable healthcare systems.
- To familiarize students with wearable devices and physiological parameter monitoring.
- To impart knowledge on communication technologies used in wearable systems.
- To explore wireless body area networks and healthcare monitoring applications.
- To inculcate understanding of data processing, validation, and analytics in wearable technologies.

UNIT I INTRODUCTION TO WEARABLES 9

Wearable Systems- Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Types of Wearable Systems, Components of Wearable Systems, Physiological Parameters Commonly Monitored in Wearable Applications, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles, Sport Application, Smart Fabrics: Intelligent Textiles.

UNIT II WEARABLE DEVICES FOR HEALTHCARE AND VITAL PARAMETERS 9

Vital Parameters Monitored and their Significances, Bio-potential Signal Recordings (ECG, EEG, EMG), Dry Electrodes Design and Fabrication methods, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters, Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile.

UNIT III COMMUNICATION TECHNOLOGIES 9

Principles of different sensors, Micro-Motors and Communication Channels - Accelerometers, Optical sensor, GPS- Various Input Methods, Power Requirements, Wearable Systems Packaging, Batteries and Charging, Wireless Communication Technologies and Protocols, Receiver Systems.

UNIT IV WIRELESS BODY AREA NETWORKS 9

Wireless Body Area Networks – Introduction, Personal Area Networks (PAN). Application in Vital Physiological Parameter monitoring, Design of Sensor & Sink Nodes, Architecture, Communication & Routing Protocols, Security, Power and Energy Harvesting, Mobile Applications Based Devices.

UNIT V DATA PROCESSING AND VALIDATION 9

Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in Wearable Applications, Issues of Wearable Physiological Monitoring Systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Examine the fundamentals and applications of wearable healthcare systems.
- Select suitable wearable sensors and devices for monitoring physiological signals.
- Apply communication technologies and protocols employed in wearable healthcare systems.
- Discuss wireless body area network solutions for healthcare monitoring applications.
- Analyze the quality of wearable technology data using suitable processing and validation methods.

TEXT BOOKS

1. Haider Raad, "Fundamentals of IoT and Wearable Technology Design", Wiley, First Edition, 2020.
2. Christine Farion, "The Ultimate Guide to Informed Wearable Technology: A Hands-on Approach for Creating Wearables from Prototype to Purpose Using Arduino Systems", Packt Publishing, First Edition, 2022.

REFERENCES

1. Subhas Chandra Mukhopadhyay, Wearable Electronics and Embedded Computing Systems, Springer, First Edition, 2021.
2. Miodrag Bolic, David Simons, and Insook Choi, Wearable Sensors: Theory, Design, and Applications, Academic Press, First Edition, 2023.

E-RESOURCES

1. https://www.youtube.com/watch?v=gp_X_DwoyC4 - (Introduction to Wireless systems).
2. https://www.youtube.com/watch?v=dm9W5WQUq2A - (Introduction Wearable device).

MAPPING OF COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	-	-	1	-	-	-	-	1	-	-
2	2	2	3	1	2	-	-	-	-	-	1	-	-
3	2	3	2	1	3	-	-	-	-	-	1	-	-
4	2	2	2	2	2	2	1	-	-	-	1	-	-
5	2	3	1	3	2	-	-	-	-	-	3	-	-
AVG.	2.2	2.4	1.8	1.75	2.25	1.5	1.0	-	-	-	1.4	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Chairman - BoS

23MDO723 MEDICAL WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

- To familiarize students with biomedical waste management practices in healthcare facilities.
- To introduce biomedical waste handling, segregation, and transportation procedures.
- To impart knowledge on biomedical waste treatment and disposal technologies.
- To explore biomedical waste regulations, standards, and compliance requirements.
- To inculcate awareness of patient safety and environmental protection measures.

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

Waste disposal management, Hospital waste management, Biosafety- regulatory framework for GMOs, bioethics and its socio economic impact, hazards associated with poor health care waste management..

UNIT II BIOMEDICAL WASTE HANDLING TECHNIQUES 9

Characterization of medical waste(management and handling) rules, 1998, amendments and guidelines, segregation, packaging, storage, transport of infectious waste. Techniques of biomedical waste management. Health and safety rules. Protocols, issues, and challenges in transportation of biomedical waste.

UNIT III DISPOSAL TECHNIQUES 9

Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposalmethod. Common Hazardous Waste Treatment Facilities (TSDF).

UNIT IV RULES AND CATEGORIES OF WASTE 9

Biomedical waste management rule: Biomedical wastes categories and their segregation, collection, treatment, processing, and disposal options, Standards For Treatment and Disposal Of Bio-Medical wastes, Standards for autoclaving of bio-medical waste, standards of microwaving, standards for deep burial, standards for the efficacy of chemical disinfection, standards for dry heat sterilization, standards for liquid waste.

UNIT V PREVENTION AND PATIENT SAFETY 9

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine biomedical waste management practices in healthcare facilities.
- Apply biomedical waste handling and transportation procedures.
- Analyze biomedical waste treatment and disposal techniques.
- Utilize biomedical waste management regulations and standards in healthcare settings.
- Develop safety measures for patient protection and environmental sustainability.

TEXT BOOKS

1. NehaSuyal , Prasenjit Debbarma , Manali Singh , Anita Mishra, Roop S Bora ,"Biomedical Waste Management: Bioremediation and Recycling", September 2024.
2. Dr. Shivakumar M.A,"Law Relating to Bio-medical Waste Management With Special Reference to Bangalore Urban City", BlueRose Publishers Pvt.Ltd, First Edition,January 2023.

REFERENCES

1. Himadri Panda, "Biomedical Waste: Management, Recycling And Applications", Discovery Publishing House PVT LTD, First Edition, April 2019.
2. NIIR Board of Consultants & Engineers, "Handbook on Recycling and Disposal of Hospital Waste Municipal Solid Waste,Biomedical Waste Plastic Waste", NIIR Project Consultancy Services, January 2018.

E-RESOURCES

1. https://www.youtube.com/watch?v=32KyVb-Ggn8 – (Biomedical Waste Management System)
2. https://www.youtube.com/watch?v=hYRp7SDWJXE - (Mnemonic for Biomedical waste management)

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	1	-	1	3	2	-	-	1	1	-	-
2	2	2	2	1	2	3	2	-	-	1	1	-	-
3	2	3	2	2	2	2	1	-	-	1	1	-	-
4	2	2	2	2	2	3	2	-	-	1	1	-	-
5	2	3	2	2	2	3	3	1	1	2	2	-	-
AVG.	2	2.4	1.8	1.75	1.8	2.8	2	1	1	1.2	1.2	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Chairman - BoS

23MDO724	LIFESTYLE DISEASES	L T P C
		3 0 0 3

OBJECTIVES

- To introduce the concepts of lifestyle diseases and their associated risk factors.
- To inculcate awareness on cancer, its types and treatment. .
- To impart knowledge on cardiovascular diseases and their causes..
- To familiarize students with types of diabetes,obesity and their preventive measures.
- To explore respiratory diseases, their causes, prevention, and management strategies.

UNIT I INTRODUCTION 9

Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER 9

Types – Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma esophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment.

UNIT III CARDIOVASCULAR DISEASES 9

Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation.

UNIT IV DIABETES AND OBESITY 9

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Pediatrics and adolescent obesity – Weight control and BMI.

UNIT V RESPIRATORY DISEASES 9

Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze lifestyle diseases and their associated risk factors.

- Examine diagnostic and treatment approaches for cancer management.
- Utilize diagnostic tools used in cardiovascular disease assessment.
- Apply weight management and diabetes prevention strategies.
- Develop preventive measures and management plans for respiratory diseases.

TEXT BOOKS

1. MingfuLu, "Solving Lifestyle Disease with Lifestyle", Thorpe Bowker Australia, February 2018.
2. Labros S. Sidossis, Labros S. Sidossis, "Textbook of Lifestyle Medicine", February 2022.

REFERENCES

1. K V Ramani , Hemlatha Ramani , Gunjan Y Trivedi Vishwanathan P Lakshmi M and Anita Verma ,"Preventing Insidious Lifestyle Diseases", January 2022.
2. Jeff Lumiri , Cliff Nyambichu, "Lifestyle Diseases: Lifestyle Disease Management" February 2018.

E-RESOURCES

1. https://youtu.be/6I6gTPIZeOk?si=3GYHWv5itK1unItc – (Diagnosis Prognosis)
2. https://youtu.be/fhL5IAyjz0o?si=GFUtO-FSyShP9gXN - (Prescribing Asthma and COPD)

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	3	1	-	1	2	1	-	-	1	1	-	-
2	2	2	2	1	2	2	1	-	-	1	1	-	-
3	2	2	2	2	3	2	1	-	-	1	1	-	-
4	2	2	2	1	2	2	1	-	-	1	2	-	-
5	2	3	2	2	2	3	2	1	1	2	2	-	-
AVG.	2	2.4	1.8	1.5	2	2.2	1.2	1	1	1.2	1.4	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Chairman - BoS

23RA0721 ROBOTIC PROCESS AUTOMATION L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals and evolution of Robotic Process Automation.
- To develop skills in workflow sequencing, data manipulation, and control flow for automated decision-making.
- To familiarize students with application integration, web scraping methods, and the use of recorders to automate UI actions.
- To develop expertise in exception handling, debugging techniques, and the organization of reusable automation projects.
- To inculcate knowledge of bot deployment using Orchestration Servers, license management, and the current landscape of RPA vendors.

UNIT I INTRODUCTION TO RPA 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation – Benefits of RPA – Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools – Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APPLICATION INTEGRATION, RECORDING & SCRAPING 9

Application integration strategies, selector usage - key workflow activities ,Recording mouse/keyboard actions -Web scraping from websites and exporting to CSV - Introductory process mining

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine

UNIT V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors – Open Source RPA, Future of RPA

OUTCOMES

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

- Classify RPA platforms and components by differentiating between traditional automation and modern robotic process evolution.
- Build automated workflows using sequences, flowcharts, and data manipulation techniques for effective decision-making.
- Apply recording and web scraping techniques to integrate applications and export data into structured formats.
- Examine exception handling and debugging techniques to ensure robust code management and workflow reusability.
- Analyze deployment strategies using Orchestration Servers to manage bot licensing, publishing, and maintenance updates.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mary C. Lacity, Leslie P. Willcocks, Robotic Process Automation and Cognitive Automation:The Next Phase, SB Publishing, 2018.
2. NandanMullakara, Robotic Process Automation with UiPath: A Complete Guide, BPB Publications, 2021.

REFERENCES

1. Alok Mani Tripathi), "A practical guide to understanding and implementing RPA with UiPath and other tools."Packt Publishing, Fourth Edition, 2019.
2. Pascal Bornet, Ian Barkin, JochenWirtz, Intelligent Automation: Welcome to the World of Hyperautomation, Apress, 2019

E-RESOURCES

1. https://nptel.ac.in/courses/112101098 -(Robotics)
2. https://docs.uipath.com/-(UiPath Documentation)

Mapping of COs-POs& PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
1	3	2	1	2	2	1	–	–	1	1	1	–	–
2	3	3	3	2	3	1	–	–	1	1	1	–	–
3	3	3	3	2	3	1	–	–	1	1	1	–	–
4	3	3	2	3	3	1	–	–	1	1	1	–	–
5	3	3	3	3	3	2	–	–	2	2	2	–	–
AVG	3	2.8	2.4	2.4	2.8	1.2	–	–	1.2	1.2	1.2	–	–

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23MAO714 **ADVANCED NUMERICAL METHODS** L T P C
3 0 0 3

OBJECTIVES

- To explore techniques for solving algebraic and transcendental equations.
- To introduce numerical techniques for solving matrix inversion and eigenvalue problems.
- To explain the concepts of interpolation and difference equations.
- To provide knowledge of numerical differentiation and integration.
- To explain various numerical methods for solving partial differential equations.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9

Introduction – Basic properties of equations – Transformation of equations – Bisection method – Method of false position – Iteration method – Newton-Raphson Method – Some Deductions From Newton-Raphson Formula.

UNIT II MATRIX INVERSION AND EIGENVALUE PROBLEMS 9

Matrix inversion – Gauss-Jordan method – Factorization method – Partition method – Power method – Jacobi's method.

UNIT III INTERPOLATION AND DIFFERENCE EQUATIONS 9

Spline interpolation – inverse interpolation by Lagrange's method – Definition and order of difference equations – Formation of difference equations – Linear difference equations – Rules for finding the complementary function.

UNIT IV NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Numerical differentiation: Formulae for derivatives – Maxima and minima of a tabulated function – Numerical Integration: Romberg's method – Gaussian integration – Gaussian quadrature for double integral approximation.

UNIT V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference approximations to partial derivatives –Solution of Laplace's equation – Solution of Poisson's equation – Solution of one dimensional heat equation – Hyperbolic equations – Solution of wave equation.

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply numerical methods to solve algebraic and transcendental equations using iterative techniques.
- Understand the concept of matrix inversion and eigenvalue problems using numerical methods.
- Apply interpolation techniques and solve linear difference equations in numerical analysis.

- Apply numerical differentiation and integration methods to approximate derivatives and definite integrals.
- Analyze partial differential equations using finite difference methods for engineering applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Dr.Grewal,B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Eleventh Edition, 2023.
2. Dr.Kandasamy, P., "Numerical Methods", S.Chand & Company PVT.LTD, Seventeenth Edition, 2016.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Tenth Edition, 2016.
2. Iyengar, S.R.K and Jain, R.K, "Numerical methods", New Age International (P) Ltd., Publishers, Seventh Edition, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/111/107/111107105/ (Numerical Methods)
2. https://nptel.ac.in/courses/127106019 (Numerical Methods)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	-	-
2	3	3	2	1	2	-	-	-	-	-	2	-	-
3	3	3	2	1	2	-	-	-	-	-	2	-	-
4	3	3	3	2	2	-	-	-	-	-	2	-	-
5	3	3	3	2	2	-	-	-	-	-	2	-	-
AVG	3	3	2.4	1.4	2	-	-	-	-	-	2	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MGO722 COST MANAGEMENT OF ENGINEERING PROJECTS L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the fundamental concepts and processes of strategic cost management.
- To inculcate knowledge of the different stages of project execution and management.
- To enhance knowledge of cost behavior and profit planning in mechanical and process industries.
- To familiarize students with various pricing strategies followed in engineering projects.
- To impart knowledge of various quantitative techniques used in cost management.

UNIT I INTRODUCTION 9

Introduction and overview of the strategic cost management process – Cost concepts in decision making – Relevant cost, Differential cost, Incremental cost and Opportunity cost – Objectives of a Costing System – Inventory valuation – Creation of a database for operational control – Provision of data for decision making.

UNIT II PROJECT 9

Meaning, different types, why to manage, cost overruns centres, various stages of project execution – Conception to commissioning – Project execution as conglomeration of technical and nontechnical activities – Detailed Engineering activities – Pre project execution main clearances and documents – Project team: Role of each member – Importance of project site – Data required with significance – Project contracts – Types and contents – Project execution – Project cost control – Bar charts and network diagram.

