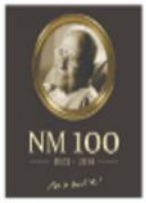


Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Udumalai Road, Pollachi, Coimbatore District - 642003
Established in 1998 ♦ Approved by AICTE ♦ Affiliated to Anna University
(A DIVISION OF NIA EDUCATIONAL INSTITUTIONS)

NAAC A++ GRADE
Cycle 3 (2023-2030)
The Highest Grade

Curriculum and Syllabi

B.Tech Information Technology

Semesters I to VIII

Regulations 2023

Dr. Mahalingam College of Engineering and Technology, Pollachi 642003.

(An autonomous institution approved by AICTE and affiliated to Anna University)

Department of Information Technology

Vision

To become a Centre of Excellence in education and research in the field of Information Technology, to meet global challenges in computing industries

Mission

- To impart world-class knowledge in the field of Information Technology
- To promote industry-institute interactions to empower the faculty members and students
- To support and facilitate research and development activities
- To develop all round personality by inculcating the values and skills needed for students to upgrade themselves as IT professionals

Dr. Mahalingam College of Engineering and Technology, Pollachi 642003.

(An autonomous institution approved by AICTE and affiliated to Anna University)

Programme: B.Tech. Information Technology

Programme Educational Objectives (PEOs) - Regulation 2023

B.Tech. Information Technology graduates will:

PEO 1. Technical Expertise: Have high level of technical competency to identify problems and to generate innovative solutions, which would conform to the needs of IT industry.

PEO 2. Lifelong learning: Successfully adapt to changes in roles and responsibilities, through lifelong learning, for collaborating professionally with various stakeholders

PEO 3. Ethical Knowledge: Ethically apply their computing knowledge and skills considering societal, economic and environmental factors

Programme Outcomes (POs) - Regulations 2023

On successful completion of B.Tech. Information Technology programme, graduating students/graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

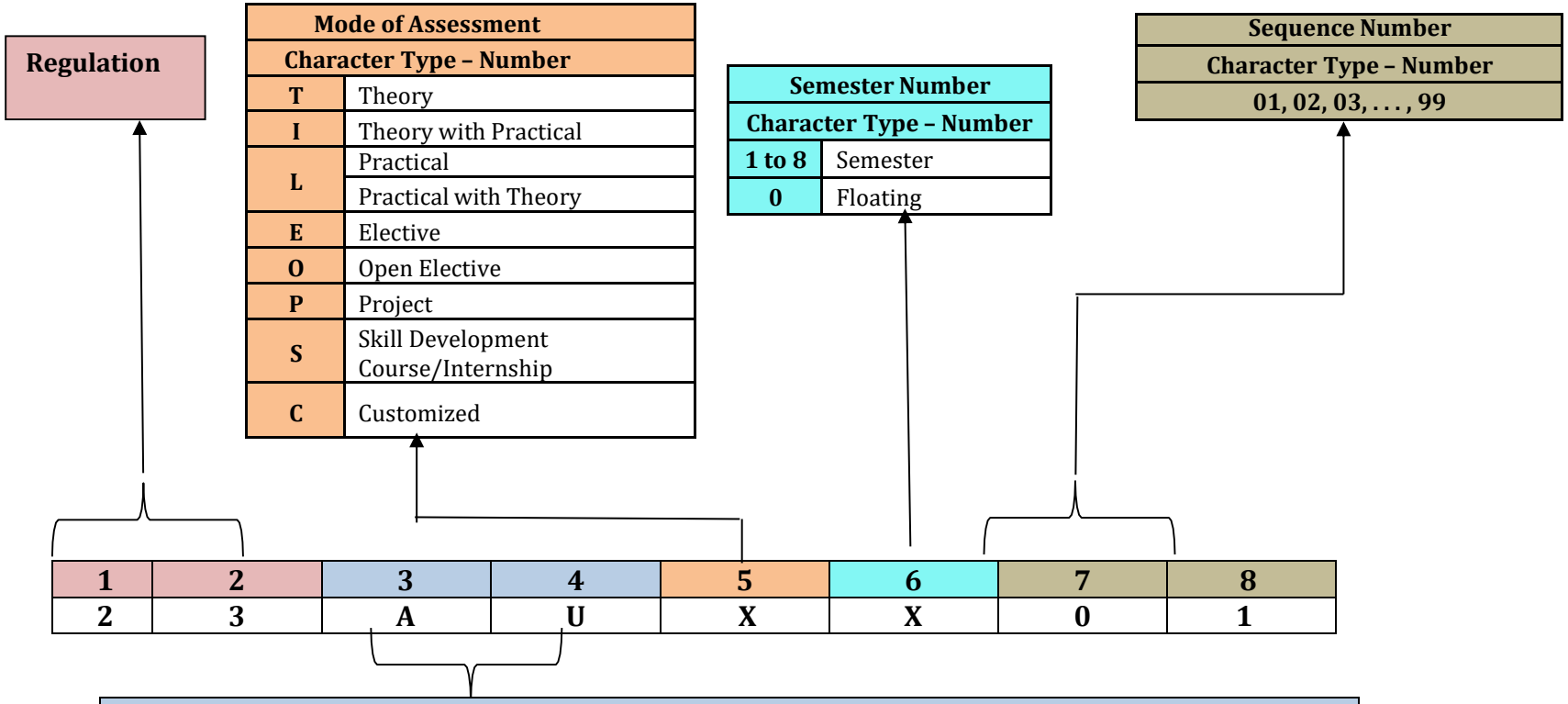
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs) - Regulations 2023

PSO 1. Build the practical expertise by employing emerging technologies and open-source platforms.

PSO 2. Develop, improve, and implement computer algorithms while using multidisciplinary expertise for creating novel ideas.

Dr. Mahalingam College of Engineering and Technology, Pollachi
2023 Regulations - Course Code Generation Procedure for UG Courses



AD	Artificial Intelligence & Data Science	**ME**	Mechanical
AM	CSE (Artificial Intelligence & Machine Learning)	**SC**	CSE (Cyber Security)
AU	Automobile	**PH**	Physics
CE	Civil	**CH**	Chemistry
CS	Computer Science	**EN**	English
EA	Advanced Communication Technology	**MA**	Mathematics
EC	Electronics and Communication	**ES**	Employability Skills
EE	Electrical and Electronics	**VA**	Value Added Course
EV	VLSI Design & Technology	**SA**	Studio Activities
IT	Information Technology		

Programme: B.Tech. Information Technology
2023 Regulations (For 2023 Batch Only)
Curriculum for Semester I & II

Course Category	Course Code	Course Title	Duration	Credits	Marks
VAC	23VAL101	Induction Program	3 Weeks	-	100

Semester I

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI101	Communication Skills I	2	0	2	3	100	All
Minor	23MAI103	Linear Algebra and Infinite Series	3	0	2	4	100	AD,AM,CS,IT,SC
Minor	23PHT001	Physics for Information Sciences	3	0	0	3	100	AD,AM,CS,IT,SC
Major	23CST101	Problem Solving using C	3	0	0	3	100	AD,AM,CS,IT,SC
Multi-disciplinary	23EEI101	Basics of Electrical and Electronics Engineering	3	0	2	4	100	AD,AM,CS,IT,SC
Minor	23PHL001	Physics for Information Sciences Laboratory	0	0	3	1.5	100	AD,AM,CS,IT,SC
SEC	23CSL101	Problem Solving using C Laboratory	0	0	3	1.5	100	AD,AM,CS,IT,SC
VAC	23VAL102	Wellness for Students	0	0	2	1	100	All
VAC	23VAT101	தமிழர்மரபு /Heritage of Tamils	1	0	0	1	100	All
AEC	23SAL101	Studio Activities	0	0	2	-	-	All
		Total	**15**	**0**	**16**	**22**	**900**	

Semester II

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI201	Communication Skills II	2	0	2	3	100	All
	23FLT201	Foreign Language- Japanese	3	0	0			
	23FLT202	Foreign Language- German	3	0	0			
Minor	23MAI203	Calculus and Transforms	3	0	2	4	100	AD, AM, CS, IT, SC
Major	23ITT201	Data Structures	3	0	0	3	100	AD, AM, CS, IT, SC
Multi-disciplinary	23EEI201	Digital System Design	2	0	2	3	100	AD, AM, CS, IT, SC
Multi-disciplinary	23MEL001	Engineering Drawing	1	0	3	2.5	100	AD,AM,CS,EA, EC,EE,EV,IT,SC
SEC	23ITL201	Data Structures Laboratory	0	0	3	1.5	100	AD, AM, CS, IT, SC
SEC	23CSL201	IT Practices Laboratory	0	0	4	2	100	AD, AM, CS, IT, SC
SEC	23ESL201	Professional Skills 1: Problem solving skills & Logical Thinking 1	0	0	2	1	100	All
VAC	23VAT201	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology	1	0	0	1	100	All
Multi-disciplinary	23CHT202	Environmental Sciences	1	0	0	-	100	All
AEC	23SAL201	Studio Activities	0	0	2	-	-	All
		Total	**13**	**0**	**20**	**21**	**1000**	

Programme: B.Tech. Information Technology
2023 Regulations (From 2024 Batch Onwards)
Curriculum for Semester I to VIII

Course Category	Course Code	Course Title	Duration	Credits	Marks
VAC	23VAL101	Induction Program	3 Weeks	-	100

Semester I

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI101	Communication Skills I	2	0	2	3	100	All
Minor	23MAI103	Linear Algebra and Infinite Series	3	0	2	4	100	AD,AM,CS,IT,SC
Minor	23PHT001	Physics for Information Sciences	3	0	0	3	100	AD,AM,CS,IT,SC
Major	23CST101	Problem Solving using C	3	0	0	3	100	AD,AM,CS,IT,SC
Multi-disciplinary	23EEI102	Introduction to Electrical and Electronics Engineering	3	0	2	4	100	AD,AM,CS,IT,SC
Minor	23PHL001	Physics for Information Sciences Laboratory	0	0	3	1.5	100	AD,AM,CS,IT,SC
SEC	23CSL101	Problem Solving using C Laboratory	0	0	3	1.5	100	AD,AM,CS,IT,SC
VAC	23VAL102	Wellness for Students	0	0	2	1	100	All
VAC	23VAT101	தமிழர்மரபு /Heritage of Tamils	1	0	0	1	100	All
AEC	23SAL101	Studio Activities	0	0	2	-	-	All
		Total	**15**	**0**	**16**	**22**	**900**	

Semester II

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI201	Communication Skills II	2	0	2	3	100	All
	23FLT201	Foreign Language- Japanese	3	0	0			
	23FLT202	Foreign Language- German	3	0	0			
Minor	23MAI203	Calculus and Transforms	3	0	2	4	100	AD, AM, CS, IT,SC
Major	23ITT201	Data Structures	3	0	0	3	100	AD, AM, CS, IT,SC
Multi-disciplinary	23EEI201	Digital System Design	2	0	2	3	100	AD, AM, CS, IT,SC
Multi-disciplinary	23MEL001	Engineering Drawing	1	0	3	2.5	100	AD,AM,CS,EA, EC,EE,EV,IT,SC
SEC	23ITL201	Data Structures Laboratory	0	0	3	1.5	100	AD, AM, CS, IT,SC
SEC	23CSL201	IT Practices Laboratory	0	0	4	2	100	AD, AM, CS, IT, SC
SEC	23ESL201	Professional Skills 1: Problem solving skills & Logical Thinking 1	0	0	2	1	100	All
VAC	23VAT201	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology	1	0	0	1	100	All
Multi-disciplinary	23CHT202	Environmental Sciences	1	0	0	-	100	All
AEC	23SAL201	Studio Activities	0	0	2	-	-	All
Total			**13**	**0**	**20**	**21**	**1000**	

Semester III

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23MAT305	Discrete Mathematics	3	1	0	4	100	AM,CS,IT,SC
Major	23ITI301	Algorithm Design and Analysis	3	0	2	4	100	-
Major	23ITT301	Object Oriented Programming using Java	3	0	0	3	100	-
Minor	23ITI302	Computer Organization and Microprocessor	3	0	2	4	100	-
Major	23ITT302	Software Engineering	3	0	0	3	100	-
Major	23ITL301	Object Oriented Programming using Java Laboratory	0	0	3	1.5	100	-
SEC	23ESL301	Professional Skills 2: Problem solving skills & Logical Thinking 2	0	0	2	1	100	All
VAC	23VAT301	Universal Human Values 2: Understanding Harmony	2	1	0	3	100	All
AEC	23SAL301	Studio Activities	0	0	2	-	-	All
		Total	**17**	**2**	**11**	**23.5**	**800**	

Semester IV

Course Category	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23MAT401	Probability and Statistics	3	1	0	4	100	AM, AU, CS, EC, EE, ME, IT, SC
Major	23ITT401	Operating System Concepts	3	0	0	3	100	-
Major	23ITI401	Computer Networks	3	0	2	4	100	-
Major	23ITI402	Database Management Systems	3	0	2	4	100	-
Major	23ITL401	Programming with Python Laboratory	1	0	3	2.5	100	-
SEC	23ESL401	Professional Skills 3: Professional Development and Etiquette	0	0	2	1	100	All
AEC	23SAL401	Studio Activities	0	0	2	-	-	All
		Total	**13**	**1**	**11**	**18.5**	**600**	

Course Category	Course Code	Course Title	Duration	Credits	Marks
SEC	23XXXXXX	Internship — 1 / Community Internship / Skill Development	2 Weeks - 4 Weeks	1	100

Semester V

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITT501	Full Stack Web Development	3	0	0	3	100	-
Major	23ITI501	Data Mining	3	0	2	4	100	-
Major	23ITI502	Cryptography and Network Security	3	0	2	4	100	-
Major	23XXXXXX	Professional Elective – I	2	0	2	3	100	-
Major	23XXXXXX	Professional Elective – II	3	0	0	3	100	-
Major	23ITL501	Full Stack Web Development Laboratory	0	0	3	1.5	100	-
SEC	23ESL501	Professional Skills 4: Communication Skills and Interview Essentials	0	0	2	1	100	All
Project	23ITP501	Reverse Engineering Project	0	0	6	3	100	-
AEC	23SAL501	Studio Activities	0	0	2	-	-	All
		Total	**14**	**0**	**19**	**22.5**	**800**	