UNIT III PROJECT COMMISSIONING 9

Mechanical and process – Cost Behavior and Profit Planning – Marginal Costing – Distinction between marginal costing and absorption costing – Break-even Analysis – Cost volume-Profit Analysis – Various decision-making problems – Standard Costing and Variance Analysis.

UNIT IV PRICING STRATEGIES 9

Pareto Analysis – Target costing – Life cycle costing – Costing of service sector – Just-in-time approach – Material requirement planning – Enterprise resource planning – Total quality management and theory of constraints – Activity-based cost management – Bench marking – Balanced score card and value-chain analysis – Budgetary control – Flexible budgets – Performance budgets – Zero-based budgets – Measurement of divisional profitability pricing decisions including transfer pricing.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Quantitative techniques for cost management – Linear programming – PERT/CPM – Transportation problems – Assignment problems – Simulation – Learning curve theory.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the basics of the cost management process.
- Examine the stages of project execution from conception to commissioning.
- Construct suitable analytical techniques for project commissioning.
- Examine various pricing strategies followed in project implementation.
- Analyze different quantitative techniques used for cost management.

TEXT BOOKS

1. Charles T. Horngren, Srikant M. Datar and Madhav V. Rajan, "Cost Accounting A Managerial Emphasis", Pearson Education, Fourteenth Edition, 2023.
2. Charles T. Horngren and George Foster, "Advanced Management Accounting", Pearson Education, Thirteenth Edition, 2020.
3. QiuGuo Lin, "Cost management of engineering project", China Electric Power Press, Seventh Edition, 2021.

REFERENCES

1. Robert S Kaplan, Anthony A. Alkinson, "Management Accounting", Pearson Education, Fourth Edition, 2022.
2. Ashish K. Bhattacharya, "Principles & Practices of Cost Accounting", PHI Learning Private Limited, Sixth Edition, 2020.
3. Kenneth K Humpheys, "Project and cost engineers" handbook (cost management), CRC Press, Fourth Edition, 2023.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106149/ (Types of Projects)
2. https://nptel.ac.in/courses/110/104/110104073/ (Cost Management for Projects)

Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
1	2	2	1	1	1	1	-	-	-	3	1	2	1
2	2	2	2	1	1	1	1	1	1	3	1	2	2
3	2	2	3	2	2	1	-	1	1	2	2	3	2
4	2	2	2	1	1	1	-	-	1	3	1	2	2
5	2	3	2	2	2	1	-	-	-	3	1	3	1
AVG	2	2.2	2	1.4	1.4	1	1	1	1	2.8	1.2	2.4	1.6

1-Low 2-Medium 3-High '-' – No Correlation

S. Thirukumaran
Chairman - BoS

GENERAL ELECTIVES

23NCCL01	NCC AIRFORCE LEVEL-1	L T P C
	(Common to All UG Programme NCC Students)	3 0 0 3

OBJECTIVES

- To familiarize students with the organizational structure of the National Cadet Corps (NCC), the duties and responsibilities of cadets, the incentives offered, and the significance of various NCC camps.
- To impart knowledge on personality development by enhancing communication skills, self-awareness, creative thinking, critical thinking, and leadership qualities.
- To introduce students to the qualities of effective leadership through the study of eminent leaders, their contributions, and the values required for responsible citizenship.
- To inculcate a sense of social responsibility by encouraging active participation in community service activities and promoting awareness of the role of youth in nation-building.
- To provide an understanding of the importance of health, hygiene, yoga, environmental cleanliness, and obstacle training while motivating students to contribute towards the vision of a Clean India.
- To provide practical training in foot drill, rifle drill, ceremonial drill, and social service activities for developing discipline, teamwork, leadership, and a sense of community responsibility.

UNIT I NCC GENERAL 7

Aims, objectives and Organization of NCC - incentives - duties of NCC Cadets - NCC camps - types - conduct.

UNIT II PERSONALITY DEVELOPMENT 7

Personality Development – Factors - Self Awareness - Communication skills –Empathy - Critical and Creative thinking - Decision making.

UNIT III LEADERSHIP 7

Leadership Capsule - Traits - Case studies - Leaders like APJ Abdul Kalam, RatanTata, shivaji, Tipu Sultan, Rabindranath Tagore, N Narayana murthy

UNIT IV SOCIAL SERVICE 7

Social Service Capsule – Basics - Rural development programmes – NGOs - Contribution of Youth - Swatch Bharath Abhiyan, Social evils - Drug Abuse - Digital Awareness - Waste Management - Women Health and Sanitation - Tree Plantation - Traffic Awareness - Pollution.

UNIT V HEALTH AND HYGIENE 7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training – Adventure.

PRACTICAL COMPONENT **10**

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Ceremonial Drill	CO2	Understand
4	Social Service and Community Development	CO4	Understand

TOTAL: 35+10= 45 PERIODS

OUTCOMES

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

- Explain the organizational structure of the NCC, the roles and responsibilities of cadets, and the significance of various NCC camps.
- Apply communication, self-awareness, and creative and critical thinking skills to demonstrate personality development and confidence.
- Analyze the leadership qualities and contributions of eminent leaders to develop effective leadership skills and responsible citizenship.
- Demonstrate social responsibility by participating in community service activities and promoting awareness of national development initiatives.
- Apply the principles of health, hygiene, yoga, environmental cleanliness, and obstacle training to maintain personal well-being and develop physical fitness.
- Demonstrate proficiency in foot drill, rifle drill, ceremonial drill, and social service activities by applying discipline, teamwork, leadership, and community service skills in practical situations.

TEXT BOOKS

1. Cadet Hand Book(Common Subjects),published by DG NCC.
2. Cadet Hand Book(Specialized Subjects),published by DG NCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG NCC.
2. Youth in Action, published by DGNCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-RESOURCES

1. https://www.indiancc.nic.in
2. https://www.indiancc.mygov.in
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

CO – PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	3	3	2	2	–	2	–	–
CO2	2	3	2	–	–	3	2	3	3	3	2	–	–
CO3	2	3	2	2	–	3	3	2	2	2	2	–	–
CO4	3	2	2	2	–	3	3	2	3	2	2	–	–
CO5	3	2	2	2	2	3	3	2	–	–	2	–	–
CO6	2	2	3	–	–	3	3	3	3	2	2		
AVG.	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	–	–

Chairman - BoS

23NCCL02	NCC AIRFORCE LEVEL- 2	L	T	P	C
		3	0	0	3

(Common to All UG Programme NCC Students)

OBJECTIVES

- To familiarize students with the concepts of national security, national integration, and threats to the nation.
- To impart knowledge on leadership development, problem-solving techniques, emotional management, and time management skills.
- To introduce the principles of disaster management and encourage active participation in disaster response and relief activities.
- To inculcate an understanding of the significance of airmanship, air campaigns, and the role of the Indian Air Force in national service.
- To provide an insight into aeromodelling and its applications in aviation, while motivating students to explore the Armed Forces as a career.
- To impart practical knowledge of weapon assembling and reassembling while emphasizing safe handling procedures and operational efficiency.

UNIT I NATIONAL INTEGRATION AND AWARENESS 7

National Integration and Awareness - importance and necessity-factors affecting National integration-Unity in Diversity-Threats to National Security

UNIT II PERSONALITY DEVELOPMENT 7

Problem solving - Group discussions-Coping with stress and emotions-Change your mindset- Time management-Social skills-Team work-public speaking

UNIT III DISASTER MANAGEMENT 7

Disaster Management Capsule – Organization - Types -Essential services – Assistance - Civil Defence Organization - Initiative training-organizing skills - Dos and Don't's Fire Services and Fire Fighting.

UNIT IV GENERAL SERVICE KNOWLEDGE ON AIRCRAFT AND AIRMANSHIP 7

Armed forces and IAF Capsule-Modes of Entry in IAF-Aircraft types, capabilities and role-Air Campaigns-Principle of Flight-Forces acting on Aircraft-Airmanship – Navigation.

UNIT V AEROMODELLING

7

Introduction and Types of Aero Engine–Aircraft Controls–Introduction to Radars–Aero modelling capsule – Flying/Building of Aero models – Micro Light Flying – Simulator Flying.

PRACTICAL COMPONENT

10

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Weapon Assembling and Reassembling	CO2	Apply
4	Basics of Aero modelling	CO5	Understand

TOTAL: 35+10= 45 PERIODS

OUTCOMES

Upon Completion of the course, Students will be able to

- **Apply** the principles of national integration to explain the threats and factors affecting national security.
- **Analyze** the role of public speaking skills and problem-solving techniques in effective leadership and decision-making.
- **Explain** the types of disasters and the appropriate emergency response measures.
- **Analyze** the role of the Indian Air Force, aircraft, and airmanship in ensuring national security and defence.
- **Apply** the concepts of aeromodelling and radar handling to demonstrate an understanding of aircraft operations and flying principles.
- Analyze the importance of drill, weapon training, and aero modelling in developing leadership, teamwork, and military skills.

TEXT BOOKS

- Cadet Hand Book(Common Subjects),published by DG NCC.
- Cadet Hand Book(Specialized Subjects),published by DG NCC.
- ANO Hand Book

REFERENCES

- Grooming tomorrow's Leaders, published by DG NCC.
- Youth in Action, published by DG NCC.
- The Cadet, Annual Journal of the NCC.
- Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-Resources

1. https://www.indiancc.nic.inhttps://www.indiancc.mygov.in
2. https://www.play.google.com/MY_IAFs
3. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

CO – PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	3	3	2	2	–	2	–	–
CO2	2	3	2	–	–	3	2	3	3	3	2	–	–
CO3	2	3	2	2	–	3	3	2	2	2	2	–	–
CO4	3	3	2	2	2	3	2	2	–	–	2	–	–
CO5	3	2	2	3	3	2	2	2	–	–	2	–	–
CO6	2	2	3	–	–	3	3	3	3	2	2		
AVG.	2.5	2.5	2.2	2.3	2.5	2.8	2.5	2.3	2.5	2.3	2.0	–	–

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Chairman - BoS

23NCCL03	NCC ARMY WING LEVEL-3	L TP C
	(Common to All UG Programme NCC Students)	300 3

COURSE PREREQUISITES: 75% Attendance in First Year of NCC Course

OBJECTIVES

- To learn the basic structure of NCC and its organization,Incentives,duties of Cadets; imbibe the knowledge of various types of Camp.
- To motivate the cadets as confidence leaders by refining theirpersonality andself-awareness, with the help of Communication skills andaware of creative, critical thinking abilities.
- To create an awareness on MilitaryHistoryand great heroes of India and to know about the important military operations
- To inspire the cadets to take part in the Social Service Activities and also to learn about the infantry battalion
- To acquire knowledge about the basics of health and hygiene, yoga, environment cleanliness and motivate young Indians towards the path of clean India and acquaint about obstacle training.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

Unit I NCC GENERAL 7

Aims, objectives and Organization of NCC-incentives-duties of NCC Cadets-NCC camps- types - conduct.

Unit II PERSONALITY DEVELOPMENT 7

Personality Development -Factors-Self Awareness-Communication skills-Empathy-Critical and Creative thinking-Decision making.

Unit III MILITARY HISTORY 7

MilitaryHistory-Biographies, Heroes StudyofBattlesofIndo-PakWar 1965,1971-OperationMeghdootandKargil.

Unit IV SOCIAL SERVICE& INFANTRYBATALLION 7

Social Service Capsule-Basics-Rural development programmes-NGOs-Contribution of Youth - Swatch BharathAbhiyan, Social evils-Drug Abuse-Digital Awareness-Waste Management-Women Health and Sanitation-Organisation of Infantry,characteristics

UnitV HEALTH AND HYGIENE 7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental

awareness and conservation – Obstacle Training -Adventure

TOTAL: 35PERIODS

OUTCOMES

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

- Understand the basic organization of NCC and roles, responsibilities of cadets for the smooth functioning of all camps
- Develop the cadets personality and to think divergently to break functional fixedness
- Identify the Leadership traits of military heroes and learn about their organization
- Understand the concept and important of Social service and evolution of infantry battalion
- Practice healthy practices to improve the personal sanitation and hygiene and get into the adventurous activities
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

E - RESOURCES

1. https://www.indiancc.nic.in
2. https://www.indiancc.mygov.in
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

LIST OF DRILLS

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Ceremonial Drill

4.Social Service and Community Development

TOTAL = 10 PERIODS

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	2	-	3	2	2	1	-	-
2	-	2	-	-	-	2	-	2	3	3	2	-	-
3	2	2	-	-	-	3	-	3	3	2	3	-	-
4	-	2	2	-	-	3	3	3	2	2	2	-	-
5	2	2	-	-	-	3	3	2	2	1	2	-	-
6	2	2	3	-	-	2	-	2	3	2	2	-	-
AVG	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23NCCL04	NCC ARMY WING LEVEL-4	L T P C
	(Common to All UG Programme NCC Students)	3 00 3

COURSE PREREQUISITES: 75% Attendance in Second Year of NCC Course

OBJECTIVES

- To realize the importance of national security and threats for the nation and aware of National Integration.
- To create interest in cadet to develop into great leaders by teaching them about problem solving techniques, handling emotions and time management skills.
- Toaware of disaster management and motivate the young minds to help during the time of disasters.
- To create a pool of organized, trained and motivated youth with authoritative qualities to serve in CAPF and to know the Modes of CAPF
- To learn about the use of Maps in army, usage of conventional signs, scale and grid systems.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

Unit I NATIONAL INTEGRATION AND AWARENESS7

National Integration and Awareness - importance and necessity-factors affecting National integration-Unity in Diversity-Threats to National Security.

Unit II PERSONALITY DEVELOPMENT 7

Problem solving - Group discussions-Coping with stress and emotions-Change your mindset-Time management-Social skills-Team work-public speaking.

Unit III DISASTER MANAGEMENT 7

Disaster Management Capsule – Organization - Types -Essential services – Assistance - Civil Defence Organization - Initiative training-organizing skills - Dos and Don'tsFire Services and Fire Fighting

Unit IV INTRODUCTION TO ARMED FORCES 7

Army-PoliceandCentralArmedPoliceForces-Badges- Role-Tasks-ModesofEntryintoArmy,PoliceandCAPF

UnitV MAPS,CONVENTIONAL SIGNS,SCALEANDGRID SYSTEMS 7ConventionalSigns-ScalesAndGridSystems - TopographicalFormsand TechnicalTerms,CardinalPointsAnd TypesOfNorth-TypesOfBearingAndUseOfServiceProtractor GoogleMaps&Applications

TOTAL: 35PERIODS

OUTCOMES

Upon the successful completion of this course students will be able to:

- Realize the importance of National integration, threats and factors affecting the National Security.
- Demonstrate their public speaking skills and problem solving techniques.
- Identify and analyzethe problems during Disaster type and to give solutions during the emergency periods with their presence of mind
- Grasp the concept of CAPF andits importanceto the nation and detailed Knowledge onmodes of entry into CAPF.
- Obtain knowledge on maps, usage of conventional signs, learn about the features of land
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1.Cadet Hand Book (Common Subjects), published by DGNCC.

2.Cadet Hand Book (Specialized Subjects), published by DGNCC.

3.ANO Hand Book

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

E - RESOURCES

https://www.indiancc.nic.in

https://www.indiancc.mygov.in

https://www.play.google.com/MY_IAFs

https://www.play.google.com/DGNCC_Training

LIST OF DRILLS

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Weapon Assembling and Reassembling
4. Basics of Maps

TOTAL: 10 PERIODS

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	3	2	3	2	2	1	-	-
2	2	2	-	-	-	2	-	3	3	2	2	-	-
3	2	2	2	-	-	3	2	3	3	2	2	-	-
4	2	2	2	-	-	3	-	3	2	2	3	-	-
5	2	2	3	-	2	2	-	3	2	2	2	-	-
6	2	2	3	-	-	2	-	3	3	2	2	-	-
AVG	2	2	2.5	-	2	2.5	2	3	2.5	2	2	-	-

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

ELECTIVE - MANAGEMENT

23MGT701 PRINCIPLES OF MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To familiarize the basic concepts of management, managerial roles, business organizations and management approaches.
- To inculcate the planning process, strategic management concepts and decision-making techniques.
- To provide knowledge of organizational structure, authority relationships and human resource management functions.
- To impart knowledge of motivation, leadership, communication and individual and group behavior in organizations.
- To enhance the concepts of controlling, performance measurement and management control techniques.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers - managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization - Sole proprietorship, partnership, company - public and private sector enterprises - Organization culture and Environment - Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose - Formal and informal organization - Organization chart - Organization - structure - Types - Line and staff authority - Departmentalization - delegation of authority - Centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour - Motivation - Motivation theories -Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership - Communication - Process of communication - Barrier in communication -Effective communication - Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling - Budgetary and non-Budgetary control techniques - Use of computers and IT in Management control - Productivity problems and management - Control and performance - Direct and preventive control - Reporting.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of management, organizational forms and management theories.
- Analyze the planning tools and decision-making techniques in organizational situations.
- Apply the organizational structures and human resource management practices.
- Explain the leadership, motivation and communication approaches for organizational effectiveness.
- Examine the assess control systems and performance management techniques used in organizations.

TEXT BOOKS

1. Stephen P. Robbins and Mary Coulter, "Management", Fourteen Edition Prentice Hall (India) Pvt. Ltd., 2017.
2. Harold Koontz and Heinz Weihrich, "Essentials of management", Eleventh Edition, Tata McGraw Hill, 2020.

REFERENCES

1. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management , Seventh Edition, Pearson Education", 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/110107150 - (Principles of Management)
2. https://nptel.ac.in/courses/110105146 - (Principles of Management)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	-	-	-	-	1	-	-	-	-	-	-	-
2	-	1	1	-	-	-	-	-	-	-	-	-	-
3	1		-	2	-	1	-	2	-	1	1	-	-
4	-	1	1	1	2	-	1	2	-	-	-	-	-
5	1	-	-	-	1	1	-	-	3	-	1	-	-
AVG	1.66	1	1	1.5	1.5	1	1	2	3	1	1	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MGT702 **TOTAL QUALITY MANAGEMENT** L T P C

3 0 0 3

OBJECTIVES

- To guide students in understanding the philosophies and practices of total quality management.
- To familiarize students with the principles of TQM, including leadership, customer satisfaction, employee involvement, and continuous improvement.
- To introduce students to quality management tools and techniques for process analysis and improvement.
- To explain advanced quality improvement methods and performance measurement techniques used in organizations.
- To guide students in understanding Quality management systems, environmental management Systems and ISO standards for quality and environmental management.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES I 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs – Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards – Sector - Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements – Implementation –

Documentation - Internal Audits – Registration - ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- **Examine** the concepts, philosophies, frameworks, and customer-focused practices of Total Quality Management.
- **Analyze** the roles of leadership, employee involvement, continuous improvement, and supplier partnership in achieving organizational excellence.
- **Analyze** quality management tools and techniques, including Six Sigma, benchmarking, and FMEA, for process improvement and problem-solving.
- **Differentiate** the applications of Control Charts, Process Capability Analysis, QFD, Taguchi Methods and TPM in quality improvement.
- Compare the requirements and implementation procedures of quality management systems and environmental management systems based on ISO standards.

TEXT BOOKS

1. Dale H. Besterfiled,, "Total quality Management", Fifth Edition, Pearson Education India, 2019.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2022.
3. John S. Oakland, "Total Quality Management and Operational Excellence: Text with Cases", Fifth Edition, Routledge, 2024.

REFERENCES

1. James R. Evans and William M. Lindsay, "Managing for Quality and Performance Excellence" Twelfth Edition, Cengage Learning, 2023.
2. Poornima M. Charantimath, "Total Quality Management", Fourth Edition, Pearson Education India, 2020.
3. David L. Goetsch and Stanley B. Davis, "Quality Management for Organizational Excellence", Nineth Edition, Pearson, 2022.

E-RESOURCES

1. https://nptel.ac.in/courses/110104080 - (Total Quality Management)
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg72 -(Total Quality Management II)

Mapping of COs-POs & PSOs

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

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23MGT703 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING L T P C

3 0 0 3

OBJECTIVES

- To introduce managerial economics for effective decision-making.
- To Familiarize students with production and cost concepts to analyse production optimization for business decisions
- To explore pricing decisions under different market structures and pricing objectives.
- To enhance the ability to interpret financial statements.
- To gain knowledge of capital budgeting techniques for investment decisions.

UNIT I DEMAND AND SUPPLY ANALYSIS 9

Managerial Economics – Relationship with other disciplines – Firms: Types, objectives and goals – Managerial decisions – Decision analysis. Demand – Types of demand – Determinants of demand – Demand function – Demand elasticity – Demand forecasting – Supply – Determinants of supply – Supply function -Supply elasticity.

UNIT II PRODUCTION AND COST ANALYSIS 9

Production function – Returns to scale – Production optimization – Least cost input Isoquants – Managerial uses of production function. Cost Concepts – Cost function – Determinants of cost – Short run and Long run cost curves – Cost Output Decision – Estimation of Cost.

UNIT III PRICING 9

Determinants of Price – Pricing under different objectives and different market structures – Price discrimination – Pricing methods in practice.

UNIT IV FINANCIAL ACCOUNTING 9

Balance sheet and related concepts – Profit & Loss Statement and related concepts – Financial Ratio Analysis – Cash flow analysis – Funds flow analysis – Comparative financial statements – Analysis & Interpretation of financial statements.

UNIT V CAPITAL BUDGETING

Investments – Risks and return evaluation of investment decision – Average rate of return – Payback Period – Net Present Value – Internal rate of return.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of this course, the student will be able to:

- Apply the principles of managerial economics for effective business decision-making.
- Analyse production and cost concepts to support production optimization and business decisions.
- Examine pricing decisions under different market structures and pricing objectives.
- Analyse financial statements to evaluate the financial performance of an organization.
- Compare capital budgeting techniques to evaluate investment opportunities and support investment decisions.

TEXT BOOKS

1. P. L. Mehta, "Managerial Economics: Analysis, Problems and Cases", Seventeenth Edition, Sultan Chand & Sons, 2022.
2. S. N. Maheshwari and S. K. Maheshwari, "Financial Accounting", seventh Edition, Vikas Publishing House Pvt. Ltd., 2023.

REFERENCES

1. Dominick Salvatore and Siddhartha K. Rastogi, "Managerial Economics: Principles and Worldwide Applications", Tenth Edition, Oxford University Press, 2024.
2. M. Pandey, Financial Management, Twelfth Edition, Pearson India, 2023.

E-RESOURCES

1. http://www.digimat.in/nptel/courses/video/110101005/110101005.html
2. https://nptel.ac.in/courses/110101131

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	1	-	1	1	3	1	-	-
2	2	3	2	1	2	1	-	-	1	3	1	-	-
3	2	3	1	-	-	2	1	1	1	3	1	-	-
4	2	3	-	1	2	1	-	-	2	3	1	-	-
5	2	3	2	1	2	2	1	1	1	3	2	-	-
AVG	2.0	2.8	1.7	1.0	2.0	1.4	1.0	1.0	1.2	3.0	1.2	-	-

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

23MGT704 HUMAN RESOURCE MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To introduce the evolution and significance of Human Resource Management in organizations.
- To familiarize students with matching HR demand and supply with internal and external sources.
- To gain knowledge about executive development programs, common practices and benefits.
- To explore career management and mentor–protégé relationships.
- To enable an understanding of performance evaluation methods and feedback.

UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT 9

Evolution of human resource management - The importance of the human factor - Challenges - Role of human resource manager Challenges for Human Resource Managers - Trends in Human Resource Policies – Computer Applications in Human Resource Management - Case analysis.

UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT 9

Importance of Human Resource Planning - Forecasting human resource requirement - matching supply and demand - Internal and External sources -. Recruitment, Selection, Placements, Induction – Case analysis.

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT 9

Training need Analysis – Purpose – Training Evaluation methods – Benefits - Executive development – Self Development – Knowledge Management – Case analysis.

UNIT IV EMPLOYEE ENGAGEMENT 9

Compensation plan - Reward - Motivation – X, Y, Z Theories - Career management - Mentoring- Developmnet of Mentor - Protege relationships.

UNIT V PERFORMANCE EVALUATION AND CONTROL PROCESS 9

Performance Evaluation Methods - types – Feedback - Industry practices. Promotion, Demotion, Transfer and Separation - The control process - Importance -Methods - grievances – Causes - Implications - Redressal Methods – Artificial Intelligence and an Era of Human Resource – Benefits – Challenges - Case analysis

TOTAL: 45 PERIODS

OUTCOMES

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

- Develop the skills needed to understand the significance of Human Resource Management.
- Differentiate internal and external sources of recruitment for effective Human Resource Planning.
- Analyze the effectiveness of HRM practices in supporting the strategic and operational needs of the organizations in a global economy.
- Examine career management and mentoring practices in organizations.
- Analyze performance evaluation methods practice and control processes.

TEXT BOOKS

1. Biswajeet Pattanayak, "Human Resource Management", Seventh Edition, PHI Learning Private Limited, 2025.
2. Dessler, G., & Varkkey, B,"Human Resource Management ", Pearson Education India, Seventeenth Edition, 2024.

REFERENCES

1. Aswathappa, K," Human Resource Management", Tenth Edition, Tata McGraw-Hill Education. 2023.
2. Ivancevich, J. M., "Human Resource Management", McGraw Hill Education, Fourteenth Edition, 2021.

E-RESOURCES

1. https://open.umn.edu/opentextbooks/textbooks/71?utm_source=.com
2. https://positivepsychology.com/theory-x-and-theory-y/

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	1	2	2	1	-	2	-	-
2	1	2	-	-	1	1	1	2	1	1	2	-	-
3	1	2	2	2	2	2	2	2	2	2	2	-	-
4	-	2	-	-	-	1	2	3	2	1	2	-	-
5	1	2	1	2	2	1	2	2	2	2	2	-	-
AVG	1	2	1.5	2	1.5	1.2	1.8	2.2	1.6	1.5	2	-	-

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

23MGT705 KNOWLEDGE MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To introduce the concepts, evolution, challenges, and ethical aspects of Knowledge Management.
- To understand knowledge sharing and tacit knowledge management.
- To explore technologies and tools supporting Knowledge Management.
- To impart knowledge of Knowledge Management strategies and organizational applications.

  To enhance understanding of future trends and case studies in Knowledge Management.

UNIT I INTRODUCTION 9

Introduction – The foundation of Knowledge Management – Cultural issues - technology applications - organizational concepts and processes - management aspects - and decision support systems. The Evolution of Knowledge management - Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets - Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT III TECHNOLOGIES AND TOOLS FOR KNOWLEDGE MANAGEMENT 9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT STRATEGIES AND APPLICATIONS 9

Knowledge Management Strategy – Components of Knowledge Strategy – Knowledge Acquisition, Storage, Sharing and Application – Knowledge Management Frameworks and Models – Organizational Applications of Knowledge Management – Case Studies on Knowledge Management Practices – Challenges in Implementing Knowledge Management.

UNIT V FUTURE TRENDS AND CASE STUDIES 9

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of this course, the student will be able to:

- Examine Knowledge Management concepts, challenges and ethical aspects.
- Analyze knowledge sharing and tacit knowledge management practices.
- Apply technologies and tools for effective Knowledge Management.
- Compare Knowledge Management strategies, frameworks, and applications.
- Analyze future trends and case studies in Knowledge Management.

TEXT BOOKS

1. Dalkir, K. "Knowledge Management in Theory and Practice", Fourth Edition, MIT Press, 2023
2. Becerra-Fernandez, I., & Sabherwal, R, "Knowledge Management: Systems and Processes" Third Edition. Routledge, 2023.

REFERENCES

1. Nonaka, I., & Takeuchi, H. "The Wise Company: How Companies Create Continuous Innovation", Oxford University Press, 2021.
2. Girard, J. P., & Girard, J. L., "Knowledge Management: Concepts, Methodologies, Tools, and Applications. IGI Global", 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg96
2. https://www.britannica.com/technology/search-engine

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	1	-	3	-	-	-	2	-	-
2	2	3	-	-	1	1	-	2	2	-	2	-	-
3	2	2	1	1	2	-	-	1	1	1	2	-	-
4	2	2	2	1	2	1	-	1	1	2	2	-	-
5	2	3	2	2	2	2	1	1	2	2	3	-	-
AVG	2.0	2.4	1.7	1.3	1.6	1.3	2.0	1.3	1.5	1.7	2.2	-	-

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

23MGT706	INDUSTRIAL MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES

- To introduce the fundamentals of management and organizations.
- To enhance planning, organizing, and staffing functions.
- To impart knowledge of leadership, communication, controlling, and decision-making.
- To familiarize students with organizational behavior and change management.
- To provide knowledge of productivity improvement and modern management practices.

UNIT I INTRODUCTION TO MANAGEMENT 9

Management: Introduction; Definition and Functions - Approaches to the study of Management - Mintzberg's Ten Managerial Roles - Principles of Taylor, Weber, Parker - Forms of Organization: Sole Proprietorship; Partnership Cooperative - Public Sector Vs Private Sector Organization - Business Environment: Economic, Social, Political, Legal - Trade Union.

UNIT II FUNDAMENTALS OF MANAGERIAL FUNCTIONS 9

Planning - Strategic Planning - Vision & Mission statement in Planning – Organizing - Departmentalization - Centralization and Decentralization - Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process.

UNIT - III MANAGERIAL FUNCTIONS IN ENGINEERING AND TECHNOLOGY 9

Directing - Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication - Barriers – Controlling - Audit - Preventive Control – Decision Making.

UNIT IV ORGANIZATION THEORY 9

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Motivation Theories - Change Management - Sources of Resistance - Overcoming Resistance - Guidelines to managing Conflict.

UNIT V PRODUCTIVITY AND MODERN TOPICS

Productivity – Concept - Measurements - Affecting Factors; Methods to Improve – Business Process Reengineering (BPR) – Benchmarking - SWOT/SWOC Analysis - Total Productive Maintenance - Management of Information Systems (MIS), Industry

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of this course, the student will be able to:

- Examine the fundamentals of management and organizations.
- Apply planning, organizing and staffing functions.
- Apply leadership, communication, controlling, and decision-making techniques.
- Analyse organizational behavior and change management practices.
- Compare productivity improvement techniques and modern management practices.