Semester VI

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITT601	Cloud Computing and Virtualization	3	0	0	3	100	-
Major	23ITI601	Compiler Design and Automata Theory	3	0	2	4	100	-
Major	23XXXXXX	Professional Elective – III	2	0	2	3	100	-
Major	23XXXXXX	Professional Elective – IV	3	0	0	3	100	-
Minor	23XXXXXX	Open Elective-I	3	0	0	3	100	-
Major	23ITL601	Cloud Computing and Virtualization Laboratory	0	0	3	1.5	100	-
SEC	23ESL601	Professional Skills 5: Ace and Elevate: Aptitude and Soft Skills	0	0	2	1	100	All
AEC	23SAL601	Studio Activities	0	0	2	-	-	All
		Total	**14**	**0**	**11**	**18.5**	**700**	

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
SEC	23XXXXXX	Internship-2 / Research Internship / Skill Development Program	2 Weeks - 4 Weeks			1	100

Semester VII

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITI701	Artificial Intelligence Principles and Applications	3	0	2	4	100	-
Major	23ITT701	Cyber Security Concepts	3	0	0	3	100	-
Major	23XXXXXX	Professional Elective – V	2	0	2	3	100	-
Major	23XXXXXX	Professional Elective – VI	3	0	0	3	100	-
Minor	23XXXXXX	Open Elective – II	3	0	0	3	100	-
Major	23ITL701	Data Science Laboratory	1	0	4	3	100	-
Project	23ITP701	Project Phase-I	0	0	8	4	100	-
		Total	**15**	**0**	**16**	**23**	**700**	

Semester VIII

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Project	23ITP801	Project Phase-II	0	0	12	6	200	-
SEC	23XXXXXX	Internship-3 / Skill Development	8 Weeks			4	100	-
		Total	**0**	**0**	**12**	**10**	**300**	

Total Credits: 161

Verticals

Vertical I: Data Science

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE001	Data Visualization Techniques	2	0	2	3	100	-
Major	23ITE002	Neural Networks and Deep Learning	3	0	0	3	100	-
Major	23ITE003	Big Data and Analytics	2	0	2	3	100	-
Major	23ITE004	Computer Vision	2	0	2	3	100	-
Major	23ITE005	Data Analytics using R	2	0	2	3	100	-
Major	23ITE006	Exploratory Data Analysis with Python	3	0	0	3	100	-
Major	23ITE007	Text and Speech Analysis	3	0	0	3	100	-
Major	23ITE008	Recommender Systems	3	0	0	3	100	-
Major	23ITE009	Power BI for Data Visualization	2	0	2	3	100	-
Major	23ITE043	Integrated Big Data Solutions	3	0	0	3	100	AD,AM,CS,IT ,SC

Vertical II: Web Application Development

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE010	Object Oriented Analysis and Design	3	0	0	3	100	-
Major	23ITE011	Server Side Jamstack Development	2	0	2	3	100	-
Major	23ITE012	Developing Web Applications using .NET	2	0	2	3	100	-
Major	23ITE013	Responsive Web Design	2	0	2	3	100	-
Major	23ITE014	UI and UX Design	2	0	2	3	100	-
Major	23ITE015	Server Side Programming	2	0	2	3	100	-
Major	23ITE016	Search Engine Optimization	3	0	0	3	100	-
Major	23ITE017	Progressive Web Framework	3	0	0	3	100	-

Vertical III: Security and Data Privacy

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE018	Ethical Hacking with vulnerability	2	0	2	3	100	-
Major	23ITE019	Web Application Security	2	0	2	3	100	-
Major	23ITE020	Quantum Computing	2	0	2	3	100	-
Major	23ITE021	Malware Analysis and Tools	3	0	0	3	100	-
Major	23ITE022	Block Chain Technologies	3	0	0	3	100	-
Major	23ITE023	Secure Mobile Development with Flutter	2	0	2	3	100	-
Major	23ITE024	Information Security	3	0	0	3	100	-
Major	23ITE025	Social Network Security	3	0	0	3	100	-

Vertical IV: Artificial Intelligence and Machine Learning

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE026	Soft Computing	3	0	0	3	100	-
Major	23ITE027	Natural Language Processing	2	0	2	3	100	-
Major	23ITE028	Swarm Intelligence	2	0	2	3	100	-
Major	23ITE029	Machine Learning with Python	2	0	2	3	100	-
Major	23ITE030	Intelligent Systems	2	0	2	3	100	-
Major	23ITE031	Prompt Engineering	2	0	2	3	100	-
Major	23ITE032	Cognitive Computing	3	0	0	3	100	-
Major	23ITE033	Knowledge Engineering	3	0	0	3	100	-
Major	23ITE034	Reinforcement Learning	3	0	0	3	100	-

Vertical V: Programming and Computing Systems

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE035	Game Programming	3	0	0	3	100	-
Major	23ITE036	Industry 5.0	3	0	0	3	100	-
Major	23ITE037	Internet of Things	3	0	0	3	100	-
Major	23ITE038	Multimedia Systems	2	0	2	3	100	-
Major	23ITE039	Augmented Reality and Virtual Reality	2	0	2	3	100	-
Major	23ITE040	Graphics and Multimedia	2	0	2	3	100	-
Major	23ITE041	Spring Boot and Micro Services	2	0	2	3	100	-
Major	23ITE042	Hybrid Mobile App Programming	2	0	2	3	100	-
Major	23ITE044	AWS Services with Devops Tools	2	0	2	3	100	AM,CS,IT,SC

Diversified Electives

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23ITE045	Principles of Management	3	0	0	3	100	-
Major	23ITE046	Total Quality Management Techniques	3	0	0	3	100	-
Major	23ITE047	Intellectual Property Rights	3	0	0	3	100	All
Major	23AUE050	Entrepreneurship Development	3	0	0	3	100	All
Major	23AUE051	Design Thinking and Innovation	3	0	0	3	100	All
Major	23MEE008	PLM for Engineers	2	0	2	3	100	All

Open Electives

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23ITO001	Enterprise Resource Planning	3	0	0	3	100	-
Minor	23ITO002	Multimedia Systems and Applications	3	0	0	3	100	-
Minor	23ITO003	Cyber Law and Information Security	3	0	0	3	100	-
Minor	23ITO004	Database Technology	3	0	0	3	100	-
Minor	23ITO005	Software Engineering and Design	3	0	0	3	100	-
Minor	23ITO006	Big Data Management and Analytics	3	0	0	3	100	-
Minor	23ITO007	Electronic Commerce	3	0	0	3	100	-
Minor	23ITO008	Graphical User Interface Design	3	0	0	3	100	-

SEMESTER I

Course Code:23VAL101		Course Title: Induction Program (Common to all B.E/B.Tech Programmes)
Course Category: VAC		Course Level: Introductory
Duration: 3 weeks	Mandatory Non- Credit Course	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and the society.

List of Activities:

1. History of Institution and Management: Overview on NIA Educational Institutions – Growth of MCET – Examination Process –OBE Practices –Code of Conduct – Centre of Excellence.
2. Lectures, interaction sessions and Motivational Talks by Eminent people, Alumni, Employer and Industry Experts
3. Familiarisation of Department / Branch:HoD's & Senior Interaction- Department Association
4. Universal Human Value Modules: Aspirations and concerns, Self-Management, Relations Social and Natural Environment.
5. Orientation on Professional Skills Courses
6. Proficiency Modules : Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cells, Clubs and its events
8. Creative Arts : Painting, Music and Dance
9. Physical Activity :Games, Sports and Yoga
10. Group Visits: Visit to local area and Campus Tour

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 : Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

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

High : 3, Medium :2, Low: 1

Text Book(s):

T1. Reading material, Workbook prepared by PS team of the college

Reference Book(s):

R1. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster Uk, 2004.

R2. Vethathiri Maharishi Institute For Spiritual and Intuitional Education, aliyar, “value educatharmonious life (Manavalakalai Yoga)”, Vethathri Publications, Erode, 2010.

R3. Dr.R.Nagarathna, Dr.H.R. Nagendra, “ Integrated approach of yoga therapy for positiveSwami Vivekananada Yoga Prakashana Bangalore,2008 Ed.

Web References:

1. https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV
2. https://www.youtube.com/watch?v=P4vjfEVk&list=PLWDeKF97v9SO0frdgmpaghDMjkom1
3. https://fdp-si.aicte-india.org/download/AboutSIP/About%20SIP.pdf

Course Code: 23ENI101	Course Title: Communication Skills I (Common to all B.E/B.Tech Programmes)		
Course Category: AEC	Course Level: Introductory		
L:T:P(Hours/Week) 2:0:2	Credits: 3	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to impart formal and informal language effectively and accurately in various real-life contexts on par with B1 level of CEFR Scale.

Module I **20 Hours**

Grammar: Synonyms & Antonyms -Tense forms - Modals - Passives – Reported Speech – Comparatives and Descriptive adjectives.

Listening: Listening for gist and specific information - Listening to past events, experiences and job preferences - Listening to descriptions of monuments- Listening for excuses - Listening to description: transportation systems and public places.

Speaking: Introducing oneself - Exchanging personal information – Effective Conversations: Role Play Situations (Describing personality traits - Describing landmarks, monuments and festivals - Making polite requests and excuses - Discussing facts - Asking for and giving information – Expressing wishes - Talking about lifestyle changes - Talking about transportation and its problems - Describing positive and negative features of things and places - Making comparisons)

Reading: Skimming and Scanning - Reading Comprehension - Reading and comprehending online posts and emails – Case Studies

Writing: Letter writing (Permission letters - Online cover letter for job applications) - Instructions - Recommendations - Write a blog (General) - Report Writing (Industrial Visit Report and Event Reports) - formal and informal emails.

Module II **20 Hours**

Grammar: Sequence adverbs - Phrasal verbs - Relative clauses – Imperatives – Infinitives Conditionals.

Listening: Listening to review of food items - Listening to results of surveys- Listening to motivational talks & podcasts

Speaking: Expressing likes and dislikes - Describing a favourite snack - Giving advices and suggestions - Speculating about past and future Events – Group Discussion

Reading: Reading different expository texts - Reading to factual texts - Print and online media- Reading Comprehension.

Writing: Process Descriptions – Email Writing (Requesting for information) - Reviewing Movie -Social media feeds/posts (Any Social Media)

List of Experiments: **20 Hours**

1. Mini Presentation and Picture Prompt Discussion
2. Debate Tournament
3. Listening, Mind Mapping & Summarization
4. Listening to Stories and Providing the Innovative Climax
5. Reading Comprehension
6. Writing - Interpretation of Visuals

Course Outcomes	**CognitiveLevel**
At the end of this course, students will be able to:	
CO1: Utilize the basic English grammar and vocabulary to acquire professional communication skills.	Apply
CO2: Develop listening and speaking skills through classroom activities based on listening comprehension, recapitulation, interpretation and debate on the same	Apply
CO3: Read and write social media posts and comments	Apply
CO4: Perform as a member of a team and engage in individual presentation	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Textbook(s):

T1. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s book 2”,5th Edition, Cambridge University Press, South Asia Edition, 2022.

T2. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s Book 1”, 5th Edition, Cambridge University Press, South Asia Edition, 2022.

Reference Book(s):

R1. David Bohlke, Jack C. Richards, “Four Corners”, 2nd Edition, Cambridge University Press,2018.

R2. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Graham Burton,Empower B1 – Student’s Book, Cambridge University Press, 2020.

R3. Raymond Murphy, “Intermediate English Grammar” 30th Edition, Cambridge University Press,2022.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Course Code: 23MAI103		Course Title: Linear Algebra and Infinite Series (Common to AD, AM, CS, IT & SC)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week)3:0:2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on Linear Algebra, vector spaces, sequences and series in mathematics to have a strong foundation in science and engineering.

Module I **23 Hours**

Solutions to System of Linear Algebraic Equations: Matrices- Rank of a matrix - Consistency of a system of linear equations- Row echelon form-Row reduced echelon form-Gauss elimination method- Crout's method.

Basis and Dimension of Vector Spaces: Vector spaces -Linear Independent and dependent of vectors-Basis, dimension, row space, column space, null space, rank nullity theorem.

Orthogonality and Inner Product Space: Inner product of vectors-Inner product spaces-length of a vector, distance between two vectors, orthogonality of vectors-orthogonal projection of a vector-Gram-Schmidt process- orthonormal basis.

Module II **22 Hours**

Eigen Values and Eigen Vectors: Eigen values and vectors-symmetric, skew symmetric and orthogonal matrices- Diagonalization of matrix through orthogonal transformation-Reduction of quadratic forms to canonical form-rank ,index, signature and nature of quadratic forms-Singular Value decomposition.

Sequences and Series: Sequences-definitions and examples- Series-Tests for convergence-comparison test, integral test, Cauchy's root test, Alembert's ratio test-Alternating series -Leibnitz's test.

List of Experiments: **30 Hours**

1. Introduction to MATLAB
2. Row Echelon form and Row reduced Echelon form of a matrix.
3. Rank of a matrix and solution of a system of linear equations
4. Dimension of row space, column space and null space.
5. Gram-Schmidt Orthogonalization.
6. Eigenvalues and Eigenvectors of matrices.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply matrix techniques for solving system of linear equations and apply the process of orthogonalization to find orthogonal vectors.	Apply
CO2: Determine the canonical form of a quadratic form using orthogonal transformation in Science and Engineering problem solving.	Apply
CO3: Apply different tests to find convergence and divergence of series in the problem solving.	Apply
CO4: Demonstrate the understanding of linear algebra concepts through modern tool.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & sons, 2010.

T2. David C Lay, Linear Algebra and its Applications, 3rd edition, Pearson India, 2011.

T3. Howard Anton, Chris Rorres, Elementary Linear Algebra Applications version,11th edition, Wiley India edition, 2013.

Reference Book(s):

R1. T. Veerarajan, Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill, 2019.

R2. V. Krsihnamurthy, V. P. Mainra and J. L. Arora, An introduction to Linear Algebra, Affiliated East-West press, Reprint 2005.

R3. P. Sivaramakrishna Das , C. Vijayakumari , Engineering Mathematics, Pearson India, 2017.