TEXT BOOKS

1. Koontz, H., Weihrich, H. and Cannice, M. V., "Essentials of Management: An International, Innovation and Leadership Perspective", Eleventh Edition, McGraw-Hill Education, 2021.
2. Govindarajan, M. and Natarajan, S., "Principles of Management, Prentice Hall of India / Pearson Education", New Delhi, 2009.

References:

1. Daft, Richard L., "Organization Theory and Design", Thirteenth Edition, Cengage Learning, 2020.
2. Certo, Samuel C. and Certo, S, "Trevis, Modern Management: Concepts and Skills", Fifteenth Edition, Pearson Education, 2020.

E-RESOURCES

1. https://www.jkkmct.edu.in/software/uploads/syllabus/8d168a38585feb8e45346543f7aeaaff.pdf?utm_source=chatgpt.com
2. https://sitams.ac.in/wp-content/uploads/2026/03/UNIT-II-MOB.pdf

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	-	1	1	-	-	2	1	-	-
2	1	2	-	-	1	-	-	1	1	3	-	-	-
3	1	2	-	-	-	1	1	2	2	2	-	-	-
4	1	2	-	-	-	2	2	2	2	1	1	-	-
5	1	2	1	-	2	1	-	1	1	3	2	-	-
AVG	1.7	3.2	1.0	-	2.0	2.0	2.0	2.4	2.4	3.7	2.0	-	-

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

23MGT707 SUPPLY CHAIN MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To introduce the major decisions in supply chain management.
- To familiarize students with the concepts of supplier selection and contract negotiation.
- To explore the impact of uncertainty on network design.
- To enhance knowledge of multiple-location inventory management concepts.
- To gain knowledge of supply chain integration concepts and their advancements in current trends.

UNIT I INTRODUCTION 9

Supply Chain - Fundamentals – Evolution - Role in Economy - Importance - Decision Phases Supplier – Manufacturer - Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy Supply Chain Performance Measures.

UNIT II STRATEGIC SOURCING 9

Outsourcing - Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum - Sourcing strategy Supplier Selection and Contract Negotiation. Creating a world class supply base - Supplier Development - World Wide Sourcing.

UNIT III SUPPLY CHAIN NETWORK 9

Distribution Network Design - Role - Factors Influencing Options, Value Addition - Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT IV PLANNING DEMAND, INVENTORY AND SUPPLY 9

Managing supply chain cycle inventory. Uncertainty in the supply chain - Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life cycle products - multiple item - multiple location inventory management. Pricing and Revenue Management.

UNIT V CURRENT TRENDS 9

Supply Chain Integration - Building partnership and trust in SC Value of

Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. SC Restructuring - SC Mapping SC process restructuring, Postpone the point of differentiation - IT in Supply Chain - Agile Supply Chains Reverse Supply chain. Agra Supply Chains

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of this course, the student will be able to:

- Apply supply chain management principles in major supply chain decision areas.
- Examine supplier selection processes and contract negotiation strategies in supply chain operations.
- Analyze the impact of uncertainty on supply chain network design decisions.
- Apply appropriate approaches for managing multiple-location inventory systems.
- Explain the concepts of supply chain integration and their evolution in current industry trends.

TEXT BOOKS

1. Sunil Chopra, "Supply Chain Management: Strategy, Planning & Operation", PHI Learning, Eigth Edition, 2025.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, and Ravi Shankar "Designing and Managing the Supply Chain: Concepts, Strategies, and Cases", Tata McGraw-Hill, Fourth Edition, 2022.

REFERENCES

1. Ballou Ronald H, "Business Logistics and Supply Chain Management", Fifth Edition, Pearson, 2021.
2. Shapiro Jeremy F, "Modeling the Supply Chain", Second Reprint, Pearson, 2022.

E-RESOURCES

1. https://www.tutorialspoint.com/supply_chain_management(SCM tutorial).
2. https://www.mixmove.io/post/supply-chain-integration(supply-chain-integration).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	2	1	1	1	1	-	-	-	2	1	1
2	2	2	1	1	-	2	1	1	2	2	2	-	-
3	2	3	2	2	2	1	1	-	-	-	2	1	1
4	2	2	3	2	2	1	1	-	-	-	3	1	1
5	1	1	1	-	1	2	1	-	1	2	2	-	1
AVG	1.8	2	1.8	1.5	1.5	1.4	1	1	1.5	2	2.2	1	1

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

23MGT708	E – WASTE MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES

- To understand e-waste generation, composition, hazards, and impacts.
- To gain knowledge of global e-waste trade and recycling practices.
- To enhance understanding of e-waste control measures and regulatory frameworks.
- To impart knowledge of e-waste handling and management practices.
- To familiarize students with international e-waste legislations and policies.

UNIT I INTRODUCTION 9

E- waste composition and generation - Global context in e- waste - E-waste pollutants - E waste hazardous properties - Effects of pollutant (E- waste) on human health and surrounding environment - domestic e-waste disposal - Basic principles of E waste management - Technologies for recovery of resources from electronic waste - resource recovery potential of e-waste - steps in recycling and recovery of materials - technologies for recovery of materials - occupational and environmental health perspectives of recycling e-waste in India.

UNIT II E-WASTE HAZARDOUS ON GLOBAL TRADE 9

Essential factors in global waste trade economy - Free trade agreements as a means of waste trading - Import of hazardous e-waste in India - India's stand on liberalizing import rules - E-waste economy in the organized and unorganized sector - Estimation and recycling of e-waste in metro cities of India.

UNIT III E- WASTE CONTROL MEASURES 9

Need for stringent health safeguards and environmental protection laws in India - Extended Producers Responsibility (EPR) - Import of e-waste permissions - Producer- Public-Government cooperation - Administrative Controls & Engineering controls - monitoring of compliance of Rules - Effective regulatory mechanism strengthened by manpower and technical expertise - Reduction of waste at source.

UNIT IV E- WASTE MANAGEMENT HANDLING 9

E-waste (Management and Handling) Rules, 2022 - and E-Waste (Management) Rules - Salient Features and its likely implication - Government assistance for TSDFs.

UNITV THE INTERNATIONAL LEGISLATION 9

The Basel Convention - The Bamako Convention - The Rotterdam Convention - Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union - Restrictions of Hazardous Substances (RoHS) Directive.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of this course, the student will be able to:

- Explain e-waste generation, composition, hazards, and environmental impacts.
- Analyze global e-waste trade and recycling practices.
- Apply e-waste control measures and regulatory frameworks.
- Describe e-waste handling, management, and recycling processes.
- Analyze international e-waste legislations and policies.

TEXTBOOKS

1. Priya, A. (Ed.), "Management of Electronic Waste: Resource Recovery, Technology and Regulation", First Edition, John Wiley & Sons, 2024.
2. Kumar.S, & Kumar, V., "Electronic Waste Management: Policies, Processes, Technologies, and Impact", John Wiley & Sons, 2024.

REFERENCES

1. Johri, R, "E-Waste: Implications, Regulations, and Management in India and Current Global Best Practices", First Edition, TERI Press, New Delhi, 2008.
2. Kumar, A., Rathore, P. S., Dubey, A. K., Srivastav, A. L., Dutt, V., & Ananth Kumar.T, "Sustainable Management of Electronic Waste", Second Edition, John Wiley & Sons, 2024.

E-RESOURCES

1. https://news.mit.edu/2013/ewaste-mit.
2. https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	2	1	1	2	1	-	2	-	1	-	-
2	1	3	2	2	1	2	1	1	2	2	2	-	-
3	2	2	3	2	2	2	2	1	2	2	2	-	-
4	2	2	3	2	2	2	1	2	1	2	2	-	-
5	2	3	2	2	1	2	1	1	2	2	2	-	-
AVG	1.8	2.4	2.4	1.8	1.4	2	1.2	1.3	1.8	2	1.8	-	-

1-Low 2-Medium 3-High '- '– No Correlation

Chairman - BoS

EMPLOYABILITY ENHANCEMENT COURSES

23EEC101 SOFTSKILLS & LIFE SKILLS

L T P C
1 0 0 1

(Common to all First year / First Semester B.E., B.Tech., Branches)

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES 3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS 3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS 3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS 3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS 3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

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

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.

TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

E-RESOURSES

3. **https://uhv.org.in/**
4. **https://nptel.ac.in**

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	0	0	0	2	2	3	2	1	0	-	-
2	1	3	1	1	0	1	0	2	3	3	1	-	-
3	0	1	0	0	0	1	0	3	3	3	1	-	-
4	2	2	1	1	3	1	0	2	3	3	3	-	-
5	1	1	1	0	0	2	0	3	3	3	3	-	-
AVG	1	1.6	0.6	0.4	0.6	1.4	0.4	2.6	2.8	2.6	1.6	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER II

23EEC201 INDIAN LANGUAGE

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C

(Common to all B.E. & B.Tech. Branches) 0 0 4 2

OBJECTIVES

- To learn the Hindi alphabet, pronunciation, and basic writing.
- To understand and use basic Hindi grammar correctly.
- To develop basic reading, writing, listening, and speaking skills in Hindi.
- To use Hindi for simple everyday communication.
- To prepare learners to successfully clear the Hindi Examination.

UNIT I वर्णमालाएवंमूलभूतव्याकरण (ALPHABET AND BASIC GRAMMAR) 5

Hindi Vowels (स्वर)- Hindi Consonants (व्यंजन) -Matras (मात्राएँ)- Barakhadi (बारहखड़ी)-Word Formation (शब्दनिर्माण)- Gender (लिंग)- Number (वचन)- Basic Sentence -Formation (सरलवाक्यरचना)

UNIT II शब्दभंडारएवंव्याकरण (VOCABULARY AND GRAMMAR) 7

Nouns (संज्ञा)- Pronouns (सर्वनाम) -Adjectives (विशेषण) -Verbs (क्रिया) -Tenses (काल– Present, Past, Future) - Opposite Words (विलोमशब्द) -Synonyms (पर्यायवाची) -One-word Substitutions (अनेकशब्दोंकेलिएएकशब्द)

UNIT III पठनएवंलेखनकौशल (READING AND WRITING SKILLS) 7

Reading Simple Hindi Passages -Comprehension (गद्यांश) -Paragraph Writing (अनुच्छेदलेखन)- Letter Writing (पत्रलेखन)- Dialogue Writing (संवादलेखन) -Picture Description (चित्रवर्णन) -Dictation Practice (श्रुतिलेख)

UNIT IV दैनिकजीवनमेंहिंदी (HINDI FOR EVERYDAY COMMUNICATION) 7

Greetings and Introductions -Family Members (परिवार)- Days, Months, Seasons -Numbers (१–१००) -Time and Date - Colours, Fruits, Vegetables - Shopping Conversations - School and Classroom Vocabulary - Common Everyday Conversations

UNIT V साहित्यएवंपुनरावृत्ति (LITERATURE AND REVISION) 4

Simple Poems (कविताएँ)- Short Stories (लघुकथाएँ)- Proverbs and Idioms (मुहावरेएवंलोकोक्तियाँ– basic) -Moral Stories - Translation (English/Tamil to Hindi – Simple Sentences) - Revision of Grammar - Model Question Papers and Practice Tests

TOTAL: 30 PERIODS

OUTCOMES

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

- Write basic Hindi words and sentences.
- Apply fundamental Hindi grammar in simple communication.
- Develop basic reading, writing, listening, and speaking skills in Hindi.
- Use Hindi confidently in day-to-day conversations.
- Develop proficiency required to successfully clear the Hindi Examination.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	1	1	3	-	1	-	-
CO3	-	-	-	-	-	-	1	2	3	-	2	-	-
CO4	-	-	-	-	-	1	2	2	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	2	-	3	-	-
AVG	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-

P. Sathy
Chairman - BoS

SEMESTER II

23EEC201 INDIAN LANGUAGE

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C

(Common to all B.E. & B.Tech. Branches) 0 0 4 2

OBJECTIVES

- **To learn the German alphabet, pronunciation, and basic communication.**
- **To understand and use basic German grammar and vocabulary.**
- **To communicate in German in simple everyday situations.**
- **To develop basic reading, writing, listening, and speaking skills in German.**
- **To apply basic German language skills confidently through practice and revision.**

UNIT I INTRODUCTION TO GERMAN LANGUAGE 6

German alphabet and pronunciation – Greetings - Self-introduction (Name, age, nationality, profession) - Numbers (0–100) -Days, months, seasons, and dates - Basic classroom expressions - Personal pronouns -Verb **sein** (to be) -Simple sentence formation

UNIT II BASIC GRAMMAR AND VOCABULARY 7

Definite and indefinite articles (der, die, das; ein, eine) - Nouns and gender - Singular and plural forms - Verb conjugation (regular verbs) - Present tense - Question words (Wer, Was, Wo, Wann, Wie, Warum) - Negation (nicht, kein) - Vocabulary: Family, occupations, countries, languages, colors

UNIT III EVERYDAY COMMUNICATION 7

Daily routine - Time and clock reading - Food and beverages - Shopping conversations - Asking for and giving directions -Making simple requests -Modal verbs (möchten, können) -Vocabulary: Home, school, transportation, weather

UNIT IV READING, WRITING, LISTENING, AND SPEAKING SKILLS 5

Reading short dialogues - Listening to simple conversations - Writing short paragraphs - Describing people, places, and objects - Introducing family and friends

UNIT V PRACTICAL APPLICATIONS AND REVISION 5

Travel and tourism vocabulary - At the restaurant - At the railway station and airport - Revision of grammar topics - Translation of simple sentences (English to German and German to English)

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify the German alphabet and pronounce basic German words correctly.
- Use basic German vocabulary and simple grammar in sentences.
- Practice in simple German for everyday situations.
- understand basic German texts and conversations.
- Apply basic German language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	1	1	3	-	1	-	-
CO3	-	-	-	-	-	1	2	2	3	-	2	-	-
CO4	-	-	-	-	-	-	1	2	3	-	2	-	-
CO5	-	-	-	-	-	1	2	2	3	-	2	-	-
AVG	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	-	-

Chairman - BoS

SEMESTER II

23EEC201 **INDIAN LANGUAGE**

(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE **L T P C**

(Common to all B.E. & B.Tech. Branches) **0 0 4 2**

OBJECTIVES

- To learn the Japanese writing system, pronunciation, and basic vocabulary.
- To understand and use basic Japanese grammar and sentence patterns.
- To communicate in Japanese in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in Japanese.
- To apply basic Japanese language skills confidently through practice and real-life communication.