Web References:

1. https://nptel.ac.in/courses/111106051
2. https://www.classcentral.com/course/matrix-algebra-engineers-11986

Course Code: 23PHT001		Course Title: Physics for Information Sciences (Common to AD, AM, CS, IT & SC)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart the knowledge on working mechanism of laser, fiber optics, display devices and introduce the concepts of integrated circuits, nanotechnology and quantum computing

Module I **22 Hours**

Laser: Characteristics of laser light- Einstein's theory of matter and radiation – A & B Coefficients- Stimulated and spontaneous emission of radiation - Population inversion and pumping methods – Types of laser: Nd: YAG laser and Carbon di oxide (CO2) molecular gas laser - Semiconductor laser (Homo junction and hetero junction) – Applications: Hologram and Holographic data storage (record/read).

Fiber Optics: Optical fibers – Principle of light propagation through optical fibers - Expressions for numerical aperture and acceptance angle - Types of optical fibers based on material, refractive index, and mode of propagation- Fabrication of optical fiber: Double crucible method- Dispersion and attenuation in optical fiber - Photo detectors: PN, PIN & Avalanche photo diodes- Fiber optic communication system and its advantages.

Nano Technology: Introduction – Importance of Nanotechnology – Nanomaterials – Nanoparticles – Synthesis of Nanoparticles: High- energy ball milling (top-down approach) – Sol-gel process (bottom-up approach) – Application of Nanomaterials.

Module II **23 Hours**

Quantum Computing: Introduction to Quantum Computing - Uses and Benefits of Quantum Computing - Features of Quantum Computing: Superposition, Entanglement, Decoherence - Limitations of Quantum Computing – Comparison of Quantum Computer with Classical Computer - Quantum Computers in Development: Google, IBM, Microsoft and others.

Integrated Circuits: Introduction to semiconductors: Intrinsic and extrinsic Semiconductors- Advantages of Integrated circuits (ICs) over discrete components- IC classification- Construction of bipolar transistor: Silicon Wafer Preparation - Epitaxial growth - Oxidation- Photolithography- Isolation diffusion - Base diffusion - Emitter diffusion - Contact mask- Aluminium metallization – Passivation- Structures of integrated PNP transistor.

Display Devices: Human vision - Red, Blue, and Green (RGB) color scheme – Primary and secondary colors- Color addition and subtraction-Optical Emissions: Luminescence, photoluminescence, cathodoluminescence- electroluminescence -Injection electro Luminescence- Displays (Working principles): Plasma display, LED display, Liquid crystal display (LCD) and Numeric display.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the basic concepts of laser, fiber optics and nanotechnology to solve different optical parameters.	Apply
CO2: Perform as a member of team in analyzing the concepts of laser, fiber optics and nanotechnology involved in engineering applications related to science and technology and make a presentation.	Apply
CO3: Interpret the concepts of nanomaterials, IC fabrication techniques and display devices and apply it for different real-life applications.	Apply
CO4: Perform as a member of team in articulating the modern technologies behind nanotechnology, integrated circuits and display devices.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. M. N. Avadhanulu and P. G. Kshirsagar, “Text Book of Engineering Physics”, S. Chand & Company Ltd., New Delhi, 2018.

T2. David Armitage, “Introduction to Micro displays”, John Wiley & Ltd, 2006.

T3. D. Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd, 3rd Edition, 2010

Reference Book(s):

R1. D. Halliday., R. Resnick and J. Walker, “Fundamentals of Physics”, Wiley Publications, 10th Edition, 2014.

R2. Ajoy Ghatak, “Optics”, Tata McGraw-Hill Education, New Delhi, 5th Edition, 2012.

R3. A. Marikani, “Engineering Physics”, PHI Learning, New Delhi, 2nd Edition, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_ph32/preview
2. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
3. https://www.investopedia.com/terms/q/quantum-computing.asp

Course Code: 23CST101		Course Title: Problem Solving using C (Common to AD,AM,CS,IT&SC)	
Course Category: Major		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives: The course is intended to impart knowledge on basic concepts of C.

Module I **23 Hours**

C Programming Basics: General Problem solving strategy – Program development cycle - Problem Solving Techniques : Algorithm, Pseudocode and Flow Chart - Overview of C – Structure of C program – C Character set – keywords - Identifiers – Variables and Constants – Data types – typedef- Type conversion – Operators and Expressions – Managing formatted and unformatted Input & Output operation.

Control Structures: Storage classes - Statements: Selection statements - Jump statements - Iteration statements.

Arrays: Characteristics of Array – Single-dimensional array – Two-dimensional array – Array Operations – Applications: Linear search, Selection sort, Matrix Operations.

Functions: Declaration & Definition – Return statement – Classification of functions – Parameter passing methods: call by value – call by reference – Passing Array to a Function– Returning Array from a function – Recursion.

Module II **22 Hours**

Strings: Declaration and Initialization of string – Display of strings with different formats – String library Functions – String conversion functions.

Pointers: Features - Types of Pointers: Null and Void pointer – Operations on pointers – Pointers to an Array.

Structures: Declaration & Initialization of Structures – Structure within Structure – Array of Structures – Pointer to Structures.

Union: Declaration & Initialization of Union – Enumerations.

Files: Introduction to Files – Streams and File Types – File operations (Open, close, read, write) – Command line arguments.

Preprocessor Directives: Macro Expansion, File Inclusion, Conditional Compilation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the fundamental concepts of programming, such as variables, data types, control structures, and functions.	Understand
CO2: Design and develop C programs for real-world applications	Apply
CO3: Apply problem-solving skills and knowledge of c programming constructs to solve a given problem	Apply
CO4: Analyze and debug C programs to identify and fix errors.	Analyze
CO5: Apply modular programming techniques to break down complex programs into smaller, manageable modules	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Yashavant P.Kanetkar, “Let Us C”, 19th Edition, BPB Publications, 2022.

T2. Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, 3rd Edition, Pearson Education, 2015.

Reference Book(s):

R1. Ajay Mittal, “Programming in C - A Practical Approach”, 3rd Edition, Pearson Education, 2010.

R2. Brian W.Kernighan and Dennis M.Ritchie,”The C Programming Language” 2nd Edition, Pearson Education, 2015.

R3. Venit S, and Drake E, “Prelude to Programming Concepts and Design”, 6th Edition, Pearson Education, 2014

R4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, 2nd Edition, Oxford University Press, 2013.

Web References:

1. http://www.cprogramming.com/

2. http://www.c4learn.com/

Course Code: 23EEI101	Course Title: Basics of Electrical and Electronics Engineering (Common to AD, AM, CS, IT and SC) (2023 Batch Only)		
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on engineering fundamentals of DC&AC circuits, Electrical machines, Electron devices, Carpentry and plumbing.

Module I **22 Hours**

Fundamentals of DC Circuits: Definition, symbol and unit of quantities – Active and Passive elements – Ohm's Law: statement, – Kirchhoff's Laws: statement and illustration – Resistance in series and voltage division rule – Resistance in parallel and current division rule – Star to Deltaand Delta to Star transformation- circuit simplification.

AC Fundamentals: Magnetic Circuits: Definition of magnetic quantities – Law of electromagnetic induction – Generation of single phase alternating EMF – Terminology – 3Phase System: 3-Wire and 4 Wire system – Root Mean Square (RMS) – Average value of AC

DC Machines: DC Generator and DC Motor: Construction, Working Principle.

Module II **23 Hours**

AC Machines: Single phase transformer: Construction, working principle - Single phase induction motor: Capacitor start and run -Three phase induction motor: An introduction.

Semiconductor Devices: Theory of Semiconductor: PN junction diode, Forward Bias Conduction, Reverse Bias Conduction, V-I Characteristics – Bipolar Junction Transistor: Operation of NPN and PNP Transistor, Common Emitter Configuration – MOSFET: construction and working principle.

Opto-Electronic Devices and Transducers: Opto-Electronic Devices: Working principle of Photoconductive Cell, Photovoltaic Cell-solar cell Transducers: Capacitive and Inductive Transducer, Thermistors, Piezoelectric and Photoelectric Transducer.

List of Experiments **30 Hours**

Electrical & Electronics:

1) Identification of resistor and capacitor values
2) Soldering practice of simple circuit and checking the continuity
3) Fluorescent tube, staircase and house wiring
4) Characteristics of PN Diode

Civil & Mechanical:

1) Make a wooden Tee joint to the required dimension
2) Make a tray in sheet metal to the required dimension
3) Assemble the pipeline connections with different joining components for the given layout

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the basic laws and simplification techniques of electrical Engineering in DC and AC Circuits.	Apply
CO2: Summarize the construction and working of Motors, Generator and transformer.	Understand
CO3: Analyze the characteristics of diodes and transistors based on its construction and working principle.	Analyze
CO4: Summarize the working of opto-electronic devices and transducers	Understand
CO5: Examine and report the analysis of different resistors, capacitors, house wiring concepts, wooden joints and pipeline connection.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	1	1	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1. R. Muthusubramanian and S.Salivahanan, “Basic Electrical and Electronics Engineering”, McGraw Hill India Limited, New Delhi, 2014.

T2. S. K. Sadhev, “Basic Electrical Engineering and Electronics”, Tata Mcgraw Hill, 2017.

Reference Book(s):

R1. B.L Theraja, “Fundamental of Electrical Engineering and Electronics”, S.ChandLimited, 2022.

R2. J.B.Gupta, “Basic Electrical and Electronics Engineering”, S.K.Kataria & Sons, 2013.

R3. Smarajit Ghosh, “Fundamental of Electrical and Electronics Engineering”, 2nd Edition, PHI Learning Private Limited New Delhi, 2010.

Web References:

1. https://www.nptel.ac.in/courses/108108076
2. https://archive.nptel.ac.in/courses/108/105/108105112
3. https://archive.nptel.ac.in/courses/108/101/108101091

Course Code: 23EEI102	Course Title: Introduction to Electrical and Electronics Engineering (Common to AD, AM, CS, IT & SC) (From 2024 Batch Onwards)		
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week): 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on engineering fundamentals of electric circuits, Electrical machines, and Electron devices.

Module I **23 Hours**

Fundamentals of DC Circuits: Definition, symbol and unit of quantities – Active and Passive elements – Ohm's Law: statement, – Kirchhoff's Laws: statement and illustration – Resistance in series and voltage division rule – Resistance in parallel and current division rule –circuit simplification.

AC Fundamentals: AC Terminologies – Law of electromagnetic induction – Generation of single phase alternating EMF – Root Mean Square (RMS) – Average value of AC

Electrical Machines: Construction and Working Principle of DC shunt Motor, Stepper Motor and single phase transformer

Module II **22 Hours**

Semiconductor Devices: PN junction diode, Forward Bias Conduction, Reverse Bias Conduction, V-I Characteristics – Half wave and Full wave rectifier using diodes – SMPS – UPS - Bipolar Junction Transistor: Operation of NPN and PNP Transistor, Common Emitter Configuration

Opto-Electronic Devices and Transducers: Opto-Electronic Devices: Working principle of Photoconductive Cell, Photovoltaic Cell – LED&LCD display - Thermistors, Thermocouple, and Piezoelectric Transducers.

Fuses – Circuit breaker: MCB, MCCB – Energy efficiency star rating.

List of Experiments **30 Hours**

1. Identification of resistor and capacitor values.
2. Soldering practice of simple circuit and checking the continuity.
3. Staircase and house wiring.
4. Characteristics of PN Diode.
5. Half wave and full wave rectifier using diodes.
6. Characteristics of CE configuration transistor.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the basic laws and simplification techniques in electrical engineering using electric circuits.	Apply
CO2: Make use of the basic laws and principles of electric circuits in analysis of the electrical machines viz., Motors & transformers, UPS and SMPS	Analyze
CO3: Analyse the Diodes, Transistors, Opto-Electronic Devices and Transducers	Analyze
CO4: Investigate and report the analysis of different resistors, capacitors, house-wiring concepts.	Evaluate

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Textbook(s):

T1. R.Muthusubramanian and S.Salivahanan, “Basic Electrical and Electronics Engineering”, McGraw Hill India Limited, New Delhi, 2014.

T2. S. K. Sadhev, “Basic Electrical Engineering and Electronics”, Tata Mcgraw Hill, 2017.

Reference Book(s):

R1. B.L Theraja, “Fundamental of Electrical Engineering and Electronics”, S.Chand Limited, 2006.

R2. J.B.Gupta, “Basic Electrical and Electronics Engineering”, S.K.Kataria & Sons, 2009.

R3. Smarajit Ghosh, “Fundamental of Electrical and Electronics Engineering”, 2nd Edition, PHI Learning Private Limited New Delhi, 2010.

Web References:

1. https://www.nptel.ac.in/courses/108108076
2. https://archive.nptel.ac.in/courses/108/105/108105112
3. https://archive.nptel.ac.in/courses/108/101/108101091

Course Code: 23PHL001		Course Title: Physics for Information Sciences Laboratory (Common to AD, AM, CS, IT & SC)	
Course Category: Minor		Course Level: Introductory	
L:T:P (Hours/Week)0:0:3	Credits:1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to expose the students to various experimental skills, which arevery essential for an Engineering student.

List of Experiments: **45 Hours**

1. Determination of wavelength of the Laser using plane transmission grating.
2. Estimation of particle size of fine lycopodium powder using laser.
3. Measurement of acceptance angle and numerical aperture of an optical fiber –Laser diffraction method.
4. Determination of band gap of semiconducting materials – Thermistor(Germanium).
5. Light Illumination characteristics of Light dependent resistor (LDR).
6. Measurement of thickness of thin material – Air wedge method.
7. Determination of wavelength of the spect ral lines of mercury spectrum usinggrating.
8. I-V characteristics of solar cell.
9. I-V characteristics of photo diode.
10. Verification of truth tables of logic gates.
11. Design of logic gates using discrete components.
12. I-V characteristics of LED.

Course Outcomes	CognitiveLevel
At the end of this course, students will be able to:	
CO1: Elucidate the basic principles involved in the given experiments	Understand
CO2: Conduct, analyze and interpret the data and results from physicsexperiment	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Physics Laboratory Manual Prepared by Faculty of Physics, Dr. Mahalingam College of Engineering and Technology.

R2. Engineering Physics Laboratory Manual, Dr. R. Jayaraman, V. Umadevi, S. Maruthamuthu, B. Saravanakumar, Pearson India Education Services Pvt. Ltd, 2022.

R3. B.Sc., Practical Physics, C.L. Arora, S. Chand and Co, 2012.

Web References:

1. https://bop-iitk.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/index.php?sub=1&brch=281
3. https://vlab.amrita.edu/index.php?sub=1&brch=189

Course Code: 23CSL101		Course Title: Problem Solving using C Laboratory (Common to AD,AM,CS,IT&SC)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0:0:3	Credits:1.5	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to enable the students for writing simple programs in C.

List of Experiments: **45 Hours**

1. Develop Algorithm, Flowchart and Pseudo code for given problem.
2. Develop C programs using data types, I/O statements, Operators and Expressions.
3. Develop C programs using Decision-making constructs.
4. Implement C programs using looping statements.
5. Design C programs to implement the concept of arrays.
6. Design C programs to implement the concept of strings
7. Develop C programs using functions.
8. Develop C programs using pointers.
9. Implement the concept of structures using C.
10. Implement C programs to perform file operations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate proficiency in using development environments, compilers, and debugging tools for C programming	Apply
CO2: Apply C programming concepts to practical programming tasks	Apply
CO3: Demonstrate an understanding of the importance of code efficiency and optimization in C programming	Analyze
CO4: Work as a team in a laboratory environment to develop and demonstrate projects with an oral presentation	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Reference Book(s):

R1. Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, 3rd Edition, Pearson Education, 2015.

R2. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Pearson Education, 2013.

R3. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

R4. ReemaThareja, “Programming in C”, Oxford University Press, 2nd Edition, 2016.

Web References:

1. https://electronicsforu.com/resources/15-free-c-programming-ebooks
2. https://www.fromdev.com/2013/10/c-programming-tutorials.html
3. https://books.goalkicker.com/CBook/

Course Code: 23VAL102	Course Title: Wellness for Students (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0 :2	Credits:1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on setting SMART goals for academic, career and life, applying time management techniques, articulating the importance of wellness for success in life and understanding the dimensions of wellbeing and relevant practices.

Module I **15 Hours**

Goal Setting Understanding Vision and mission statements - Writing personal mission statements – „Focus" as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, what you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

Time Management - Tools and Techniques Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying „NO"
– Managing procrastination.

Concept of Wellness – impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

Module II **15 Hours**

Simplified Physical Exercises. Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

Practices for Mental Wellness

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas.

Putting Into Practice

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Set well-articulated goals for academics, career, and personal aspirations	Apply
CO2: Apply time management techniques to complete planned tasks on time	Apply
CO3: Explain the concept of wellness and its importance to be successful in career and life	Apply
CO4: Explain the dimensions of wellness and practices that can promote wellness	Apply
CO5: Demonstrate the practices that can promote wellness	Valuing

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	-	-	-	-	-	-	-	-	1	-	1	1
CO3	-	-	-	-	-	-	-	-	1	-	-	1
CO4	-	-	-	-	-	-	-	-	1	-	-	1
CO5	-	-	-	-	-	1	1	-	1	-	-	1

High-3; Medium-2;Low-1

Text Book(s):

T1. Reading material, workbook and journal prepared by PS team of the college

Reference Book(s):

R1. Stephen R Covey, “First things first”, Simon & Schuster UK, Aug 1997

R2. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster UK, 2004.

R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, I Ed. (2010).

R4. Dr. R. Nagarathna, Dr. H.R. Nagendra, “Integrated approach of yoga therapy forpositive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.

R5. Tony Buzan, Harper Collins, “The Power of Physical Intelligence English”

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்ள இயலும்.

CO.2இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்ள இயலும்.

தமிழர் மரபு

அலகு 1 – மொழி மற்றும் இலக்கியம் 3

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

அலகு 2 – மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை 3

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

அலகு 3 – நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

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

அலகு 4 – தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக் கோட்பாடு – சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5 – இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுய மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள்– தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
மாணவர்கள் இப்பாடத்தை கற்றபின்	
CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

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

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

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

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

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

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

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

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.
2. Understand the Contribution of Tamils to Indian National Movement and Indian Culture.

HERITAGE OF TAMILS

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

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.	Understand
CO.2 Understand the Contribution of Tamils to Indian National Movement and Indian Culture.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

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

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

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

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

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

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

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

SEMESTER II

Course Code: 23ENI201		Course Title: Communication Skills II (Common to all B.E/B.Tech Programmes)	
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:2	Credits: 3	Total ContactHours:60	Max Marks:100

Course Objectives

The course is intended to impart effective and accurate language in business correspondence on par with B2 level of CEFR Scale.

Module I **20 Hours**

Grammar: Linking Words - Collocations –Sentence Completion - Articles - Adverbs- Indefinite Pronoun

Listening: Listening to short conversations - Listening for gist and summarizing - Listening for detail - Responding to straightforward questions.

Speaking: Making statements of facts - Agreeing and disagreeing to opinions - Respond to queries - Group Discussion.

Reading: Read and select (phrasal verbs & relative clause)- Cloze Test - Gapped sentences - Multiple- choice gap-fill

Writing: Paragraph Writing: Descriptive, narrative, persuasive and argumentative - Emails: Giving information - Making enquiries - Responding to enquiries - Power Point Presentation

Module II **20 Hours**

Grammar: Expressions of cause and result – Concord - Error Spotting (Parts of Speech & Indian English) - Prepositions.

Listening: Listening for identifying main points - Responding to a range of questions about different topics - Listening to identify relevant information

Speaking: Empathetic Enunciation – Situation handling – Visual Interpretation - - Short presentations

Reading: Intensive Reading: Comprehending business articles, reports and proposals and company websites-- Open gap-fill - Extended reading

Writing: Report Writing - Memo – Complaint letter - Business Letters (Seeking permission & Providing Information)

List of Experiments: **20 Hours**

1. Listening to Monologue and Extended Listening Activity I
2. Listening to Monologue and Extended Listening Activity II
3. Expressing Opinions and Situational based speaking
4. Mini Presentation and Visual Interpretation
5. Reading Comprehension
6. Writing letter, email and report

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify the common errors in written and spoken correspondence.	Apply
CO2: Develop listening, reading and speaking skills through task based activities in listening, reading comprehension, recapitulation, interpretation and discussion.	Apply
CO3: Read business correspondences like memo, Email, letter, proposals and write reports and website entries and product launches.	Apply
CO4: Perform as an individual and member of a team and engage effectively in group discussion and individual presentation.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Textbook(s):

T1. Guy Brook- Hart, “Business Benchmark Upper Intermediate”, 2nd Edition, South Asian, Cambridge University Press, 2020.

T2. Norman Whitby, “Business Benchmark pre-intermediate to Intermediate”, 2nd Edition,South Asian, Cambridge University Press, 2014.

Reference Book(s):

R1. Hewings Martin - Advanced Grammar in use Upper-intermediate Proficiency, CUP,3rd Edition,2013.

R2. Clark David – Essential BULATS (Business Language Testing Service), CUP, 2006.

R3. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Rachel Godfrey, Gareth Davies, Empower B1+ – Student’s Book, Cambridge University Press,2015.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Course Code:23FLT201		Course Title: Foreign Language - Japanese (Common to all B.E/B.Tech Programmes)	
Course Category: AES		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max. Marks:100

Course Objectives:

The course objectives intended to:

1. Express a basic exposure on Japanese language and culture
2. Express thoughts and communicate in the beginner level of Japanese with native Japanese speaker
3. Identify the kanji etymology as well as use it in basic vocabulary required for the JLPT / NAT 5 examination level
4. Read and write 100 kanji of the official JLPT N5
5. Choose the appropriate verb forms for learning and practicing the Japanese language

UNIT I Introduction to Japan and greetings 9 Hours

Japan : Land and culture - Introduction to Japanese language – Greetings – Seasons - Days of the week - Months of the year – Dates of the month - Self introduction – Numbers (Upto 99,999) – Expressing time – Conversation audio and video.

Listening: Listening to Greetings - Listening for Specific Information: Numbers, Time. Speaking: Self-Introduction

UNIT II Building vocabulary 9 Hours

Family relationships - Colours - Parts of body - Profession - Directions - Time expressions (today, tomorrow, yesterday, day before, day after) - Japanese housing and living style - Food and transport (vocabulary) - Stationery, fruits and vegetables

Listening: Listening for Specific Information: Directions, Family Members, Parts of body Speaking: Introducing one's family.

UNIT III Writing systems 9 Hours

Hiragana Chart 1 - vowels and consonants and related vocabulary – Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary – Introduction to Kanji – Basic Vocabulary – Basic Conversational Phrases.

Listening: Listening to Japanese Alphabet Pronunciation, Simple Conversation. Speaking: Pair Activity (Day to day situational conversation)

UNIT IV Kanji and preposition 9 Hours

Katakana script and related vocabulary – Basic kanjis: naka, ue, shita, kawa , yama , numbers (1- 10, 100, 1000, 10,000 and yen) , person, man, woman, child, tree , book , hidari, migi, kuchi , 4 directions - Usage of particles wa, no, mo and ka and exercises - Usage of kore, sore, are, kono, sono, ano, arimasu and imasu - Particles – ni (location) and ga , donata and dare - Particles ni (time), kara, made , ne , koko, soko, asoko and doko - Directions : kochira, sochira, achira and dochira , associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)

Listening: Listening to conversation with related particles

UNIT V Verb forms 9 Hours

Introduction to Verbs - Verbs –Past tense, negative - i-ending and na-ending adjectives introduction - ~masen ka, mashou - Usage of particles de, e , o, to, ga(but) and exercises - Adjectives (present/past – affirmative and negative) – Counters - ~te form

Listening: Listening to different counters, simple conversations with verbs and adjectives. Speaking: Pair Activity (Explaining one's daily routine by using appropriate particles and verbs)

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Recognize and write Japanese alphabet	Understand
CO2: Comprehend the conversation and give correct meaning	Understand
CO3: Apply appropriate vocabulary needed for simple conversation in Japanese language	Apply
CO4: Apply appropriate grammar to write and speak in Japanese language	Apply
CO5: Speak using words of the Japanese language	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Genki 1 Textbook: An Integrated Course in Elementary Japanese by Eri Banno, Yoko Ikeda, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, Kyoko Tokashiki published by The Japan Times

T2. Genki 1 Workbook: An Integrated Course in Elementary Japanese by Eri Banno published by The Japan Times

Reference Book(s):

R1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007

R2. Japanese for Everyone: Elementary Main Textbook1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007

Web References:

1. www.japaneselifestyle.com
2. www.learn-japanese.info/
3. www.learn.hiragana-katakana.com/typing-hiragana-characters/
4. www.kanjisite.com/

Course Code:23FLT202		Course Title: Foreign Language - German (Common to all B.E/B.Tech Programmes)	
Course Category: AEC		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max. Marks:100

Course Objectives:

The course is intended to:

1. Listen and understand numbers, names and dialogues of a native speaker on par with A1 level.
2. Speak and introduce self in simple sentences to convey their opinion and ideas on par with A1 level.
3. Read simple passages and given text on par with A1 level.
4. Write letter and simple sentences on par with A1 level.

UNIT I Basic Introduction to German Scripts 9 Hours

Theme and Text (Introduction to German - German script, Deutsche Namen, Daily Greetings and Expressions) – Grammar ('wh' questions, das Alphabet)– Speak Action (Buchstabieren, sich und andere vorstellen nach Namen und Herkunft fragen, internationale Wörter auf Deutsch verstehen, jemanden begrüßen)– pronunciation (Buchstabieren J,V,W,Y, - Long vowels A,E,I,O,U - Pronunciation of Ä,Ü,Ö) – To learn (internationale Wörter in Texten finden, Wörter sortieren)

Theme and Text (Gespräche im caf'e, Getränkekarte, Telefon-buch, Namen, Rechnungen) – Grammar (Frägesatze mit wie, woher, wo, was Verben in präsens Singular und Plural, das Verb Sein, Personalpronomen und Verben)– Speak Action (eine Gespräch beginnen sich und andere vorstellen zählen, etwas bestellen und bezhalen Telefonnummern und verstehen)– pronunciation (Wortakzent in Verben und in Zahlen) – To learn (Grammatiktabelle ergänzen, mit einem Redemittelkasten arbeiten)

UNIT II Numbers and Nominative Case 9 Hours

Theme and Text (Numbers – 1 to 12 (Eins bis Zwolf) – 20, 30, 40, 90 (zwanzig-Neunzig) – All Numbers (1-10000) – German Currency (Euro) – Basic Mathematics (plus, Minus, Malen, Geteilt durch)) – Grammar (Introduction of verbs –Have Verb – To Come, To Speak, To Read, To Drive, To Fly, To write, To Eat, To sleep, To take etc.,)

Theme and Text (Communication in course) – Grammar (Singular and Plural, Artikel: der,das,die/ ein,eine, verneinung: kein, keine, Komposita: das Kursbuch) – Speak Action (Gegenständen fragen/ Gegenstände benennen im kurs:) – pronunciation (word accent

Marking, Umlaute ö ä ü hören und sprechen) – To learn (Lernkarten schreiben, Memotipps, eine Regel selbst finden)

Theme and Text (City, Town, Language: Nachbar, Sprachen, Sehenswürdigkeiten in Europa) – Grammar (Past tense for Sein, W-Frage, Aussagesatz und Satzfrage) – Speak Action (about city and siteseeing) – pronunciation (Satzakzent in Frage- und Aussagesätzen) – To learn (eine Regel ergänzen, eine Grammatiktabelle erarbeiten, Notizen machen)

UNIT III Akkusative Case and Prepositions 9 Hours

Theme and Text (Menschen und Hauser, Furniture catalogue, E-Mail, House information) – Grammar (possesivartikel im Nominativ, Artikel im Akkusativ, Adjektive im satz, Graduierung mit zu)– Speak Action (Whonung bescreiben about perons and things)– pronunciation (consonant - ch) – To learn (wortschatz systematisch)

Theme and Text (Termine - Appointment and punctuality in Germany) – Grammar (questions with wann?, Preposition (am, um, von... bis), verneinung mit nicht, trennbare verben, präteritum von haben) – Speak Action (Daily plan making, time commitment, excuse for late coming) – pronunciation (consonants- p,b,t,d / k,g) – To learn (Rollenkarten arbeiten) Theme and Text (orientation in working area, go for work, floor plan city plan, office and computer) – Grammar (preposition: in,neben, unter, auf, vor, hinter, an, zwischen, bei und mit + Datic)– Speak Action (work place, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in calender)

UNIT IV Dativ Case and Prepositions 9 Hours

Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and iregular verbs) – Speak Action (holiday speak, accident, Ich-Text schreiben) – pronunciation (lange und kurze vokale markieren) – To learn (Text Order)