UNIT I WRITING SYSTEMS & PRONUNCIATION **5**

Hiragana chart reading and writing - Katakana chart reading and writing - Basic pronunciation rules (long vowels, double consonants) – Numbers - Colours, body parts, pets description

UNIT II KANJI & BASIC GRAMMAR **7**

First 50 Kanji (Numbers, Time & Days, Basic Directions & People) - Topic marker は (wa) - Identification sentences: Noun + です (desu) - Possession particle の (no) - Inclusion particle も (mo) - Subject marker が (ga) - Direction particles へ (he) and に (ni) - Self-introductions and greetings (Aisatsu) - Numbers, prices, shopping terms - Days, months, relative time - Family members and occupations

UNIT III KANJI & FUNCTIONAL GRAMMAR **8**

Next 50 Kanji (Nature, Core Verbs, Adjectives & Nouns) - Verb groups (Group 1, Group 2, Group 3) - Masu forms (Present, Past, Positive & Negative) - Te-form (~て): requests, connecting sentences, continuous actions (~ている) - Adjective conjugation (い & な adjectives) - Desires (~たい) and Invitations (~ましょう)

UNIT IV VOCABULARY & FUNCTIONAL COMMUNICATION **5**

Action verbs (daily routine, hobbies) - Adjectives for people, food, and places - Positional words (inside, outside, next to, between) - Transport, travel, and location vocabulary - Simple conversations in everyday situations

UNIT V READING & LISTENING COMPREHENSION 5

Reading short sentences in Hiragana, Katakana, and basic Kanji - Understanding classroom instructions - Listening to slow, clear daily-life conversations - Understanding simple shopping dialogues

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify the Japanese writing system and pronounce basic Japanese words correctly.
- Use basic Japanese vocabulary and simple grammar in sentences.
- Communicate in simple Japanese for everyday situations.
- Read, write, listen to, and understand basic Japanese texts and conversations.
- Apply basic Japanese language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	1	1	-	1	2	-	-	-	-
CO2	-	-	-	-	1	2	-	2	2	-	-	-	-
CO3	-	-	-	-	2	2	1	2	3	-	1	-	-
CO4	-	-	-	-	2	2	1	3	3	-	1	-	-
CO5	-	-	-	-	1	1	1	2	3	-	1	-	-
AVG	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-

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23EEC301	PROFESSIONAL DEVELOPMENT	L T P C
		0 0 2 1

OBJECTIVES

To be proficient in important Microsoft Office tools: MS WORD, EXCEL and POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate and Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)

Work with Lookup and reference formulae

Create and Work with different types of charts

Use pivot tables to summarize and analyze data

Perform data analysis using own formulae and functions

Combine data from multiple worksheets using own formulae and built-in functions to generate results

Export data and sheets to other file formats

Working with macros

Protecting data and Securing the workbook

MS POWERPOINT: **10 Hours**

Select slide templates, layout and themes

Formatting slide content and using bullets and numbering

Insert and format images, smart art, tables, charts

Using Slide master, notes and handout master

Working with animation and transitions

Organize and Group slides

Import or create and use media objects: audio, video, animation

Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES

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

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

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23EEC401	ONLINE COURSE COMPLETION	L T P C
		3 0 0 3

Students may be permitted to study online courses (NPTEL, SWAYAM or any Proctored Assessment Certification Courses) with 3 credits during the 4th semester curriculum for all B.E./B.Tech. Programmes. Such courses offered to students shall be recommended by the Department Academic Committee (DAC). The DAC shall ensure that the courses offered are not core courses in their respective curriculum.

The number of credits and transfer of credits are based on the procedure explained in following Table. The mapping of marks with grades is applicable only if the student passes the course as per the guidelines of NPTEL.

S.No.	No. of Weeks	Credits
1	4	1
2	8	2
3	12	3
4	16	4

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23EEC501	INDUSTRIAL TRAINING	L T P C 0 0 4 2

Students shall undergo Industrial Training for duration of four weeks carrying 2 credits during the Fifth Semester for all B.E./B.Tech. Programmes. The industry/organization shall be selected with the approval of the Head of the Department. Alternatively, the concerned department may arrange industrial training through an industry expert relevant to the student's discipline of study.

A faculty member nominated by the Head of the Department shall act as the faculty coordinator and shall be responsible for the periodic monitoring and evaluation of the student's progress during the training period.

Duration of Industrial Training	Credits
2 Weeks	1
4 Weeks	2

*1 week of Industrial Training = 40 hours.

23EEJ601	PROJECT WORK – PHASE I	L T P C
		0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work may be assigned to a single student or to a group of students, not exceeding 4 per group.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester VI is 4.
- There shall be three reviews (Zeroth Review,(Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- Sixty percentage of Project work to be completed in this Project Work - Phase I.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

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

- Formulate real-world problems.

- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

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23EEJ701 PROJECT WORK - PHASE - II L T P C
0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- Continuation of Project Work – Phase I.
- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks.
- The total credit for project work in semester VII is 4.
- There shall be two reviews (Review I and Review II, each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student is expected to submit the project report on or before the last working day of the semester. The project report shall be submitted as per the approved guidelines given by Controller of Examinations. The COE shall appoint an External Examiner for the ESE of the Project Work. The ESE for the project work shall be evaluated by both the external examiner and an internal examiner. The project coordinator shall be the internal examiner.

OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

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23EEJ801	PRODUCT DEVELOPMENT	L T P C
		0 0 12 6

OBJECTIVES

- To convert the completed project into a functional product or working prototype.
- To improve the product by incorporating necessary modifications.
- To prepare the required technical documents for the developed product.
- To understand the basic aspects of product quality, usability and maintenance.
- To develop professional skills through product demonstration and presentation.

COURSE DESCRIPTION

This course is to develop a product to meet the real time needs and suitable to market delivery. The product development is desirable to be the continuation of the Capstone Project completed in Project Work – Phase II. Students shall enhance the completed project into a functional product or working prototype by improving its design, performance and usability wherever applicable. The course emphasizes testing, refinement, documentation and presentation of the developed product. Students are encouraged to demonstrate the final outcome before the evaluation committee.

PROCESS DESCRIPTION

- The Product Development course shall be based on the Capstone Project completed during Project Work – Phase II.
- Students shall improve the completed project by incorporating suitable modifications and documentation to develop a functional product or working prototype, wherever applicable.
- The work may be carried out individually or in groups not exceeding four students.
- The total credits for Product Development in Semester VIII shall be 6.
- For Product Development, the maximum marks shall be 100, of which Continuous Internal
- Assessment (CIA) carries 60 marks and the End Semester Examination (ESE) carries 40 marks.
- There shall be three reviews during the semester by a Review Committee duly constituted by the Head of the Department.
- The Review Committee shall consist of:
  - Supervisor
  - Product Development Coordinator
  - One Senior faculty member

Review I

- Progress of product development
- Design improvements
- Implementation status

Review II

- Performance improvements
- Action taken on previous review suggestions.
- Documentation progress

Review III

- Final product or prototype demonstration
- Technical documentation
- Presentation
- Students shall submit a Product Development Report as per the guidelines prescribed by the Controller of Examinations.
- The End Semester Examination shall consist of product/prototype demonstration, report evaluation and viva-voce examination.
- The End Semester Examination shall be jointly evaluated by both an External Examiner and an Internal Examiner.

OUTCOMES

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

- Develop a functional product or working prototype based on the completed project.
- Improve the product to meet the intended requirements.
- Prepare technical documentation for the developed product.
- Explain the basic aspects of product quality, maintenance and future improvements.
- Demonstrate the developed product effectively through presentation and viva-voce.

Assessment Scheme

- For Product Development, out of 100 marks, the maximum marks for Continuous Internal Assessment (CIA) is fixed as 60 and the End Semester Examination (ESE) carries 40 marks.
- Continuous Assessment shall be based on the progress of product development, technical contribution, documentation and presentations made during the three reviews conducted by the Review Committee constituted by the Head of the Department.
- The End Semester Examination shall consist of the evaluation of the Product Development Report, demonstration of the developed product/prototype or the work completed, and Viva-Voce Examination.
- The evaluation shall focus on the student's critical thinking, skills and understanding of the work carried out, technical knowledge, documentation, presentation and overall contribution.
- The End Semester Examination shall be jointly evaluated by an External Examiner appointed by the Controller of Examinations and an Internal Examiner nominated by the Head of the Department.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

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23EEC801	INTERNSHIP	L T P C
		0 0 4 2

Students shall undergo internship of 4 weeks with 2 credits during 8th semester curriculum for all B.E. / B.Tech Programmes. The industry / organization is to be selected with the approval of Head of the Department. One faculty member approved by the Head of the department shall be responsible for the periodic monitoring and evaluation of the students' progress in the course.

Duration of Industrial Training	Credits
2 Weeks	1
4 Weeks	2

*1 week of Industrial Training = 40 hours.

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MANDATORY COURSES - I

MANDATORY COURSE I

23MDC501 INTRODUCTION TO WOMEN AND GENDER STUDIES L T P C
3 0 0 0

OBJECTIVES:

- To introduce foundational concepts of sex, gender, masculinity, femininity, and socialization.
- To examine structural systems including patriarchy, essentialism, binaryism, power, and hierarchy.
- To study major theoretical frameworks of feminism
- To examine the history and evolution of global, national, and local women's movements.
- To analyze how gender is constructed and represented across language, popular visual media, and social media.

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power. hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS:

Global, National and Local Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

TOTAL: 30 PERIODS

OUTCOMES

- Identify and articulate concepts of socialization, binaryism, essentialism, and hegemony in social structures.
- Differentiate among various feminist theories and explain their core ideological foundations.
- Illustrate the milestones of women's rights movements in Europe, America, and India.
- Deconstruct linguistic forms and literary narratives to expose implicit gender biases.
- Assess media representations of gender roles in advertising and alternative media critically.

23MDC502	ELEMENTS OF LITERATURE	L T P C
		3 0 0 0

OBJECTIVES:

- To explain students aware of the finer sensibilities of human existence through art.
- To develop students' appreciation of different literature forms as modes of human expression.
- To enhance reading, critical thinking, discussion, and writing skills through literary studies.
- To familiarize students with the essential elements, modes, and patterns of fiction and narrative perspective.
- To explore the representational, theatrical, and rhetorical elements of drama and poetry.

.UNIT I RELEVANCE OF LITERATURE

Enhances Reading, thinking, discussing and writing skills. Develops finer sensibility for better human relationship. Increases understanding of the problem of humanity without bias. Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION

Fiction, fact and literary truth, Fictional modes and patterns. Plot character and perspective.

UNIT III ELEMENTS OF POETRY

Emotions and imaginations. Figurative language. (Simile, metaphor, conceit, symbol, pun and irony).Personification and animation. Rhetoric and trend

UNIT IV ELEMENTS OF DRAMA

Drama as representational art, Content mode and elements, Theatrical performance, Drama as narration, mediation and persuasion, Features of tragedy, comedy and satire.

READINGS:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

TOTAL: 30 PERIODS

OUTCOMES

- Demonstrate enhanced reading, thinking, and writing skills by engaging with literary texts.
- Develop finer interpersonal sensibilities and an unbiased understanding of human issues.
- Experience catharsis and emotional reconciliation through literary analysis.
- Identify key figurative devices (metaphor, simile, irony, conceit) and emotional dimensions in poetry.
- Analyze dramatic performance, features of tragedy, comedy, satire, and narrative structures.

23MDC503	FILM APPRECIATION	L T P C
		3 0 0 0

OBJECTIVES:

- To introduce the development of film as an art and entertainment form.
- To explore the century-long evolution of film language, movement, and form.
- To instruct students on how to read a film text and appreciate its structural nuances.
- To examine technical components including equipment, screenplays, roles, and the filmmaking process.
- To guide students in studying film theory, criticism, and visual storytelling joyfully.

Theme – A: The Component of Films

A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making... structure of a film

Theme – B: Evolution Of Film Language

B-1: Film language, form, movement etc.
B-2: Early cinema... silent film (Particularly French)
B-3: The emergence of feature films: Birth of a Nation
B-4: Talkies

Theme – C: Film Theories And Criticism/Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films

D-2: Representative Japanese films
D-3: Representative Italian films
D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era
E-2: The important films made by the directors

E-3: The regional films

E-4: The documentaries in India

READING: A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

TOTAL: 30 PERIODS

OUTCOMES

- Explain the roles of materials, crew members, screenplays, and directors in film production.
- Trace the historical transition from silent cinema and early French films to talkies and feature films.
- Apply visual and auditory cinematic language to "read" films as complex texts.
- Evaluate film theories and engage in critical film appreciation.
- Demonstrate an understanding of storytelling structure and narrative techniques in modern cinema.

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23MDC504 DISASTER RISK REDUCTION AND MANAGEMENT L T P C
3 0 0 0

COURSE OBJECTIVE •

- To impart knowledge on core concepts of hazards, vulnerability, resilience, and disaster risks.
- To familiarize students with international frameworks (Sendai Framework) and community-based risk reduction strategies.
- To explain the legislative, policy, and institutional frameworks governing disaster management in India.
- To introduce tools, technology, and early warning systems used in preparedness and damage assessment.
- To build practical response skills using case studies, field work, and mock drills.

UNIT I: HAZRADS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India

UNIT II DISASTER RISK REDUCTION (DRR)

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health. Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyze the potential impacts and actions in the contest of disasters-Landslide Hazard Donation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill

OUTCOMES

- Categorize natural, human-induced, and climate-related disasters and assess India's vulnerability profile.
- Formulate disaster risk reduction measures using structural, non-structural, and indigenous methods.
- Understand institutional roles (NDMA, SDMA, DDMA) and legal provisions under the Disaster Management Act (2005).
- Apply GIS, information technology, and standard operating procedures for risk assessment and relief planning.
- Perform damage assessments and participate in mock drills, practical response plans, and field interventions.

Chairman - BoS

23MDC505	CONSTITUTION OF INDIA	L T P C
		3 0 0 0

OBJECTIVES

The main objective of this course is to:

- Understand the meaning of the Constitution law and Constitutionalism.
- Realize the fundamental rights.
- Understand the execution powers of union and states bout.
- Be aware of the Constitutional powers.
- Acquaint with other Constitutional functionaries.

UNIT I: INTRODUCTION 3

Meaning of the Constitution law and constitutionalism - Historical perspective of the Constitution of India - Preamble - Salient features and characteristics of the Constitution of India - Citizenship.

UNIT II: FUNDAMENTAL RIGHTS 3

Scheme of the fundamental rights - The scheme of the fundamental duties and its legal status - The directive principles of state policy - Its importance and implementation.

UNIT III: UNION AND STATE EXECUTIVE 3

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary form of Government in India - The Constitution powers and status of the President of India - Governor - Appointment, powers and functions.

UNIT IV: CONSTITUTIONAL POWERS 3

Amendment of the Constitutional powers and procedure - The historical perspectives of the Constitutional amendments in India - Emergency provisions: National emergency, President rule, financial emergency.

UNIT V: OTHER CONSTITUIONAL FUNCTIONARIES 3

Election Commission of India: Organization, powers and functions, Union Public Service Commission, State Public Service Commission - Local Self Government.

TOTAL: 30 PERIODS

OUTCOMES

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

- Understand the salient features and characteristics of the Constitution of India.

- Analyze the scheme of the fundamental rights and duties.
- Evaluate in detail the powers between the Union and the States.
- Know the concept of Constitutional powers.
- Recognize other Constitutional functionaries.

Chairman - BoS

MANDATORY COURSES II

23MDC601 WELL-BEING WITH TRADITIONAL PRACTICES- YOGA, AYURVEDA AND SIDDH

L T P C
3 0 0 0

OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handbill every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I HEALTH AND ITS IMPORTANCE

Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath

UNIT II DIET

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the

population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunit

UNIT V YOGA

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL: 30 PERIODS

OUTCOMES

- Identify and explain the ten types of health, including physical, mental, emotional, spiritual, and environmental health.
- Analyze the role of a balanced diet and its 7 components in preventing lifestyle disorders like diabetes, hypertension, and arthritis.
- Understand the principles of Siddha and Ayurveda systems, including the Five Element Theory, Tri-Dosha Theory, and daily/seasonal regimens (Dinacharya/Ritucharya).
- Apply stress management techniques, sleep hygiene practices, and emotion-regulation strategies to enhance mental wellness.
- Demonstrate basic yogasanas and understand the Eight Limbs of Yoga for health disorder prevention and cure.