Theme and Text (organising an Excursion to Berlin through city orientation, Bus plan, City plan, post card, Excursion programme) – Grammar (preposition: in, durch, über + Akkusativ: zu, an... vorbei + Dativ, Modalverb wollen) – Speak Action (Tourism, culture, postcard preparation, travel description) – pronunciation (r and l)– To learn (plaket making)Theme and Text (Beruf und all Tag, Visiten karten, wörterbuch) – Grammar – Speak Action (profession, statistic speaking) – pronunciation (n,ng and nk)– To learn (wörterbuch , text information in tabel)

UNIT V Adjectives and Pronunciation 9 Hours

Theme and Text (Haushaltstipp, kochrezept, maße und gewichte, Mahlzeiten und Gerichte) – Grammar (jeden Tag, manchmal, nie, Question - welche, Comparison – viel, gut, gern) – Speak Action (about eat, drink question and answers) – pronunciation (e,en,el,er) – To learn (Text auswerten und zusammenfassen)

Theme and Text (Clothing , colour, weather) – Grammar (Adjecktive im Akkusativ, unbestimmer Artikel) – Speak Action (weather, dress and colour understanding) – pronunciation (e-o- ö and ie-u- ü) – To learn (wetter and Farben interkulturelle)

Theme and Text (in super market,purchase, House Maintainence, Emotion, Sports, Body parts) – Grammar (Modal Verb) – Speak Action (Body parts) – To learn (Rollenkarten arbeiten)

Total:45 Hours

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Recognize and write German alphabet, numbers.	Understand
CO2: Comprehend the conversation and give correct meaning	Understand
CO3: Apply appropriate grammar and vocabulary to write and speak.	Apply
CO4: Apply appropriate cases and texts to listen, write and speak.	Apply
CO5: Speak and read using words of the German language	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s)

T1. Netzwerk, “Deutsch als Fremdsprache” by Stefanie Dengler, Paul Rusch, Helen Schmitz published by Goyal Publishers & Distributors Pvt Ltd;

T2. Funk, Kuhn, Demme, “Studio D A1 Deutsch als Fremdsprache” published by Goyal Publishers & Distributors Pvt Ltd;

Reference Book(s)

R1. Hueber, “Fit for Goethe- Zertifikat A1 (Start Deutsch 1)” by Goyal Publishers and Distributors; 2016

Course Code: 23MAI203		Course Title: Calculus and Transforms (Common to AD, AM, CS, IT & SC)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) : 3: 0 :2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on differential calculus, vector calculus, ordinary differential equations, Fourier Series and Z transform to devise engineering solutions to solve real world problems.

Module I **23 Hours**

Differential Calculus: Curvature-Cartesian and Polar coordinates- radius of curvature-center of curvature- circle of curvature- Evolutes and Involutes.

Multivariable Calculus: Partial derivatives-total derivatives-Jacobian- maxima and minima and saddle points- Constrained maxima and minima: Method of Lagrange multipliers--Gradient- directional derivative- curl and divergence.

Ordinary Differential Equations of Second and Higher Orders: Second and higher order linear differential equations with constant coefficients – Second order linear differential equations with variable coefficients (Cauchy - Euler equation, Legendre's equation) – Method of variation of parameters – Solution of first order simultaneous linear ordinary differential equations.

Module II **22 Hours**

Fourier Series: Dirichlet's condition -Fourier series – Even and odd functions- Half rangesine and cosine series - Parseval's identity -Harmonic Analysis.

Z Transforms: Z transform- region of convergence- properties of z transforms- inverse transform-Solution to homogeneous linear constant difference equations.

List of Experiments (Using suitable software): **30 Hours**

1. Find the radius of curvature of a given curve.
2. Find the extremum value of a given function.
3. Compute second order ordinary differential equation.
4. Find the Fourier series of a periodic function.
5. Compute solution of difference equation using z transform.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply differential calculus to find curvature of a curve, Jacobian, extremum of functions of several variables and vector quantities to solve problems in Science and Engineering.	Apply
CO2: Solve the second and higher order ordinary differential equations using various techniques.	Apply
CO3: Determine the Fourier series of periodic functions and solve finite difference equations using Z-transforms.	Apply
CO4: Develop programs using calculus and transforms concepts through modern tool.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & sons, 2010.

T2. B.S.Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2015.

Reference Book(s):

R1. Veerarajan T., Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill,New Delhi, 2019.

R2. Srimanta Pal & Subodh C. Bhunia. “Engineering Mathematics”, 1st Edition, Oxford University Press, 2015.

R3. P. Sivaramakrishna Das , C. Vijayakumari , Engineering Mathematics, Pearson India, 2017.

Web References:

1. https://nptel.ac.in/courses/111104092
2. https://www.classcentral.com/course/differential-equations-engineers-13258

Course Code: 23ITT201		Course Title: Data Structures (Common to AD,AM CS,IT &SC)	
Course Category: Major		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The objective of the course is to impart knowledge of fundamental data structures and how they are implemented. Additionally, learn how to apply the right data structures for solving problems.

Module I **22 Hours**

Linked List: Introduction- Types of Data Structures- Abstract Data type

List ADT: Array Implementation of list - Linked List Implementation list – Doubly Linked List – Circularly Linked List-Applications: Radix sort.

Stack ADT: Stack Model – Array and Linked List Implementation of Stack - Applications: Balancing Symbols - Postfix Expressions- Infix to Postfix Conversion

Queue ADT: Queue Model – Array and Linked List Implementation of Queue-Double ended Queue- Applications of Queue

Trees: Implementation of Trees - Tree Traversals -Binary Trees: Implementation – Expression Trees – Binary Search Tree: Implementation

Module II **23 Hours**

AVL Trees: Implementation -Single Rotation – Double Rotation.

Binary Heap: Min Heap-Max Heap

Graphs: Definitions – Representation of Graphs – Graph Traversals: Breadth First Search – Depth First Search -Topological Sort

Shortest Path Algorithms: Unweighted Shortest Paths -Dijkstra's Algorithm – Critical Path

All Pairs Shortest Path: Floyds Algorithm

Minimum Spanning Tree: Prim's Algorithm – Krushkal's Algorithm.

Internal Sorting:-Insertion Short-Shell Sort-Merge Sort-Quick sort

External sorting: Simple Algorithm-Multiway Merge

Hashing: Hash Functions-Separate Chaining-Open Addressing-Rehashing-Extendible hashing

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement principles of Data Structures that efficiently manage dynamic collections of data in real-world applications.	Apply
CO2: Categorize the linear data structures list, stack and queue to various applications	Analyze
CO3: Relate the nonlinear data structures trees and graph concepts to various applications	Analyze
CO4: Interpret various internal and external sorting techniques to solve real world problems across different domain	Apply
CO5 : Analyze different hash function properties for efficient data storage and retrieval systems	Analyze
CO6: Develop solutions with ethical standards as a team to the practical problems using Data Structures Concepts	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	-	-	-	-
CO6	-	-	3	2	-	-	-	3	3	3	3	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education Asia, New Delhi, 2015.

Reference Book(s):

R1. Sahni Horowitz , “Fundamentals of Data Structures in C”, 2nd Edition Tata McGraw-Hill, New Delhi, 2008.

R2. Seymour “Lipschutz, Data Structures with C”, McGraw Hill, 2014.

R3. Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, “Introduction to Algorithms” 3rd ed., The MIT Press Cambridge, 2014

Web References:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://archive.nptel.ac.in/courses/106/106/106106127/
3. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Course Code: 23EEI201		Course Title: Digital System Design (Common to AD,AM,CS,IT and SC)	
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week): 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on basics of logic gates, number system and different types of implementations of digital circuits with its simplification methods. Also, course describes the analysis of synchronous and asynchronous sequential circuit. At the end of the course the basics in design of computer system is discussed.

Module I **15 Hours**

Number System Representation and Conversion - Logic Gates, Universal Gates - Boolean Algebra and Simplification Techniques: SOP – POS and Karnaugh Map Methods for Boolean Expression Simplification. Implementation of Combinational Logic - Arithmetic Circuits: Full Adder- Full Subtraction - Magnitude Comparator – Multiplexer – De-Multiplexer – Encoder and Decoder.

Module II **15 Hours**

Flip-Flop: RS - JK – T and D – Types of Triggering. Analysis of synchronous sequential circuit - Shift Register. Analysis of asynchronous sequential circuit – Hazards – Static, Dynamic and Essential Hazards Computer System – Computer Memory - Random Access Memory - Read Only Memory - Expanding Memory Capacity –Secondary Storage - Input / Output Devices.

List of Experiments **30 Hours**

1. Verification of Boolean theorems using digital logic gates
2. Implementation of combinational circuits using basic gates
3. Logic verification of half adder and full adder
4. Logic verification of Multiplexer / De-Multiplexer
5. Logic verification of 4 bit shift register
6. Logic verification of 3 bit binary counter

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the numbers system representation, operation of logic gates and design of computer system	Understand
CO2: Apply the fundamental concepts of Boolean algebra insimplification of digital circuits	Apply
CO3: Design and implement the arithmetic circuits using combinational logiccircuits.	Create
CO4: Analyze the sequential logic circuit and infer the results.	Analyze
CO5: Analyze and interpret the digital circuits by performing hardware implementations and report the inference as a team or individual.	Evaluate

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. M. Morris Mano, “Digital Logic and Computer Design”, 1st Edition, Pearson Publication, New Delhi, 2016.

T2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, 6th Edition, McGraw-Hill, 2011.

Reference Book(s):

R1. Anil K. Maini, “Digital Electronics Principles, Devices and Applications”, John Wiley & Sons,1st Edition, 2007.

R2. Charles H.Roth, Jr. “Fundamentals of Logic Design”, 7th Edition, Jaico publishing House,New Delhi, 2014.

R3. S.Salivahanan and S. Arivazhagan, Digital Circuits and Design, Oxford University Press, 5th Edition, 2018.

R4. Leach P Donald, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications”, 7th Edition, Mcgraw Hill, 2010.

Web References:

1. http://www.nptel.ac.in/courses/ 108105132
2. https://de-iitr.vlabs.ac.in
3. https://nptel.ac.in/courses/117105080

Course Code: 23MEL001	Course Title: Engineering Drawing (Common to AD,AM,CS,EA,EC,EE,EV,IT,SC)		
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week) 1: 0: 3	Credits:2.5	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on basic dimensioning. 2D and 3 D drawings such as points, lines,planes and solids on first quadrant.

Module I **8 Hours**

Basics of Engineering Drawing: Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Basic Geometrical constructions –Orthographic projection- Free hand Sketching.

Projection of Points, Lines: First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces by rotating object method.

Projection of Solids: Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination).

Module II **7 Hours**

Sectioned Solids: Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other – Orthographic views of sections of simple solids.

Development of Surfaces: Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders using straight line and radial line method.

Isometric Projection: Principles of isometric projection – Isometric scale –Isometric projections of simple solids and truncated solids. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination).

List of Experiments **45 Hours**

1. Lettering & Dimensioning
2. Projection of Points & Lines
3. Orthographic projections
4. Projection of Simple Solids
5. Projection of Section of Simple Solids
6. Development of Surfaces
7. Isometric Projections

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO 1: Apply the concepts related to free hand sketching, orthographic and Isometricprojection in first quadrant.	Understand
CO2: Apply the concepts and draw projections of points in four different quadrants and lines located first quadrant.	Apply
CO3: Apply the concepts and draw projections and sections of simple solids using rotating object method.	Apply
CO4: Apply the concepts and draw lateral surface of simple solids using straight line and radial line development methods.	Apply
CO5: Apply the concepts and draw isometric view of simple solids and truncated solids using principles of isometric projection.	Apply
CO6: Conduct experiments to demonstrate concepts, implement and analyze the drawing concepts using engineering tool: Using AutoCAD.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-
CO6	-	3	-	-	3	-	-	-	1	1	-	1

High-3; Medium-2; Low-1

Textbook:

T1. Cencil Jensen, Jay D.Helsel and Dennis R. Short, " Engineering Drawing and Design", TataMcGraw Hill India, New Delhi, 3rd edition, 2019.

Reference Book(s):

R1.Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill India,New Delhi, 2nd edition, 2014.

R2. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw India, New Delhi, 3rd edition, 2010.

R3. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, Gujarat, 54rd edition, 2023.

Publications of Bureau of Indian Standards

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
2. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.IS 11669 – 1986 &SP 46 – 2003: Dimensioning of Technical Drawings.
3. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods. The mode ofdelivery is like practical.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://www.coursera.org/specializations/autodesk-cad-cam-cae-mechanical-engineering

Course Code: 23ITL201		Course Title: Data Structures Laboratory (Common to AD,AM,CS,IT & SC)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0:0:3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives:

The objective of the course is to improve students' abilities to create and analyze basic linear and nonlinear data structures. It improves students' capacity to pick and use the ideal data

List of Experiments **45 Hours**

1. Array based implementation of List ADT
2. Array based implementation of Stack ADT and Queue ADT
3. Linked list implementation of List ADT
4. Linked list implementation of Stack ADT and Queue ADT
5. Implementation of Binary Tree traversals
6. Implementation of Binary Search Tree
7. Implementation of Graph traversals
8. Implementation of Floyds Algorithms
9. Implementation of insertion sort
10. Implementation of Quick sort

Course Outcomes	CognitiveLevel
At the end of this course, students will be able to:	
CO1: Implement linear data structure operations using C programs	Apply
CO2: Predict the solution using non-linear data structure data structuresusing C programs	Evaluate
CO3: Evaluate the efficiency of sorting algorithms using relevant data structures	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	-	2	-	3	3	-	-	-	-	-	-	-
CO3	-	-	2	3	3	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education Asia, New Delhi, 2015.

R2. Sahni Horowitz , “Fundamentals of Data Structures in C”, 2nd Edition Tata McGraw-Hill, New Delhi, 2008.

Web References:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://archive.nptel.ac.in/courses/106/106/106106127/
3. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Course Code:23CSL201		Course Title: IT Practices Laboratory (Common to AD,AM,CS,IT&SC)	
Course Category: SEC		Course Level: Introductory	
L:T:P (Hours/Week) 0:0:4	Credits: 2	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on developing web and mobile applications.