Chairman - BoS

23MDC602 HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA L T P C
3 0 0 0

OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health also.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handle every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT-I CONCEPTS AND PERSPECTIVES

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology- Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT-III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT-IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT-V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

Science and Technology In A Post-Independent India

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

TOTAL: 30 PERIODS

COURSE OUTCOMES

- Explain the concepts, perspectives, and significance of history, science, and technology in India.
- Examine the contributions of major historians to the historiography of science and technology in

India.

- Analyze the development of science and technology in Ancient and Medieval India and their societal contributions.
- Analyze the influence of colonial rule on scientific progress and institutional development in India.
- Evaluate the advancements in science and technology in post-independent India and their impact on development and globalization.

Chairman - BoS

23MDC603 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY L T P C
3 0 0 0

OBJECTIVES

- Define key historical concepts like determinism, relativism, causation, and historical positivism as applied to science and technology.
- Recognize the historiographical contributions of scholars such as D.D. Kosambi, Dharampal, and Debiprasad Chattopadhyay.
- Explain the technological advancements made during ancient and medieval Indian history, including interactions with Arabic sciences.
- Evaluate the growth of techno-scientific institutions and the Indian response to Western science during the colonial period.
- Assess the social implications of emerging technologies and science policy decisions in post-independent and globalizing India.

COURSE TOPICS:

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. (6 lectures)

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society.

Future directions. **(4 lectures)**

(Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

Conclusion **(2 lectures)**

TOTAL: 30 PERIODS

OUTCOMES

- Understand the core considerations required for a humane society and achieving harmony across self, society, and nature.
- Compare the theoretical foundations and historical implementations of free-market capitalism, imperialism, and communism.
- Analyze the relation between human desires, empowerment, satisfaction, and the mechanisms of a welfare state.
- Apply Gandhian economic and political thought (Swaraj, decentralized polity) to contemporary societal and environmental challenges.
- Evaluate future directions for society by considering technology as a driver and education .

Chairman - BoS

23MDC604	STATE, NATION BUILDING AND POLITICS IN INDIA	L T P C
		3 0 0 0

OBJECTIVES

- To provide an understanding of the state, its main organs (Executive, Legislature, Judiciary), separation of powers, and the concept of sovereignty.
- To acquaint students with the legacies of the national movement and constitutional development in India.
- To explain the reasons for adopting a Parliamentary-federal system and the broad philosophy of the Constitution of India.
- To examine the changing nature of the Indian political system, new social movements, and challenges to nation-building.
- To discuss issues concerning national integration and nation-building with the aim of developing a future vision for better governance.

TOPICS:

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world. 183 Organs of State – Executive, Legislature, Judiciary. Separation of powers forms of government unitary-federal, Presidential-Parliamentary, and The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.

Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system? National integration and nation-building

Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

OUTCOMES:

- Understand the theoretical aspects of the state, its organs, operationalization, and sovereignty in a globalized world.
- Explain the historical background, philosophy, goals, and objectives behind the founding of the Indian Constitution.
- Analyze the rationale behind adopting a federal-parliamentary system and the broad streams of national integration.
- Identify major challenges to nation-building, social movements, and institutional difficulties within the democratic setup.
- Devise perspectives for active participation in the system to improve governance and delivery for the common citizen.

Chairman - BoS

23MDC605 **INDUSTRIAL SAFETY** L T P C
3 0 0 0

OBJECTIVES

- To understand the introduction and basic terminologies of safety.
- To enable the students to learn about the important statutory regulations and standards.
- To enable students to conduct and participate in various safety activities in the industry.
- To have knowledge about workplace exposures and hazards.
- To assess various hazards and consequences through various risk assessment techniques

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives-Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- 217 Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL: 30 PERIODS

COURSE OUTCOMES

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards
- . Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

MINOR DEGREE / HONOURS

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR/HONOURS DEGREE – FULL STACK DEVELOPMENT)

B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23ADFT01	Client-Server Scripting Languages	PC	3	0	0	3	40	60	100
23ADFT02	Web Essentials	PC	3	0	0	3	40	60	100
23ADFT03	DevOps Engineering	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ADFE01	Cloud Computing Services	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23ADFP01	Project Work	EEC	0	0	12	6	40	60	100
Total Credits			**19**						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER - III

23ADFT01	CLIENT-SERVER SCRIPTING LANGUAGES	L T P C
		3 0 0 3

OBJECTIVES

- To discuss fundamental principles of web development.
- To analyze handling of HTTP requests and responses on the server-side.
- To explore AJAX, RESTful APIs, and JSON concepts.
- To implement user registration and login functionality.
- To apply security best practices to prevent common web vulnerabilities.

UNIT I INTRODUCTION TO WEB DEVELOPMENT AND CLIENT-SIDE SCRIPTING 9

Introduction to web development principles, Overview of client-server architecture, Setting up the development environment, Basics of HTML, CSS, and JavaScript, DOM manipulation and event handling.

Coding Exercises:

1. Build a simple webpage using HTML, CSS, and JavaScript that manipulates DOM elements on user interaction.
2. Implement event handling for mouse clicks and keyboard inputs to change webpage content dynamically.
3. Create a responsive webpage layout that adapts between desktop and mobile viewports using CSS media queries.

Problem-solving Assignments:

1. Analyze the client-server model workflow for a web application and map the data flow between browser and server.
2. Design a browser-based form with client-side validation and user feedback for data entry errors.

UNIT II SERVER-SIDE SCRIPTING FUNDAMENTALS 9

Introduction to server-side scripting languages (e.g., PHP, Node.js, Python, or Ruby). Handling HTTP requests and responses, Working with server-side databases, Implementing basic server-side logic.

Coding Exercises:

1. Create a basic RESTful API using Node.js or Python Flask that handles GET and POST requests.

2. Write server-side scripts to connect to a MySQL/PostgreSQL database and perform CRUD operations.
3. Implement error handling and response status codes for malformed HTTP requests in your server app.

Problem-solving Assignments:

1. Design and implement a session management system to handle user logins and authentication on the server.
2. Analyze performance differences between synchronous and asynchronous server-side request handling.

UNIT III COMMUNICATION BETWEEN CLIENT AND SERVER 9

AJAX (Asynchronous JavaScript and XML) for client-server communication, RESTful API concepts and implementation, Data exchange between client and server, JSON (JavaScript Object Notation) and its usage.

Coding Exercises:

1. Write AJAX calls in JavaScript to asynchronously fetch data from server APIs and update webpage content.
2. Develop RESTful API endpoints supporting JSON data exchange between client and server.
3. Implement client-side JavaScript to consume and display JSON data from server responses dynamically.

Problem-solving Assignments:

1. Design an efficient client-server synchronization protocol using REST APIs and real-time data updates.
2. Analyze the security risks of AJAX and RESTful services and propose mitigation strategies.

UNIT IV DATA STORAGE AND USER MANAGEMENT 9

Introduction to databases (e.g., MySQL, MongoDB, or PostgreSQL), CRUD operations using server-side scripting languages, Implementing user registration and login functionality, User authentication and authorization.

Coding Exercises:

1. Write server-side scripts to implement user registration, login, and logout functionality with password hashing.

2. Create CRUD operations for user profiles stored in a NoSQL database like MongoDB.
3. Implement role-based access control for different user types with session validation.

Problem-solving Assignments:

1. Design a secure user authentication and authorization system protecting against common vulnerabilities.
2. Develop a database schema and access layer for a scalable user management system.

UNIT V ADVANCED TOPICS AND PROJECT DEVELOPMENT 9

Front-end frameworks (e.g., React, Angular, or Vue.js) and integrating them with server-side scripts, Server-side templating and generating dynamic content, Security best practices for web applications, Deployment and hosting options for web applications, Final project development: Students work on a comprehensive web application that demonstrates the skills learned throughout the course.

Coding Exercises:

1. Build a front-end app using React or Angular integrating with your server API for a complete user interface.
2. Implement server-side rendering and template engines to dynamically generate web pages.
3. Set up deployment scripts using cloud hosting platforms like AWS or Heroku for your web app.

Problem-solving Assignments:

1. Analyze the trade-offs between client-side rendering and server-side rendering for performance and SEO.
2. Develop a comprehensive testing and security plan for a full-stack web application.

TOTAL : 45 PERIODS

OUTCOMES

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

- Explain the web development principles and the client-server architecture.
- Create server-side databases and implement basic server-side logic to process data and generate dynamic content.

- Explain about AJAX (Asynchronous JavaScript and XML), concepts of RESTful APIs and JSON (JavaScript Object Notation).
- Develop user registration and login functionality with user authentication and authorization features.
- Describe about deployment and hosting options for web applications.

TEXT BOOKS

1. David Flanagan, O'Reilly Media, "JavaScript: The Definitive Guide", Inc. Publications, Seventh Edition, 2020.
2. Mario Casciaro and Luciano Mammino, "Node.js Design Patterns", Packet Publishing Limited Publications, 2020.

REFERENCES

1. Miguel Grinberg , " Flask Web Development: Developing Web Applications with Python", Shroff/O'Reilly Publications, Second Edition, 2018.
2. Eve Porcello, Alex Banks, "Learning React: Modern Patterns for Developing React Apps", O'Reilly Publications, Second Edition, 2020.

E-RESOURCES

1. https://developer.mozilla.org/en-US/docs/Web/JavaScript (MDN Web Docs - JavaScript)
2. https://nodejs.org/en/docs/ (Node.js Official Documentation)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	1	3	-	1	-	3	-	-	-	-	-	-
2	1	-	2	-	1	-	-	-	-	-	-	-	-
3	2	2	3	1	1	1	-	-	-	-	-	-	-
4	1	1	2	1	-	-	-	-	-	-	-	-	-
5	2	1	2	1	3	-	1	-	-	-	-	-	-
6	2	3	-	2	3	-	-	-	-	-	-	-	-
AVG	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER IV

23ADFT02	WEB ESSENTIALS	L T P C
		3 0 0 3

OBJECTIVES

- To examine web protocols, URLs, domain names, web browsers, and web servers.
- To explore HTML and CSS for web page designing.
- To analyze JavaScript for client-side scripting and validation.
- To investigate server-side scripting using PHP and database handling.
- To study Java Servlets and their role in web applications.

UNIT I WEBSITE BASICS 9

Internet Overview - Fundamental computer network concepts - Web Protocols - URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website –Creating a Website - Client-side and server-side scripting.

Coding Exercises:

1. Create a simple static website using HTML to display personal or business information.
2. Develop a website with client-side scripting using JavaScript to handle form inputs and validations.
3. Simulate client-server interaction by creating a basic web page that fetches data from a mock server using AJAX.

Problem-solving Assignments:

1. Analyze the flow of a website request-response cycle and create a diagram mapping client-server communication.
2. Compare different web protocols (HTTP, HTTPS) and discuss their impact on web browsing security.

UNIT II WEB DESIGNING 9

HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

Coding Exercises:

1. Design forms using various HTML input types and style them using CSS3 selectors and box model properties.
2. Implement CSS3 animations and transitions on text and images for dynamic

webpage interaction.

3. Create a multiple column layout webpage incorporating user interface elements and responsive design.

Problem-solving Assignments:

1. Evaluate an existing website's design for usability and accessibility, proposing visual improvements.
2. Design a brand style guide including colors, fonts, and UI patterns to maintain consistency across web pages.

UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING 10

JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-Functions- Objects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers.

Coding Exercises:

1. Write JavaScript programs demonstrating variables, operators, functions, and array manipulations.
2. Implement event handling to respond to button clicks, mouse events, and form submissions with validation.
3. Use JavaScript debugger tools to identify and fix errors in sample scripts.

Problem-solving Assignments:

1. Develop a JavaScript application that validates user input in real-time and gives corrective feedback.
2. Analyze the advantages of client-side validation versus server-side validation in web forms.

UNIT IV SERVER SIDE PROCESSING AND SCRIPTING – PHP 8

PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading – Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Databases with PHP.

Coding Exercises:

1. Build PHP scripts to handle form data processing and store information in text files or databases.
2. Write PHP programs for file uploading and handling email sending with attachments.
3. Develop a simple PHP calculator and practice string functions and array handling.

Problem-solving Assignments:

1. Design a secure data handling mechanism in PHP to prevent SQL injection and other vulnerabilities.
2. Create a database-driven PHP application that manages user registrations and data updates.

UNIT V SERVLETS AND DATABASE CONNECTIVITY 9

Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions - Sessions – Cookies – Database connectivity – JDBC Creation of simple interactive applications - Simple database applications.

Coding Exercises:

1. Develop Java Servlets to handle GET and POST requests with form data processing.
2. Write servlet code to manage sessions and cookies for user tracking.
3. Connect servlets to a database using JDBC to perform CRUD operations.

Problem-solving Assignments:

1. Design a servlet-based web application architecture supporting multiple user sessions.
2. Analyze database connection pooling and transaction management strategies in servlet applications.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain fundamental concepts of the Internet, web protocols, URLs, and domain names.
- Design and develop responsive web pages using HTML and CSS.
- Build dynamic and interactive functionalities using JavaScript.
- Develop server-side applications using PHP and integrate them with databases.
- Explain Java Servlets to manage web applications and handle HTTP requests.

TEXT BOOKS

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5", O'Reilly publishers, Third Edition, 2014.

2. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", Pearson Education, Fifth Edition, 2012.

REFERENCES

1. Fritz Schneider, Thomas Powell , "JavaScript – The Complete Reference", Mc- Graw Hill Publishers, Third Edition 2017.
2. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

E-RESOURCES

1. 1.https://nptel.ac.in/courses/106105084 (HTML Basic)
2. 2.https://nptel.ac.in/courses/106105086 (Java script)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	3	1	-	-	2	3	1	2	3	3
2	2	2	2	3	3	-	-	1	2	2	3	1	1
3	3	3	3	3	3	-	-	2	1	1	2	2	1
4	3	3	1	1	1	-	-	1	3	1	3	2	1
5	3	2	2	2	3	-	-	2	3	2	2	2	3
6	3	3	3	3	2	-	-	1	2	3	1	3	3
Avg	2.8	2.5	2.2	2.5	2.2	-	-	1.5	2.3	1.7	2.2	2.2	2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER V

23ADFT03	DEVOPS ENGINEERING	L T P C
		3 0 0 3

OBJECTIVES

- To examine DevOps terminology, definitions, and core concepts.
- To analyze version control tools, including Git and Mercurial.
- To explore Continuous Integration, Continuous Testing, and Continuous Deployment concepts.
- To investigate configuration management using Ansible.
- To assess benefits and adoption of cloud-based DevOps tools for real-world problem solving.

UNIT I INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

Coding Exercises:

1. Set up Git and GitHub repositories for a sample software project including version control commands (clone, commit, push).
2. Deploy a simple cloud instance in AWS, GCP, or Azure and run a basic web server.
3. Write a shell script to automate the deployment of code from GitHub to a cloud-hosted instance.

Problem-solving Assignments:

1. Analyze and compare advantages and challenges of AWS, Azure, and GCP for DevOps deployments.
2. Design a version control workflow using Git branching models for collaborative development.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package), Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle.

Coding Exercises:

1. Create a Maven project with a POM file managing dependencies and build lifecycle

phases.

2. Write a Gradle build script to compile and package a Java application with multiple modules.
3. Demonstrate managing Maven profiles for different build environments (dev, test, prod).

Problem-solving Assignments:

1. Compare and contrast Maven and Gradle in terms of build performance and dependency management.
2. Optimize a complex build process by configuring Maven plugins and Gradle tasks.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with Java, Git and Maven, Creating a Jenkins Build and Jenkins workspace

Coding Exercises:

1. Install and configure Jenkins to create a CI pipeline that builds and tests a Java project.
2. Add essential Jenkins plugins (Git, Maven, HTML Publisher) and configure automatic email notifications.
3. Write Jenkins Pipeline scripts for multi-stage build and test automation with workspace management.

Problem-solving Assignments:

1. Design a Jenkins-based CI/CD pipeline integrating Git, Maven, and automated testing.
2. Troubleshoot and resolve common Jenkins job failures and plugin compatibility issues.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

Coding Exercises:

1. Write Ansible playbooks to install and configure a web server on multiple virtual machines.
2. Use Ansible inventory files and roles to manage configuration of heterogeneous environments.
3. Execute ad hoc Ansible commands for quick system management tasks and generate reports.

Problem-solving Assignments:

1. Develop a configuration management strategy using Ansible for dynamic cloud infrastructure.
2. Analyze challenges and best practices in managing multiple Ansible roles and playbooks.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

Coding Exercises:

1. Create a GitHub repository and integrate it with Azure Pipelines to trigger builds on code commits.
2. Write and modify an azure-pipelines.yaml file to automate build, test, and deployment stages.
3. Deploy a sample application to Azure App Service using the CI/CD pipeline.

Problem-solving Assignments:

1. Design a complete DevOps pipeline in Azure, optimizing for build times and deployment reliability.
2. Evaluate security and compliance concerns in pipeline design and propose mitigation measures.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Implement different actions performed through Version control tools like Git.
- Apply Continuous Integration and Continuous Testing and Continuous Deployment
- Develop the Automated Continuous Deployment
- Explain the configuration management using Ansible.

25

Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users. From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition 2016.

2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.

2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

E-RESOURCES

1. https://www.jenkins.io/user-handbook.pdf
2. https://maven.apache.org/guides/getting-started/

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	1	1	1	3	-	-	-	1	3	1	3	3
2	3	1	2	1	2	-	-	-	1	2	2	1	2
3	2	2	1	2	3	-	-	-	2	1	1	3	2
4	2	3	3	1	1	-	-	-	2	2	2	2	1
5	1	2	1	3	1	-	-	-	3	2	1	3	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.2	1.8	1.6	1.6	2	-	-	-	1.8	2	1.4	2.4	2.2

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER VI

23ADFE01 CLOUD COMPUTING SERVICES L T P C
3 0 2 4

OBJECTIVES

- To introduce principles of cloud architecture, models, and infrastructure.
- To explore concepts of virtualization and virtual machines.
- To analyze virtualization infrastructure components.
- To experiment with various cloud deployment environments.
- To investigate security issues in cloud environments.
- To monitor and manage cloud performance for optimal service delivery and resource utilization.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

Coding Exercises:

1. Write a program simulating different Cloud deployment models like Public, Private, Hybrid clouds and demonstrate service accessibility.
2. Develop a project to model the NIST Cloud Computing Reference Architecture, mapping its major actors and service layers.
3. Create an architecture diagram tool that categorizes cloud services into Cloud service models such as SaaS, PaaS, and IaaS.

Problem-solving Assignments:

1. Analyze design challenges faced in Architectural Design of Compute and Storage Clouds and suggest scalable solutions.
2. Compare Autonomous Data Warehouse cloud infrastructure with traditional architectures in terms of operational efficiency.

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

Coding Exercises:

1. Build simulators demonstrating Full Virtualization and Para Virtualization of virtual machines.
2. Write scripts to illustrate virtualization at different levels: CPU, Memory, and I/O device.
3. Implement a basic Hypervisor that manages resource allocation among virtual machines.

Problem-solving Assignments:

1. Devise a taxonomy categorizing common virtualization types and discuss their impact on cloud performance.
2. Examine virtualization security concerns dependent on implementation levels and propose safeguards.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

Coding Exercises:

1. Create Docker containers and images with scripted deployment and resource configuration.
2. Develop virtualization demonstrations encompassing desktop, network, and storage virtualization.
3. Write comparative scripts highlighting performance differences between Docker containers and full virtual machines.

Problem-solving Assignments:

1. Design a resource management policy for virtual clusters orchestrated through container technologies.
2. Analyze security vulnerabilities unique to container-based virtualization and formulate prevention approaches.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

Coding Exercises:

1. Automate deployment pipelines on Google App Engine, Amazon AWS, and Microsoft

Azure to host simple applications.

2. Develop dashboards for managing cloud resources using Eucalyptus or OpenStack APIs.
3. Write scripts to provision virtual machines and storage across multiple cloud environments.

Problem-solving Assignments:

1. Create migration strategies from on-premises to cloud platforms considering differing architectures.
2. Evaluate multi-cloud deployment models optimizing performance and cost-effectiveness.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

Coding Exercises:

1. Simulate attacks like Guest hopping, VM migration attack, and hyperjacking on virtual environments.
2. Implement basic Identity and Access Management (IAM) solutions with role-based access control.
3. Write encryption and secured storage mechanisms for cloud data protection.

Problem-solving Assignments:

1. Design an end-to-end cloud security architecture addressing vulnerabilities in virtualization systems.
2. Examine IAM Challenges and propose frameworks for resilient cloud identity management.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain different cloud architecture models for distributed and cloud computing
- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker.
- Develop and deploy services on the cloud and set up a cloud environment.
- Explain security challenges in the cloud environment.
- Classify how cloud computing is applied in various industries, from startups to enterprises, to streamline operations and support business growth

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.

REFERENCES

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview (Basics of Computer Architecture and Organization, Networking)
2. https://nptel.ac.in/courses/106105167 (Cloud Computing)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	1	-	-	-	2	3	1	2	1
2	3	1	2	2	1	-	-	-	1	2	1	2	2
3	2	3	2	3	1	-	-	-	3	1	1	1	1
4	1	2	3	3	3	-	-	-	3	3	1	1	3
5	2	3	3	1	3	-	-	-	2	2	1	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.2	2.2	2.2	1.8	1.8	2	-	-	2.2	2.2	1	1.6	1.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER VII

23ADFP01 **PROJECT WORK** L T P C

0 0 12 6

OBJECTIVES

- To develop students' learning and skills in a specific area of interest.
- To provide opportunities to apply theoretical knowledge from minor courses to practical, real-world scenarios or problems.
- To conduct research and investigations, fostering critical thinking and problem-solving skills.
- To promote collaboration and teamwork, enabling effective work in a team environment.
- To prepare project reports and participate in reviews and viva-voce examinations.

GUIDELINES

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 180 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Develop problem-solving skills as they analyze issues, design solutions, and implement them in their projects.
- Improve their communication and presentation abilities.
- Build successful collaboration and teamwork will be evident in the project's execution and outcomes
- Explain new knowledge or insights to the relevant field, making it a valuable addition to the academic community.

Mapping of COs-POs & PSOs

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

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - FULL STACK DEVELOPMENT)

CREDIT SUMMARY

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Category	Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	3	3	3	4	-	-	13
EEC	-	-	-	-	-	-	6	-	6
Total	-	-	3	3	3	4	6	-	19

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR / HONOURS DEGREE - BLOCKCHAIN)

B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23ADBT01	Fundamentals of Blockchain	PC	3	0	0	3	40	60	100
23ADBT02	Blockchain Platforms and Use cases	PC	3	0	0	3	40	60	100
23ADBT03	Blockchain Security and Performance	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ADBE01	Smart Contracts and Solidity	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23ADBP01	Project Work	EEC	0	0	12	6	40	60	100
Total Credits			**19**						

PC : Professional Core
EEC : Employability Enhancement Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER - III

23ADBT01	FUNDAMENTALS OF BLOCKCHAIN	L T P C 3 0 0 3

OBJECTIVES

- To discuss fundamental concepts of blockchain technology.
- To analyze the Bitcoin blockchain model.
- To explore the Ethereum blockchain, focusing on smart contracts, structure, operations, consensus, and incentive models.
- To investigate various types of blockchain.
- To understand different consensus algorithms used in blockchain networks.

UNIT I INTRODUCTION 9

The Double-Spend Problem, Byzantine Generals' Computing Problems, PublicKey Cryptography, Hashing, Distributed Systems, Distributed Consensus.

Coding Exercises:

1. Implement a simple hash function and demonstrate its role in blockchain data immutability.
2. Simulate the Byzantine Generals' Problem using a consensus algorithm in a distributed system.
3. Develop basic public-key cryptography operations (key generation, encryption, and decryption) in Python.

Problem-solving Assignments:

1. Analyze the mechanics and implications of the Double-Spend problem in digital currencies.
2. Design a distributed consensus protocol to tolerate certain node failures and malicious actors.

UNIT II TECHNOLOGY STACK AND BITCOIN BLOCKCHAIN 9

Technology Stack: Blockchain, Protocol, Currency. Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.

Coding Exercises:

1. Build a simplified model of the Bitcoin blockchain including block structure and proof-of-work.
2. Simulate Bitcoin's incentive model with mining rewards and transaction fees in a small network of nodes.

3. Write code to validate Bitcoin transactions and build a simplified UTXO (Unspent Transaction Output) system.

Problem-solving Assignments:

1. Compare Bitcoin's consensus model with alternative blockchain consensus mechanisms.
2. Analyze security assumptions and potential vulnerabilities in Bitcoin's blockchain structure.

UNIT III ETHEREUM BLOCKCHAIN 9

Ethereum Blockchain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

Coding Exercises:

1. Create and deploy a "Hello World" smart contract on Ethereum testnet using Solidity and Remix IDE.
2. Write smart contracts in Solidity to implement simple token transfers and state changes.
3. Build an Ethereum App interacting with smart contracts through web3.js or ethers.js.

Problem-solving Assignments:

1. Design a decentralized voting application using Ethereum smart contracts emphasizing security and transparency.
2. Analyze Ethereum's incentive and consensus models, discussing scalability challenges.

UNIT IV TIERS OF BLOCKCHAIN TECHNOLOGY 9

Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.

Coding Exercises:

1. Develop example applications illustrating Blockchain 1.0, 2.0, and 3.0 capabilities.
2. Simulate private and public blockchain environments highlighting access controls.
3. Implement sidechain functionality to offload transactions from a main blockchain.

Problem-solving Assignments:

1. Evaluate the trade-offs between different types of blockchains (public, private, semi-private).
2. Design a blockchain architecture for supply chain management optimizing performance and security.

UNIT V TYPES OF CONSENSUS ALGORITHMS 9

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

Coding Exercises:

1. Implement proof-of-work (PoW) and proof-of-stake (PoS) consensus algorithms in simplified models.
2. Write simulations of federated consensus and practical Byzantine fault tolerance (PBFT) protocols.
3. Create a basic supply chain use case demonstrating consensus-based validation.

Problem-solving Assignments:

1. Compare energy consumption and security of various consensus algorithms.
2. Analyze how delegated proof of stake (DPoS) and proof elapsed time affect blockchain decentralization.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Demonstrate a clear understanding of the fundamental concepts and challenges addressed by blockchain technology.
- Explain the Technology Stack of blockchain systems and the roles of Blockchain, Protocol, and Currency layers in a blockchain ecosystem.
- Analyze the Ethereum Blockchain, with a focus on Smart Contracts, Ethereum Structure, Operations, Consensus Model, and Incentive Model.
- Differentiate between various tiers of blockchain technology and understand the unique characteristics of different types of blockchains.
- Compare and contrast various Consensus Algorithms used in blockchain networks.

TEXT BOOKS

1. Kirankalyan Kulkarni, "Essentials of Bitcoin and Block chain", Packt Publishing, 2018.
2. Anshul Kaushik, "Block Chain & Crypto Currencies", Khanna Publishing House, 2018.

REFERENCES

1. Tiana Laurence. "Block chain for Dummies",John Wiley & Sons, Second Edition 2019.
2. Imran Bashir, "Mastering Block chain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Block chain frameworks" , Packet Publishing 2017.

E-RESOURCES

1. https://www.coursera.org/specializations/blockchain
2. https://nptel.ac.in/courses/106105184/
3. https://swayam.gov.in/nd1_noc20_cs01/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	1	1	-	-	-	2	3	1	2	1
2	3	1	2	2	1	-	-	-	1	2	1	2	2
3	2	3	2	3	1	-	-	-	3	1	1	1	1
4	1	2	3	3	3	-	-	-	3	3	1	1	3
5	2	3	3	1	3	-	-	-	2	2	1	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.2	2.2	2.2	1.8	1.8	2	-	-	2.2	2.2	1	1.6	1.8

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER IV

23ADBT02	BLOCKCHAIN PLATFORMS AND USE CASES	L T P C
		3 0 0 3

OBJECTIVES

- To explore different types of blockchain platforms.
- To analyze decentralized applications (DApps) developed using blockchain technology.
- To compare blockchain platforms based on consensus mechanisms, performance, scalability, security, and use case suitability.
- To investigate real-world use cases for blockchain technology.
- To examine various blockchain application scenarios.

UNIT I PERMISSIONED BLOCKCHAINS 9

Hyperledger Fabric Services, Model and Functions, Hyperledger Composer, Microsoft Azure Blockchain Platform and Services, Other Platforms: IOTA, TRON, Ziliqa, Cosmos, Ripple.

Coding Exercises:

1. Deploy a Hyperledger Fabric network using Docker and create channels with multiple organizations.
2. Write Hyperledger Composer models for assets, participants, and transactions in a commodity trading network.
3. Set up Microsoft Azure Blockchain Service and deploy a sample smart contract using Azure CLI.

Problem-solving Assignments:

1. Compare Hyperledger Fabric architecture with IOTA, TRON, and Zilliqa for enterprise use cases.
2. Design a multi-organization permissioned blockchain network using Hyperledger Fabric services.

UNIT II DECENTRALIZED APPLICATION PLATFORMS 9

Augur-Decentralised Prediction Market Platform, Grid+-Energy Ecosystem Platform.

Coding Exercises:

1. Build a prediction market dApp similar to Augur using Ethereum smart contracts and React frontend.
2. Create a decentralized energy trading platform prototype simulating Grid+ energy

ecosystem.

3. Develop oracle integration for external data feeds in prediction market applications.

Problem-solving Assignments:

1. Analyze scalability challenges in decentralized prediction markets and propose layer-2 solutions.
2. Design tokenomics and incentive models for energy ecosystem platforms.

UNIT III CHALLENGES AND SOLUTIONS RELATED TO BLOCKCHAIN 9

Consensus, Scalability, Privacy and Confidentiality, Escrow, and Multi signature.