List of Experiments: **60 Hours**

1. Study of Peripheral Devices and PC Hardware.
2. Study of different communication protocols
   - USB
   - HDMI
   - WIFI
   - Bluetooth
3. Develop a web page with image, text, links, tables, Menus, Navigations bars, containers and Media.
4. Construct a web page to display resume.
5. Construct a web page to display the products of a company.
6. Create an application using GUI widgets, Layouts, Media and Event handlers.
7. Develop a calculator application to perform all arithmetic operations.
8. Construct an application to calculate BMI.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the components of PC hardware.	Understand
CO2: Design and develop websites, mobile applications for the given scenario using open source tools.	Apply
CO3: Optimize web application performance by considering factors such as page load times, resource usage, and caching mechanisms for ensuring efficient user experiences.	Apply
CO4: Demonstrate the developed web and mobile applications with an oralpresentation.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Reference Book(s):

R1. Peter Abel, Niyaz Nizamuddin, “IBM PC Assembly Language and Programming”, Pearson Education, 2007.

R2. Harvey M. Deitel, Paul J. Deitel,“Internet and World Wide Web – How to Program”, 4th Edition, Pearson Education Asia, 2009.

R3. David Wolber, Hal Abelson, Ellen Spertus, Liz Looney, “App Inventor 2: Create Your Own Android Apps”, 2nd Edition, O'Reilly Media, 2014.

Web References:

1. Open Element Tool: https://www.openelement.uk/index.htm
2. MIT App Inventor Tutorials: https://appinventor.mit.edu/explore/ai2/tutorials

Course Code: 23ESL201		Course Title: Professional Skills 1:Problem Solving Skills & Logical Thinking 1 (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week)0:0:2	Credits: 1	Total Contact Hours: 30	Max Marks: 100

Course Objectives:

- To enhance the students' numerical, analytical and logical reasoning ability.
- To make them prepare for various public and private sector exams and placement drives.

Module I Quantitative Ability **20 Hours**

Number System and LCM & HCF- Percentage- Ratio and Proportion - Average- Progressions- Ages-Partnership- Mixture & Allegation - Profit and loss- Interest calculation- Data interpretation.

Module II Reasoning Ability **10 Hours**

Seating Arrangement- Linear, circular and Complex - Direction Problems- Blood Relation- Puzzles- Crypt arithmetic- Venn diagrams- Statement and conclusion- Statement and argument- Causes and effects- Self-Learning.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Build the competence in numerical, analytical and logical reasoning ability	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021

Web References:

1. https://www.indiabix.com/aptitude/questions-and-answers/
2. https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்ள இயலும்.

CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்ள இயலும்.

தமிழரும் தொழில்நுட்பமும்

அலகு 1 – நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்

அலகு 2 – வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ஷ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.

அலகு 3 – உற்பத்தித் தொழில்நுட்பம் 3

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

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன் வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு 5 – அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

Course Outcomes மாணவர்கள் இப்பாடத்தை கற்றபின்	**Cognitive Level**
CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

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

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

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

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

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

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

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

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.
2. Understand the Scientific Tamil & Tamil Computing.

TAMILS AND TECHNOLOGY

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.	Understand
CO.2 Understand the Scientific Tamil & Tamil Computing.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

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

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

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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

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

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

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

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

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

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

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

P
A

Course Code: 23CHT202	Course Title: Environmental Sciences (Common to all B.E/B.Tech Programmes)		
Course Category: Multidisciplinary		Course Level: Introductory	
L:T:P(Hours/Week)1: 0: 0	Mandatory Non-Credit Course	Total ContactHours: 15	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on sustainable utilization of natural resources, prevention of pollution, disaster management and environmental issues & public awareness on ecosystem.

Module I **8 Hours**

Natural Resources

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Environmental Pollution and Disaster Management

Role of an individual in prevention of pollution; Disaster management: floods, earthquake, cyclone and landslides.

Environmental Ethics and Legislations

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

Module II **7 Hours**

Environmental Issues and Public Awareness

Public awareness - Environment and human health.

Environmental Activities

(a) Awareness Activities:

i. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii. Slogan making event.
iii. Poster making event.

(b) Actual Activities:

i. Plantation.
ii. Cleanliness drive.
iii. Drive for segregation of waste.
iv. To know about the different varieties of plants.
v. Shutting down the fans and ACs of the campus for an hour or so.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the use of natural resources for a sustainable life as an individual in prevention of pollution.	Understand
CO2: Apply the environmental ethics and legislations for various environmental issues.	Apply
CO3: Create the public awareness on environment and human health as an individual or team through various activity-based learning.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	3	3	-	-	-	-
CO3	3	-	-	-	-	3	3	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

T2. Mackenzie Davis and Susan Masten, "Principles of environmental engineering andscience", Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliancesand Standards", Vol.I and II, Enviro Media.

R2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview.
2. https://en.wikipedia.org/wiki/Environmental_science.

SEMESTER III

Course Code: 23MAT305		Course Title: Discrete Mathematics (Common to AM,CS,IT & SC)	
Course Category: Minor		Course Level: Intermediate	
L:T:P(Hours/Week) : 3:1:0	Credits: 4	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The objective of the course is aimed to equip engineering students with the mathematical tools and reasoning skills needed for effective problem-solving and analytical thinking in their respective fields.

Module I **22+8 Hours**

Logic: Propositions- Logical operators – Logical equivalences and implications - Normal forms – Rules of inference - Consistency and inconsistency - Theory of Inference – Proofs – Predicates – Quantifiers - Universe of discourse – Validity of arguments.

Relations and Functions: Relations – Types of relations – Properties of relations - Equivalence relations – Relational matrix - Graph of relations – Partial ordering relation - Poset – Hasse Diagram. Functions - Type of functions: Injective, surjective and bijective functions – Composition of functions – Inverse functions.

Combinatorics: Mathematical induction - Basics of counting – Pigeonhole principle – Permutations with and without repetition – Circular permutation – Combinations.

Module II **23+7 Hours**

Recurrence relations: Recurrence relations - Solution of linear recurrence relations.

Algebraic Structures: Algebraic Systems – properties – Semi groups and monoids – Groups - Sub groups- Homomorphism – Abelian group – Cyclic group – Normal subgroup and Cosets – Lagrange's theorem – Codes and Group codes.

Divisibility and Congruence: Division Algorithm – Prime and Composite Numbers – Fundamental theorem of Arithmetic - Euclidean algorithm - GCD and LCM – Congruence – Linear congruence – Chinese Remainder Theorem.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply propositional and predicate logic to solve engineering problems and implementing the concepts of sets, relations and functions in discrete structures.	Apply
CO2: Solve problems using combinatorial techniques, such as counting principles, permutations and combinations in the context of algorithm design and analysis.	Apply
CO3: Apply the concepts of groups and its properties to algebraic structures and solve system of linear congruence equations using Chinese Remainder Theorem.	Apply
CO4: Demonstrate a deepened understanding of fundamental concepts such as sets, relations, functions and combinatorics covered in lectures through guided practice.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. J.P.Trembly, R. Manohar, “Discrete Mathematical Structures with applications to Computer Science”, 1st Edition, TMH International Edition, July 2017.

T2. T.Veerarajan, “Discrete Mathematical Structures with Graph Theory and Combinatorics” 1st Edition, Tata McGraw-Hill Education Private Limited, New Delhi, July 2017.

Reference Book(s):

R1. Kennth H. Rosen, “Discrete Mathematics and Its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, July 2017.

R2. Ralph P Grimaldi, Ramana. B. V, “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education India, 2011.

Web References:

1. http://nptel.ac.in/courses/106106094
2. https://nptel.ac.in/courses/111/104/111104026/

Course Code: 23ITI301		Course Title: Algorithm Design and Analysis	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:2	Credits:4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to apply the fundamental principles of algorithm analysis categorize the problem types using various algorithm design techniques.

Module I **22 Hours**

Introduction: Algorithm specifications - Performance Analysis - Space complexity — Time complexity - Asymptotic Notations & its properties - Basic efficiency classes — Important problem types - Mathematical analysis of non-recursive algorithms - Mathematical analysis of recursive algorithms — Master's Theorem - Applications: Linear and Non Linear Data Structures.

Sorting: Selection sort - Bubble sort. **Divide & Conquer:** General method - Merge sort – Quick sort - Finding maximum and minimum element - Strassen's Matrix Multiplication.

Searching: Sequential search - Binary search. **Brute Force:** General Method- String Matching.

Greedy: General method - Knapsack Problem - Optimal storage on tapes - Huffman trees.

Module II **23 Hours**

Dynamic Programming: Principles of Optimality - Multistage Graphs - 0/1 Knapsack problem - All pair shortest path - Optimal Binary Search tree - Traveling Salesman Problem.

Backtracking: General method – N Queens Problem - Hamiltonian Circuit Problem – Sum of Subsets – Graph Coloring – Knapsack Problem.

Branch and Bound Techniques: General method - FIFO Branch & Bound - LC Branch & Bound - 0/1 Knapsack problem - Traveling Salesman Problem - Assignment Problem — P, NP, NP Complete, NP Hard Problems– Theory of Reducibility.

List of Experiments **30 Hours**

1. Implement and Analyze Sorting Algorithms: Selection Sort and Bubble Sort
2. Implement and Analyze Searching Algorithms: Sequential search and Binary search
3. Implement and Analyze Brute-force string Matching Problem
4. Implement and Analyze Knapsack Problem using Greedy Approach
5. Implement and Analyze All pair shortest path using Dynamic Programing Approach
6. Implement and Analyze Sum of subsets using Back Tracking Approach

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the fundamental principles of algorithm analysis for various problems	Apply
CO2: Analyze the performance of sorting and searching problems	Analyze
CO3: Examine the different algorithm design technique for the stated problem	Analyze
CO4: Identify the various class of problems and reducibility concept for computational problems	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbook(s):

T1. Anany Levitin," Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2017.

Reference Book(s):

R1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition, MIT Press and McGraw-Hill Publications, 2009.

R2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2nd Edition, Galgotia Publications, NewDelhi 2010.

R3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education Asia, New Delhi, 2011.

Web References:

1. https://www.geeksforgeeks.org/
2. http://www.pearsoned.co.in/prc/book/anany-levitin-introduction
3. https://vtucsenotes.wordpress.com
4. https://www.khanacademy.org/computing/computer-science/algorithms

Course Code: 23ITT301		Course Title: Object Oriented Programming using Java	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to acquire practical skills in Java programming, applying object-oriented concepts and advanced techniques to address business challenges.

Module I **22 Hours**

Introduction: Java Features - Java Program Structure - Constants – Variables - Data Types - Scope of Variables – Operators - Java Virtual Machine -Command Line Arguments

Fundamentals of Object-Oriented Programming: Classes & Methods - Object Creation - Constructors – Method Overloading - Static Members - Garbage Collection– Arrays.

Inheritance and Abstract Classes: Class Inheritance: Types - Method Overriding - Super Keyword - Final Variables and Methods- Final Classes. Abstract Classes and Methods

Interfaces: Interfaces - Extending Interfaces -Implementing Interfaces - Hiding Classes

Packages: Importing Packages - Visibility Control

Strings: String Class -String Buffer.

Exception Handling: Exception: Types - Uncaught Exceptions - Try - Catch - Multiple Catch - Nested Try -Throw-Throws - Finally - Built in Exceptions – User Defined Exceptions

Module II **23 Hours**

Thread: Thread - Extending the Thread Class - Thread Life Cycle -Multithreading-Thread Exception -Thread Priority -Thread Model.

Stream and Built in Classes: Introduction to File & Operations - Introduction to Stream – Byte Streams – Data Input / Output Stream —File Input / Output Stream) - Character Streams (Reader/Writer-File Reader/Writer) – String Tokenizer - Calendar- Date.

Collections: Collection, Set, List, Queue, Collections Classes – Array List, Hash Set, Tree Set. Accessing a Collection via Iterators. Map Interfaces

Enterprise Application Development with Spring: Introduction to the Spring Framework - Spring Core Concepts - Aspect-Oriented Programming (AOP) in Spring - Spring MVC (Model - View-Controller) - Data Access in Spring - Spring Security - Introduction to Spring Boot.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify the OOPS concepts to address business problems in Java.	Apply
CO2: Examine String Handling and Exception Optimization in advanced Java Programs	Analyze
CO3: Analyze the implementation and benefits of multi-threading and file/stream handling in Java for efficient data management.	Analyze
CO4: Apply the concept of Spring for Design Enterprise Application Development	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Schildt. Herbert. “Java - The complete Reference”, 12th Edition, McGraw Hill Education,2021.

Reference Book(s):

R1. Deitel and Deitel, “Java How to Program”, Prentice Hall, 11th Edition, 2017.

R2. Kathy Sierra, Bert Bates, Trisha Gee, “Head First Java: A Brain-Friendly Guide”, 3rd Edition, O’Reilly, 2022.

Web References:

1. https://www.w3schools.com/java
2. https://www.javatpoint.com/java-tutorial
3. https://www.javatpoint.com/sun-microsystems
4. https://docs.oracle.com/javase/tutorial/

Course Code: 23ITI302	Course Title: Computer Organization and Microprocessor		
Course Category: Minor		Course Level: Intermediate	
L:T:P(Hours/Week) : 3:0:2	Credits: 4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to analyze the basic structure of computers, control units and I/O systems with an architectural design of Microprocessor and Microcontrollers

Module I **22 Hours**

Basic Structure of Computers and Instruction Set

Functional Units-Basic Operational Concepts –Performance-Memory Location and Addressing-Instructions and Instruction Sequencing- RISC and CISC Architecture -RISC Pipelining.

Instruction Execution and Control Unit

Instruction Execution- Hardwired and Micro programmed control, Pipeline Organization and issues. Data dependencies- Branch and Memory Delays.

Memory Systems

Semiconductor RAM Memories - Read only memories, Cache Memories-Input/Output Organization-Accessing I/O Devices-Interrupts-Direct memory Access-Block Diagram of DMA with its Features.

Module II **23 Hours**

8085 and 8086 Microprocessor

Introduction to 8085 Architecture- Instruction Set and Assembly Language Programming. Introduction to 8086 Architecture, Minimum and Maximum Mode, I/O & Memory Interfacing, Addressing Modes, Instruction Formats, Instruction Sets, Assembler Directives, Interrupts-Interrupt Service Routines, Assembly Language Programming, Programmable Peripheral Interfacing (PPI).

8051 Microcontroller

8051 Architecture- Special Function Registers- Memory Organization- Counters and Timers-Interrupts and its Types- Instruction Sets- Assembly Language Programming- Keyboard display interfacing-Case Study on Pentium Processor and MODEM.

List of Experiments: **30 Hours**

1. Arithmetic Operation Using 8085/8086 Microprocessor
2. Serial and Parallel Interfacing Using 8085
3. Waveform Generation interfacing using 8086
4. Arithmetic operations Using 8051 Microcontroller
5. Stepper Motor interfacing using 8051.
6. Create a Mini Projects using Processors / Controllers

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Classify the basic computer systems, addressing modes and instruction sequences	Apply
CO2: Identify the functionality of various memory systems and pipelining.	Apply
CO3: Apply the programming concepts of 8085/8086 microprocessor and 8051 microcontroller.	Apply
CO4: Design a hardware component using various peripheral devices.	Create

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbook(s):

T1: Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, 6th Edition, McGraw-Hill, 2017. (Unit-I, Unit-II and Unit-III)

T2: Ray.A.K. & Bhurchandi.K.M, “Advanced Microprocessor and Peripherals Architecture, Programming and Interfacing”, 3rd Edition Tata Mc Graw Hill, 2013.(Unit-IV and Unit-V)

Reference Book(s):

R1. William Stallings, “Computer Organization & Architecture - Designing for Performance”, 10th Edition, Pearson Publication, 2015.

R2. John Hayes, “Computer Architecture and Organization”, 3rd Edition, McGraw Hill Education, 2017.

R3. Kenneth J. Ayala, “The 8086 Microprocessor: Programming & Interfacing the PC”, 1st Edition, Delmar Publishers, 2007.

R4. Mohamed Ali Mazidi, Janice Gillispie Mazidi, “The 8051 Microcontroller and Embedded Systems using Assembly and C”, 2nd Edition, Pearson Education / Prentice Hall ofIndia, 2007.

Web References:

1. https://archive.nptel.ac.in/courses/108/105/108105102/
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://www.udemy.com/course/8086-microprocessor/
4. https://www.vectorindia.org/8051_microcontroller.html

Course Code: 23ITT302	Course Title: Software Engineering		
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to apply the suitable software process model to the scenario, analyze the functional and Non-functional requirements for SRS, design a user Interface for the given scenario and evaluate the software using testing strategy.

Module I **23 Hours**

Introduction to Software Engineering - Process Framework-Process Models: Waterfall Model-Incremental Model-Evolutionary model- Object Oriented Model- Introduction to Agility-Agile process model: XP –Kanban.

Requirement Engineering Tasks- Groundwork-Eliciting requirements- Functional and Nonfunctional Requirements-Developing Use Cases - Building the analysis Model -Negotiating Requirements-Validating Requirements-SRS.

Design Concepts-Design Model Architectural Styles- Component Level Design: Designing Class based components, Designing traditional Components

Module II **22 Hours**

User Interface Design: Interface analysis, Interface Design: Golden Rules-User interface analysis and design- Interface Analysis-Design issues- Scrum Master-Roles and Responsibilities –skills.

Strategic approach to Software testing- Test strategies for conventional software- Unit Testing-Integration testing- Validation testing system Testing-White Box Testing-Black Box Testing- Manual Testing-Automation Testing.

Software Quality Assurance- Software Reviews-Formal Technical Reviews-Software Configuration Management- SCM Repository- SCM process-JIRA Tool.

Course Outcomes	CognitiveLevel
At the end of this course, students will be able to:	
CO1: Apply a suitable process model for the selected scenario	Apply
CO2: Develop a Software Requirement Specification for the given scenario.	Apply
CO3: Design a suitable user interface with scrum master for the selected scenario	Apply
CO4: Analyze the Cyclomatic complexity for the given scenario	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Roger Pressman, Bruce.R. Maxim, " Software Engineering A Practitioner's Approach", 9th Edition, McGraw-Hill International Edition, New Delhi, 2020.

Reference Book(s):

R1. Aggarwal K.K and Yogesh Singh, "Software Engineering‖", 3rd Edition, New Age International Publishers, 2022.

R2. Ian Sommerville, "Software Engineering‖", 10th Edition, Pearson Education Asia,2015.

R3. Shari Lawrence Pfleeger, Joanne M Atlee, " Software Engineering Theory and Practice", 4th Edition, Pearson Education Asia, 2012.

R4. Mark C.Layton, "Agile Project Management for Dummies", John Wiley &Sons, 2020.

Web References:

1. https://nptel.ac.in/courses/106/105/106105182/
2. http://freevideolectures.com/Course/2318/Software-Engineering

Course Code: 23ITL301		Course Title: Object Oriented Programming using Java Laboratory	
Course Category: Major		Course Level: Intermediate	
L:T:P (Hours/Week): 0:0:3	Credits:1.5	Total Contact Hours:45	Max Marks: 100

Course Objectives:

The course is intended to acquire practical skills in Java programming, applying object-oriented concepts and advanced techniques to address business challenges.

List of Experiments: **45 Hours**

1. Programming in Java Environment
2. Creation of classes and use of constructors and different types of functions (inclusive static methods)
3. Programs using inheritance
4. Programs using method overloading & overriding
5. Abstract classes & Interfaces
   a. Use of abstract classes and methods
   b. Developing user-defined interfaces
6. Exception Handling Mechanism in Java
   a. Handling pre-defined exceptions
   b. Creating user-defined exceptions
7. Threading
   a. Creation of thread in Java applications
   b. Multi-Threading
8. Programs using Files & Streams
9. Programs using Java Collection
10. Creation of Enterprise Application using Spring framework

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply object-oriented programming concepts to solve business challenges in Java	Apply
CO2: Determine advanced Java programming for effective String Handling and Exception Optimization	Analyze
CO3: Determine the incorporation of threads and the utilization of files and streams in Java	Analyze
CO4: Create Enterprise Application Development using Spring	Create

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Reference Book(s):

R1. Schildt. Herbert., "Java - The complete Reference", 12th Edition, McGraw Hill Education, 2021.

R2. Deitel and Deitel, "Java How to Program", Prentice Hall, 11th Edition, 2017.

R3. Kathy Sierra, Bert Bates, Trisha Gee, "Head First Java: A Brain-Friendly Guide", 3rd Edition, O'Reilly, 2022.

Web References:

1. https://www.w3schools.com/java
2. https://www.javatpoint.com/java-tutorial
3. https://education.oracle.com/java-se-programming-i-mooc

Course Code: 23ESL301	Course Title: Professional Skills 2: Problem solving skills & Logical Thinking 2 (Common to all B.E/B.Tech Programmes)		
Course Category: SEC	Course Level: Introductory		
L:T:P(Hours/Week): 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives:

To enhance the students' numerical, analytical and logical reasoning ability.

To make them prepare for various public and private sector exams and placement drives.

Module I Quantitative Ability 20 Hours

Time and work –Pipes and cisterns- - Time Speed Distance-Problems on Trains-Boats and Streams- Permutation and Combination-Probability, Mensuration- Heights and distance- Logarithms- Clocks and Calendars – Data Sufficiency

Module II Reasoning Ability 10 Hours

Number & Alpha series- Odd man out-Coding and Decoding-Syllogisms- -Problems on Cubes and Dices- Logical Venn diagram -Visual Reasoning- Element & logical series- Analogies- Self-Learning

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Enhance their problem solving skills & Logical thinking Skills	**Apply**

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

1. https://www.indiabix.com/aptitude/questions-and-answers/
2 . https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Code: 23VAT301		Course Title: Universal Human Values 2: Understanding Harmony (Common to all B.E/B.Tech Programmes)	
Course Category: VAC		Course Level: Practice	
L:T:P (Hours/Week): 2:1: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act
5. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

UNIT I - INTRODUCTION TO VALUE EDUCATION **9 Hours**

Need for the Value Education; Self -exploration as the process for value education; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities; Happiness and Prosperity: current scenario; Method to fulfill the Basic human aspirations

UNIT II - HARMONY IN HUMAN BEING **9 Hours**

Human being as a co-existence of self (‘I’) and the material ‘Body’; needs of Self ('I') and 'Body'; The Body as an instrument of ‘I’; Harmony in the self (‘I’); Harmony of the self (‘I’) with body; Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT III - HARMONY IN THE FAMILY AND SOCIETY **9 Hours**

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation; Understanding harmony in the society (society being an extension of family); Vision for the universal human order.

UNIT IV - HARMONY IN THE NATURE **9 Hours**

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

UNIT V - HARMONY ON PROFESSIONAL ETHICS **9 Hours**

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case study: holistic technologies, management models and production systems; Strategy for transition towards value-based life and profession

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO2: Appraise physical, mental and social wellbeing of self and practice techniques to promote wellbeing.	Responding
CO3: Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO4 : Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO5 : Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. “Human Values and Professional Ethics” by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Book(s):

R1. “Jeevan Vidya: Ek Parichaya”, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

R2. “Human Values”, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

R3. “The story of stuff”, Annie Leonard, Free Press, New York 2010.

Web References:

1. https://aktu.ac.in/hvpe/ResourceVideo.aspx
2. http://hvpenotes.blogspot.com/
3. https://nptel.ac.in/courses/109/104/109104068/

SEMESTER IV

Course Code: 23MAT401		Course Title: Probability and Statistics (Common to AM, AU, CS, EC, EE, ME, IT & SC)	
Course Category: Minor		Course Level: Intermediate	
L:T:P(Hours/Week): 3:1:0	Credits: 4	Total Contact Hours:60	Max Marks:100

Course Objectives:

This course aims at helping the students to gain knowledge on random variables, probability distributions and hypothesis testing for data.

Module I **22 + 8 Hours**

Probability and Random Variables: Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables-One Dimensional Random variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties- Two Dimensional Random Variables - Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression using least square method – Transformation of random variables.

Standard Distributions: Discrete Distributions - Binomial- Poisson- Properties, Moment generating functions -Continuous Distributions - Uniform –Exponential- Normal Distributions and their properties.

Module II **23 + 7 Hours**

Testing of Hypotheses: Sampling distributions, Estimation of parameters, Statistical hypothesis, Large sample test based on Normal distribution for single mean and difference of means, Tests based on t-test, Chi-square distributions and F distributions for mean, variance and proportion, Contingency table (test for independent), Goodness of fit.

Design of Experiments: Analysis of Variance (ANOVA) - One-way Classification – Completely Randomized Design (CRD) – Two-way Classification – Randomized Block Design (RBD) – Latin square.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate the concepts of probability theory to engineering problems.	Understand
CO2: Calculate the expected values, variances and correlation coefficient of random variables	Apply
CO3: Use the theoretical discrete and continuous probability distributions in the relevant application areas.	Apply
CO4: Apply the concepts of testing the hypothesis and design of experiments to solve real life problems.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Veerarajan T, “Probability, Statistics and Random process”, 3rd Edition, Tata McGraw-Hill, New Delhi, 2017.

T2. Dr.J.Ravichandran, “Probability and Statistics fo5r Engineers”, 1st Edition, Wiley India Pvt. Ltd., 2010.

Reference Book(s):

R1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, “Probability and Statistics for Engineers and Scientists”, 9th Edition, Pearson Education, Asia, 2013.

R2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, “Schaum's Outlines Probability and Statistics”, 4th Edition, Tata McGraw Hill edition, 2012.

R3. Morris DeGroot, Mark Schervish, “Probability and Statistics”, 4th Edition, Pearson Educational Ltd, 2014, India.

Web References:

1 https://archive.nptel.ac.in/courses/111/105/111105090/

2. https://archive.nptel.ac.in/courses/111/105/111105041/

Course Code: 23ITT401		Course Title: Operating System Concepts	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to apply Semaphores and paging techniques for classical real world synchronization scenarios, memory management, analyze and evaluate various scheduling algorithms for process and disk management.

Module I **23 Hours**

Introduction: Operating system overview-objectives and functions - Evolution of Operating System - Computer System Organization Operating System Structure and Operations- System Calls - System Programs - OS Generation and System Boot.

Computing Environments: Virtualization - Process Concept: Process Scheduling: Scheduling Queues-Schedulers-Context Switch– Operations on Processes – Inter-process Communication - Threads: Multi-Threading Models – Threading Issues.

CPU Scheduling: Scheduling Criteria – Scheduling Algorithms: FCFS, SJF, Priority, Round Robin– Multiple-Processor Scheduling. Synchronization: Critical Section Problem. Synchronization Hardware – Mutex - Locks-Semaphores – Classic Problems of Synchronization.

Module II **22 Hours**

Access Methods: Directory and Disk Structure - Implementing File-System: File-System Implementation-Directory Implementation – Allocation Methods – Free - Space Management Memory Management Strategies- Background – Swapping – Contiguous Memory Allocation – Segmentation- Paging – Structure of the Page Table- Virtual-Memory Management: Demand Paging – Page Replacement-Allocation of Frames-Thrashing.

Mass-Storage Structure: Disk Structure- Disk Scheduling – Disk Management – Swap - Space Management - RAID Structure - Case Study-Linux System: Design Principles - Kernel Modules - Process Management – Scheduling - Memory Management - File System - Input-Output - Inter-Process Communication - Mobile OS - iOS and Android - Distributed operating systems.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze various process management scheduling algorithms for concurrently executing process.	Analyze
CO2: Apply Semaphores and monitors for classical real world synchronization scenarios using operating system concepts.	Apply
CO3: Identify the various memory management techniques to improve the utilization of the CPU.	Apply
CO4: Classify various disk scheduling algorithms in operating systems for device management	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Text Book(s):

T1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne," Operating System Concepts", 10th Edition, Wiley India Edition,New Delhi 2018.

Reference Book(s):

R1. Andrew S. Tanenbaum," Modern operating Systems", 4th Edition, Pearson Education/PHI,New Delhi 2014.

R2. Gary Nutt," Operating Systems", 3rd Edition, Pearson Education, New Delhi 2009.

R3. Harvey M, Deital," Operating Systems", 3rd Edition, Pearson Education, New Delhi 2009.

Web References:

1. http://codex.cs.yale.edu/avi/os-book/OS9
2. http://fivedots.coe.psu.ac.th/~cj/os/slides/slide-ppt.html
3. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://os.ecci.ucr.ac.cr/slides/Abraham- Silberschatz-Operating-System-Concepts-10th-2018.pdf

Course Code: 23ITI401	Course Title: Computer Networks		
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives:

The course is intended to understand holistically of networking principles across various layers and how the layers work together to design and manage the network infrastructures effectively

Module I **22 Hours**

Data Communications: Networks - Network Type - Protocol Layering - TCP/IP ProtocolSuite -The OSI Model - Client/Server Paradigm.