Coding Exercises:

1. Implement multi-signature wallets using Ethereum smart contracts for escrow functionality.
2. Develop privacy-preserving smart contracts using zero-knowledge proofs or private transactions.
3. Create scalable consensus mechanisms comparing PoW, PoS, and hybrid approaches.

Problem-solving Assignments:

1. Design solutions addressing blockchain trilemma (scalability, security, decentralization).
2. Analyze privacy requirements for financial applications and implement confidentiality layers.

UNIT IV INTERPLANETARY FILE SYSTEM 9

Alternative Decentralized Solutions: Interplanetary File System (IPFS) Working and Uses, Hashgrapgh- Working, Benefits, And Use-Cases.

Coding Exercises:

1. Build a decentralized file storage application using IPFS for content addressing and retrieval.
2. Implement IPFS pubsub messaging for peer-to-peer communication in decentralized apps.
3. Create a Hashgraph prototype simulating gossip protocol and virtual voting consensus.

Problem-solving Assignments:

1. Compare IPFS with traditional cloud storage in terms of cost, availability, and censorship resistance.
2. Design hybrid storage solutions combining IPFS with blockchain for metadata anchoring.

UNIT V BLOCKCHAIN USE CASES 9

Financial Services Related Use Cases, Revolutionization of Global Trade, Digital Identity, Auditing Services, Supply Chain Management, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.

Coding Exercises:

1. Develop a supply chain tracking dApp using Ethereum smart contracts and IPFS for document storage.
2. Build a digital identity verification system with self-sovereign identity principles.
3. Create healthcare data sharing platform with patient consent management via smart contracts.

Problem-solving Assignments:

1. Design blockchain-IoT integration for real-time supply chain monitoring with edge computing.
2. Analyze AI-blockchain convergence for secure federated learning and model provenance tracking.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Classify various blockchain platforms and their underlying technologies
- Explain the concept of the Grid+-Energy Ecosystem Platform and its decentralized nature for energy-related applications.
- Identify and analyze the challenges related to consensus mechanisms in blockchain networks and propose potential solutions
- Explain a clear understanding of the Interplanetary File System (IPFS) and its decentralized approach to file storage and sharing
- Explain the use of block chain technology in various financial services applications, such as payment systems, remittances, and asset tokenization

TEXT BOOKS

1. Tiana Laurence, "Blockchain for Dummies", John Wiley & Sons Publisher, Second Edition 2019.
2. Anshul Kaushik, "Block Chain & Crypto Currencies", Khanna Publishing House, 2018.

REFERENCES

1. Narayan Prusty, "Building Blockchain Projects", Packt Publishing, 2017.
2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization. cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/106105184/
2. https://www.coursera.org/learn/blockchain-platforms

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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2	2	3	1	3	2	-	-	-	1	2	2	1	2
3	1	3	3	2	2	-	-	-	2	3	1	1	3
4	1	2	3	3	1	-	-	-	3	2	1	3	3
5	1	2	3	2	1	-	-	-	2	1	1	3	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	1.6	2.2	2.2	2.6	1.4	-	-	-	2.2	2.2	1.4	2.2	2.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER V

23ADBT03	BLOCKCHAIN SECURITY AND PERFORMANCE	L T P C
		3 0 0 3

OBJECTIVES

- To examine blockchain security issues.
- To learn smart contract security tools.
- To analyze blockchain performance challenges.
- To explore performance improvement techniques.
- To evaluate blockchain applications.

UNIT I SECURITY ISSUES 9

Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments

Coding Exercises:

1. Write Solidity code demonstrating reentrancy vulnerability and implement the Checks-Effects-Interactions pattern to fix it.
2. Simulate integer overflow/underflow attacks using Solidity and mitigate with SafeMath library.
3. Create a vulnerable smart contract exhibiting access control issues and secure it with OpenZeppelin's Ownable/AccessControl contracts.

Problem-solving Assignments:

1. Analyze real-world attacks like The DAO hack or Parity wallet incidents and identify root causes.
2. Design secure smart contract patterns for handling external calls and untrusted inputs.

UNIT II SECURITY TOOLS FOR SMART CONTRACTS 9

Working, Advantages, And Disadvantages of Tools- Oyente, Securify, Maian, Manticore, Mythril, SmartCheck, Verx. Secure Key Management, Quantum Resilience Keys.

Coding Exercises:

1. Run Mythril analysis on vulnerable Solidity contracts and interpret security warnings.
2. Use Slither static analyzer to detect common vulnerabilities in sample smart contracts.

3. Deploy Manticore for symbolic execution testing on simple smart contracts and analyze results.

Problem-solving Assignments:

1. Compare effectiveness of Oyente, Securify, and Mythril on benchmark vulnerable contracts.
2. Implement secure key management practices and evaluate quantum-resistant cryptography options.

UNIT III PERFORMANCE RELATED ISSUES 9

Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems. Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications

Coding Exercises:

1. Measure transaction speed and gas costs for different smart contract complexity levels.
2. Simulate network congestion scenarios and analyze impact on transaction finality times.
3. Benchmark interoperability challenges between different EVM-compatible chains.

Problem-solving Assignments:

1. Analyze transaction fee dynamics during network congestion and propose mitigation strategies.
2. Evaluate standardization challenges across different blockchain ecosystems.

UNIT IV PERFORMANCE IMPROVEMENTS 9

Off-Chain State Channels, Sidechains, Parallels Chains, Concurrent Smart Contract Transactions, Sharding Technique and Its Benefits, Atomic Swaps Between Smart Contracts.

Coding Exercises:

1. Implement a state channel prototype for off-chain payments between two parties.
2. Create a simple sidechain bridge contract for asset transfers between mainnet and sidechain.
3. Simulate sharding by partitioning smart contract state across multiple shards.

Problem-solving Assignments:

1. Design atomic swap mechanisms between different blockchain networks.
2. Compare parallel transaction processing techniques and their scalability benefits.

UNIT V BLOCKCHAIN APPLICATIONS 9

Decentralized Cryptocurrency, Distributed Cloud Storage, EVoting, Insurance Claims, Cross-Border Payments, Asset Management, Smart Appliances.

Coding Exercises:

1. Build a decentralized eVoting system using smart contracts with quadratic voting mechanisms.
2. Develop insurance claims processing dApp with automated payouts based on oracle data.
3. Create cross-border payment smart contract integrating Chainlink price feeds.

Problem-solving Assignments:

1. Design asset tokenization platform for real-world assets with compliance requirements.
2. Analyze smart appliance integration challenges with blockchain and propose IoT-blockchain architecture.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Identify and evaluate security vulnerabilities and risks in blockchain applications and smart contracts
- Explain a thorough understanding of various security tools used for auditing and analyzing smart contracts
- Recognize the challenges related to interoperability and the lack of supportive regulations for blockchain applications
- Identify and apply performance improvement techniques to enhance the scalability and efficiency of blockchain systems
- Understand the potential benefits and limitations of implementing blockchain solutions in different real-world scenarios

TEXT BOOKS

1. Andreas Antonopoulos and Gavin Wood, " Mastering Ethereum: Building Smart Contracts and Dapps ", Shroff Publisher/O'Reilly Publisher.
2. Rajendra Akerkar, Natarajan Meghanathan, and Dhinaharan Nagamalai ,"Blockchain and Healthcare: New Era of Digital Health Systems", Springer Publisher, 2019.

REFERENCES

1. Daniel Drescher ,"Blockchain Basics: A Non-Technical Introduction in 25 Steps", Apress Publication, 2017.
2. Arshdeep Bahga and Vijay Madisetti, "Blockchain for Business: A Hands-On Approach", VPT Publisher, 2020.

E-RESOURCES

1. https://www.edx.org/course/blockchain-and-fintech-basics-applications-and-limitations
2. https://nptel.ac.in/courses/106105235

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	-	-	-	-	1	3	1	2	3	1	1
2	1	3	3	3	2	-	-	-	1	2	2	2	1	2	2
3	2	3	3	3	1	-	-	-	1	3	1	2	1	2	1
4	3	3	1	1	1	-	-	-	3	1	1	3	2	3	3
5	3	2	2	3	2	-	-	-	1	2	1	2	2	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	2.4	2.6	2.4	2.2	1.5	-	-	-	1.4	2.2	1.2	2.2	1.8	2	1.6

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER VI

23ADBE01 **SMART CONTRACTS AND SOLIDITY** L T P C

3 0 2 4

OBJECTIVES

- To introduce concepts of smart contracts in blockchain technology
- To analyze the lifecycle of smart contracts from development through deployment and execution.
- To explore the Solidity programming language for smart contract development.
- To investigate the Truffle framework and Ganache for smart contract testing and deployment.
- To develop decentralized applications (DApps) integrating smart contracts with front-end interfaces.
- To demonstrate processes for connecting smart contracts to DApp front-end applications.

UNIT I SMART CONTRACTS 9

Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.

Coding Exercises:

1. Write a basic Solidity contract demonstrating smart contract lifecycle (deployment, function calls, state changes).
2. Implement a simple voting contract showing features like immutability and transparency.
3. Create Ethereum account management scripts using Web3.js to interact with contract ABIs.

Problem-solving Assignments:

1. Analyze use cases where smart contracts provide advantages over traditional contracts.
2. Design smart contract architecture for a decentralized escrow service.

UNIT II DEVELOPMENT ENVIRONMENT 9

Building A Simple Smart Contract with Solidity, SolcCompiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.

Coding Exercises:

1. Deploy a "Hello World" smart contract using Remix IDE on JavaScript VM and testnet.
2. Compile Solidity contracts using solc command line and generate ABI/bytecode files.
3. Write deployment scripts using Hardhat or Truffle for local Ethereum networks.

Problem-solving Assignments:

1. Compare Remix IDE vs local development environments for smart contract workflows.
2. Troubleshoot common compilation errors and deployment failures in Ethereum.

UNIT III INTRODUCTION TO SOLIDITY 9

Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity. Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events

Coding Exercises:

1. Create Solidity contracts using structs, mappings, arrays, and memory/storage distinctions.
2. Implement inheritance, interfaces, events, and error handling (require, assert, revert).
3. Build advanced contracts with libraries, modifiers, and getter/setter patterns.

Problem-solving Assignments:

1. Optimize gas usage by properly managing storage vs memory variables.
2. Design reusable contract patterns using abstract contracts and interfaces.

UNIT IV TRUFFLE FRAMEWORK & GANACHE 9

Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands.

Coding Exercises:

1. Set up Truffle suite with Ganache CLI/GUI and deploy contracts using truffle migrate.
2. Write Truffle test scripts using Mocha/Chai to test contract functionality.
3. Create Truffle project with multiple contracts, scripts, and migration files.

Problem-solving Assignments:

1. Configure Truffle for multi-network deployments (local, testnet, mainnet).
2. Implement CI/CD pipeline for smart contract testing using Truffle and Ganache.

UNIT V DECENTRALIZED APP CREATION 9

Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End

Application, Deploying Dapp, Validation, And Testing of Dapp.

Coding Exercises:

1. Build complete DApp with React frontend connecting to Solidity contracts via ethers.js.
2. Deploy DApp to IPFS and integrate MetaMask wallet for user authentication.
3. Implement DApp testing with end-to-end scenarios including contract interactions.

Problem-solving Assignments:

1. Design secure frontend-backend communication patterns for DApps.
2. Create deployment and validation strategy for production DApp launch.

LIST OF EXPERIMENTS

1. Create a simple Solidity smart contract that allows you to store and retrieve a "Hello, World!" message on the blockchain.
2. Develop a Solidity contract that accepts incoming transactions, stores sender information, and emits an event when a new transaction occurs.
3. Write a Solidity smart contract to create a basic ERC-20 token with functions for minting, transferring, and querying the token balance.
4. Design a crowdfunding smart contract where users can contribute funds, and the contract releases funds to the campaign creator when a predefined goal is reached.
5. Create a voting decentralized application (DApp) using Solidity, where users can cast their votes for a given proposal, and the contract calculates the winner.
6. Design a simple DAO using a Solidity smart contract, allowing members to vote on proposals for decision-making.
7. Implement a Solidity contract that locks funds for a specified duration and releases them only after a predetermined time.
8. Develop a Solidity contract that generates a random number using various methods like block hash and chainlink VRF.
9. Create a multi-signature wallet contract that requires multiple parties' approval for fund withdrawals.
10. Build a basic decentralized marketplace using Solidity, where users can list items for sale and other users can purchase them using cryptocurrency.

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Classify the life cycle of a smart contract, from its inception to execution and eventual termination.
- Create a simple smart contract using Solidity and the necessary tools like SolcCompiler and Remix-IDE
- Apply various data structures in Solidity, such as arrays and mappings, and differentiate between memory and storage usage
- Develop a Truffle project and learn how to use Truffle commands
- Design a complete decentralized application (DApp) by combining smart contract development with front-end creation
- Deploy the DApp on the Ethereum blockchain and perform thorough validation and testing to ensure its functionality and security

TEXT BOOKS

1. Tiana Laurence, "Blockchain for Dummies", John Wiley & Sons publisher, Second Edition 2019.
2. Anshul Kaushik, "Block Chain & Crypto Currencies", Khanna Publishing House , 2020.

REFERENCES

1. Narayan Prusty, "Building Blockchain Projects", Packt Publishing, 2017.
2. Andreas Antonopoulos and Gavin Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", Shroff Publisher/O'Reilly Publisher, 2018.

E-RESOURCES

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	3	-	1	-	3	-	-	-	-	2	-	-	-
2	1	-	2	-	1	-	-	-	-	-	-	-	-	-	-
3	2	2	3	1	1	1	-	-	-	-	-	1	-	-	-
4	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-
5	2	1	2	1	3	-	1	-	-	-	-	-	-	-	-
6	2	3	-	2	3	-	-	-	-	-	-	-	-	-	-
AVG	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	1.5	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER VII

23ADBP01	PROJECT WORK	L T P C 0 0 12 6

OBJECTIVES

- To develop students' learning and skills in a specific area of interest.
- To provide opportunities for students to apply theoretical knowledge from their minor courses to practical, real-world scenarios or problems.
- To conduct research and investigations, fostering critical thinking and problem-solving skills.
- To promote collaboration and teamwork, enabling effective work in a team environment.
- To prepare project reports and participate in reviews and viva voce examinations.

GUIDELINES FOR REVIEW AND EVALUATION

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 180 PERIODS

OUTCOMES

Upon completion of this course, Students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Develop problem-solving skills as they analyze issues, design solutions, and implement them in their projects.
- Improve their communication and presentation abilities.
- Build successful collaboration and teamwork will be evident in the project's execution and outcomes

- Explain new knowledge or insights to the relevant field, making it a valuable addition to the academic community.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
2	-	-	-	-	3	3	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	3	-	3	-	-	-	-	-	3
4	-	-	-	-	-	-	-	3	3	3	3	-	-	-	3
5	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3
AVG	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low 2-Medium 3-High '-' – No Correlation.

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CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - BLOCKCHAIN)

CREDIT SUMMARY

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Category	Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	3	3	3	4	-	-	13
EEC	-	-	-	-	-	-	6	-	6
Total	-	-	3	3	3	4	6	-	19