Data Link Layer: Introduction - Framing - Error Control: Simple Parity Check — Cyclic Redundancy Check - Link Layer Addressing - Address Resolution Protocol.

Network Layer: Services - Packet Switching - Network Layer Performance - InternetProtocol Version 4: IPv4 Addressing.

Module II **23 Hours**

Network Routing: IPv4 Datagram - Options - ICMPv4 - Forwarding of IP packets - IPv6 Protocol - Distance Vector Routing - Link State Routing.

Transport Layer: Services - Transport Layer Protocols - User Datagram Protocol - Transmission Control Protocol: TCP Services -TCP Features - Segment - A TCP Connection - Error Control - TCP Congestion Control.

Application Layer: World Wide Web - HTTP - FTP - Electronic Mail - Domain Name System - Basics of Software Defined Network.

List of Experiments: **30 Hours**

(Exercises are to be carried out using Java / Python / Wireshark / Command Line Utility)

1. Network trouble-shooting and performance monitoring using ipconfig, ping, netstat commands.
2. Visualization of packet flow.
3. Interpret the working principles of address resolution protocol.
4. Examine IP traffic and its routing options.
5. Analyze the TCP connection establishment and termination.
6. Implementation of and client server communication using socket programming

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the significance of error control mechanisms in the data link layer and various services offered by layers in TCP/IP protocol suite.	Apply
CO2: Identify various classes of network addresses, routing mechanisms in forwarding data packets through shortest path utilizing Address resolution protocol.	Apply
CO3: Utilize various services like reliable data transfer, flow control and error control capabilities offered by transport layer in TCP/IP suite.	Apply
CO4: Examine the endpoint services offered to applications by the application layer protocol and various components in software defined networks	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Behrouz A. Forouzan, “Data Communication and Networking with TCP/IP Protocol Suite”, 6th Edition, McGraw Hill, 2022.

Reference Book(s):

R1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top Down Approach”,8th Edition, Pearson Education, 2022.

R2. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, “Computer Networks”,6th Edition. Prentice Hall, New Delhi, 2022.

R3. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks: An Authoritative Review of Network Programmability Technologies”, 1st Edition, O'Reilly Media, 2022.

Web References:

1. https://www.mheducation.co.in/product_resources/protectedcontent/login?id=9631
2. https://archive.nptel.ac.in/courses/106/105/106105081/

Course Code: 23ITI402	Course Title: Database Management Systems		
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week): 3:0:2	Credits:4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to analyze data requirements, design efficient database schemas, implementnormalized structures, develop queries using SQL and comprehend the fundamental concepts of transaction management

Module I **23 Hours**

Introduction: Database- Types of Database-System Applications-View of Data - Unstructured data- Database Languages- Database and Application Architecture-Database Users and Administrators

Relational Model: Structure of Relational Databases-Database Schema - Keys - Schema Diagrams - Relational Query Languages-The Relational Algebra

SQL-Introduction to SQL- Intermediate SQL- Advanced SQL: Accessing SQL from a Programming Language-Functions and Procedures-Triggers

Database Design Using the E-R Model: Entity-Relationship Model- Network model - Complex Attributes-Mapping Cardinalities-Primary Key

Module II **22 Hours**

Relational Database Design: Decomposition Using Functional Dependencies- Normal Forms- Functional-Dependency Theory-Algorithms for Decomposition Using Functional Dependencies- Decomposition Using Multivalued Dependencies

Indexing: Ordered Indices - B+-Tree Index Files - B+-Tree Extensions - Hash Indices - Multiple-Key Access

Query Processing and Optimization: Measures of Query Cost - Selection Operation - Sorting - Join Operation - Evaluation of Expressions-Transformation of Relational Expressions - Introduction to No SQL- Mongo DB Creating and Deleting Documents- Querying

Transaction Management: Transactions: Transaction Model- Serializability- Transactions as SQL Statement- Concurrency Control: Lock-Based Protocols- Deadlock Handling- Timestamp-Based Protocols - Validation-Based Protocols

List of Experiments: **30 Hours**

(Exercises are to be carried out in MySQL with required front-end software)

1. DDL, DML, DCL and TCL operations in Relational Database Management Systems.
2. Retrieving Data from a Database using Clause, Aggregate Functions, Joins, Views and Subqueries.
3. Write a program to implement trigger.
4. Write a program to implement stored procedure.
5. Write a program to implement functions.
6. Build a GUI to any application with back-end connectivity.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Design complex queries, implement database structures, perform data manipulation, and apply advanced SQL techniques to solve real-world data- related challenges	Apply
CO2: Identify the high-level view of the issues in database design and of the problems encountered in capturing the semantics of realistic applications within the constraints using entity-relationship data model	Apply
CO3: Examine the relational database design principles, normalization, and indexing techniques, and apply query optimization strategies and transaction management concepts with understanding in both relational and NoSQL database systems, including MongoDB.	Analyze
CO4: Develop an application utilizing comprehensive database management principles	Create

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text book(s):

T1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 7th Edition, Tata McGraw Hill, March 2019.

T2. Kristina Chodorow, “Mongo DB: The Definitive Guide”, 3rd Edition, O'Reilly Publications, December 2019.

Reference Book(s):

R1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson, 2023.

R2. Raghu Ramakrishnan, “Database Management Systems”, 4th Edition, McGraw-Hill Publications, 2015.

R3. C.J. Date, A.Kannan, S.Swaminadhan, “An Introduction to Database systems”,8th Edition, Pearson, 2009.

Web References:

1. https://nptel.ac.in/courses/106106095
2. https://nptel.ac.in/courses/106104021

Course Code: 23ITL401		Course Title: Programming with Python Laboratory	
Course Category: Major		Course Level: Intermediate	
L:T:P (Hours/Week) 1: 0: 3	Credits: 2.5	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course is intended to develop an application using python data structures, object oriented concepts and GUI design for real time scenario.

Module I Introduction to Python and Data Structures 15 Hours

Introduction to Python- Variables, Expressions and Statements – File handling operations Conditionals - Lists- Tuples- Dictionaries – Strings – Set-Modules and Packages. Classes- Creating Instance Objects- Built-In Class Attributes- Inheritance- TKinter –Widget creation - Database Connection: GUI application with database connection.

List of Experiments: 45 Hours

1. Analyze Python interpreter command line for various mathematical equations
2. Construct a Python program using variables, expressions & statements
3. Implement the file handling operations in Python
4. Examine a Python program using List and Tuple data structure
5. Write a Python program using Dictionary data structure
6. Develop a Python program to utilize string data structure
7. Write Python program to create pre-defined modules in IDLE environment
8. Build a python program to demonstrate class with inheritance concept
9. Design a GUI programming using Tkinter for given application
10. Create a Python GUI application with database connection

Course Outcomes	CognitiveLevel
At the end of this course, students will be able to:	
CO1: Examine a console-based application using variables, expressions & functions	Analyze
CO2: Develop a python application using data structure and also apply object-oriented programming concepts	Apply
CO3: Create a GUI application using Tkinter with database connectivity.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	3	-	2	-	3	2	-		-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Allen Downey, Think Python, 2nd Edition, Green Tea Press, 2015

R2. Laura Cassell, Alan Gauld , Python Projects, Wrox Publication,2015

Web References:

1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://www.geeksforgeeks.org/python-programming-language-tutorial/?ref=home articlecards

Course Code: 23ESL401		Course Title Professional Skills 3 : Professional Development and Etiquette (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week): 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to cultivate students' appropriate etiquette across various personal and professional contexts, fostering professionalism and effective communication.

Module I **15 Hours**

Emotional Intelligence

Intrapersonal Skill: Goal Setting- Self-management- Emotional Intelligence: Understanding & Developing EI for Effective Communication and Relationships – Enhancing Social Skills

Professional Development

Introduction to Professional Development - Career State Assessment - Set Career Goals- Stay on Industry Trends - Self & Lifelong learning – Creativity - Problem Solving Skills - Strong Fundamentals – Using/ Creating Opportunities – Work & Life Balancing - Revisiting Goals

Teamness and Interpersonal skills

Paraphrasing: Techniques for Active Listening -Paraphrasing as a Tool for Effective Understanding and Communication – Collaboration and Team Building: Building Trust and Rapport - Self-paced learning.

Module II **15 Hours**

Effective Communication

Effective Verbal Communication - Assertive Communication - Elements of Effective Communication - Barriers to Effective Communication - Persuasion Skills - Effective Presentation: Oral and visual presentation – Drafting formal reports.

Professional Etiquette

Introduction - Types of professional Etiquette- Personal Grooming: Importance of Personal Grooming in Professional Settings- Dress Codes and Professional Appearance Guidelines- Body language - Social – Email – Telephonic – Dining – Classroom – Business.

Activities:

- Emotional Intelligence: Scenario based role play, Debate
- Paraphrasing: Listening, Reading
- Effective Presentation:
  - Oral Presentation: Self-Introduction, JAM , Extempore speech
  - Visual presentation: Email Writing, Power Point Presentation, Vlog
- Professional Etiquette: Demonstrate required Professional Etiquette in all the above activities.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Communicate effectively and exhibit Professional etiquettes in various social forums.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	3	-	1	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Sabina Pillai, Agna Fernandez, “Soft Skills & Employability Skills”, Cambridge University Press, 2018.

T2. Peggy Post &Peter Post, “The Etiquette Advantage in Business: Personal Skills for Professional Success”, 2nd Edition (May 3, 2005), William Morrow.

Reference Book(s):

R1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2018.

R2. Maithry Shinde, Jyotsna Sreenath, “Life Skills & Personality Development”, Cambridge University Press 2022.

Web References:

1. https://www.indeed.com/career-advice/career-development/etiquette-at-work
2. https://www.skillsyouneed.com/interpersonal-skills.html

SEMESTER V

V Semester

Course Code: 23ITT501		Course Title: Full Stack Web Development	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to develop modern web projects with best practices for two-tier and three-tier architectures, analyze real-time applications and build RESTful APIs for seamless front-end interaction.

Module I **22 Hours**

React Foundation - JSX, Built-in components - Inspecting React DevTool components- Props- React State - Events - Forms - Styling React – Hooks – Routing - Errors - Fetching and Catching Data - Fetch and Axios method

Module II **23 Hours**

Introduction to Django Rest Framework - Dynamic Web Pages - Django Template System - Interacting with a Database: Models - Django Administration Site - Form Processing - Views and URLconfs - Generic Views - Sessions – Cookies- Testing APIs using POSTMAN.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Examine the usage of frontend and deploy it on a server.	Apply
CO2: Examine the front-end and back-end development tools for web development	Analyze
CO3: Identify and use code packages for web application development.	Apply
CO4: Apply web applications that utilize database access method.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Chris Minnick, “Beginning ReactJS Foundations: Building User Interfaces with ReactJS”, 1st Edition, Wiley Publication, 2020. (Module I)

T2. Adrian Holovaty, Jacob K. Moss, “The Definitive Guide to Django: Web Development Done Right”, 2nd Edition, Apress Publication, 2021. (Module II)

Reference Book(s):

R1. Joe Lewis, Meaghan Lewis, “HTML & CSS: Level Up with Responsive Web Design”, 2nd Edition, O’Reilly Media, 2020.

R2. Daniel Roy Greenfeld, Audrey Roy Greenfeld, “Two Scoops of Django 4.x: Best Practices for the Django Web Framework”, 2nd Edition, 2021.

R3. William S. Vincent, “Django for Beginners: Build websites with Python and Django”, 1st Edition, WelcomeToCode, 2021.

R4. Ryan Burgess, “Learning React: Functional Web Development with React and Redux”, 2021.

R5. Eric Matthes, “Python Crash Course: A Hands-On, Project-Based Introduction to Programming”, 2020.

Web References:

1. https://developer.mozilla.org/en-US/docs/Web/HTML

2. https://docs.djangoproject.com/en/5.1/

3. https://www.django-rest-framework.org/

Course Code: 23ITI501		Course Title: Data Mining	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives

This course is intended to understand the concepts of Data Ware housing and extract knowledge from data repository for data analysis, Pattern mining, Classification, Clustering and Data mining applications.

Module I **22 Hours**

Data Mining: Knowledge Discovery - Mining various kinds of knowledge- Confluence of multiple disciplines - Data types- Statistics of data **-** Similarity and Distance Measures- Data Quality, Data Cleaning, and Data Integration- Data Transformation- Dimensionality Reduction

Online Analytical Processing: Data Warehouse - Data Warehouse Modelling - OLAP Operations - Data Cube Computation

Pattern mining: Basic Concepts- Frequent Itemset Mining Methods- Apriori Algorithm – FP Growth Algorithm- Pattern Evaluation Methods

Module II **23 Hours**

Classification: Decision Tree Induction – Bayesian Classification methods – Lazy learners- Linear classifiers- Model Evaluation and Selection - Techniques to improve classification accuracy

Cluster analysis: Cluster analysis- Partitioning Methods - Hierarchical Methods - Density-based and grid-based methods - Evaluation of clustering

Data mining applications – Introduction to GDPR.

List of Experiments: **30 hours**

(Exercises can be carried out using Weka / R / Rapid miner / Python)

1. Data Processing Techniques:
   (i) Data Cleaning – Missing Values, Smoothing by Regression
   (ii) Data Transformation-Normalization
   (iii) Data Integration
2. Implement Apriori algorithm or FP-Growth algorithm to find frequent itemset for real time dataset.
3. Generate strong association rules from frequent itemset using support and confidence measure.
4. Construct a model using Decision Tree Induction using real time dataset.
5. Classification of data using K-Nearest Neighbor and Linear classifiers approach.
6. Implementation of K-Means algorithm and a hierarchical clustering algorithm and visualize the cluster mean values and standard deviation of dataset attributes.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify the data types that need preprocessing and implement the relevant preprocessing techniques.	Apply
CO2: Characterize the various kinds of patterns that can be discovered by Pattern Mining.	Apply
CO3: Analyze interesting patterns from large amounts of data to analyze for Predictions and Classification.	Analyze
CO4: Determine appropriate clustering algorithm to cluster the object for different applications.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Jiawei Han, Jian Pei, Hanghang Tong, Data Mining: Concepts and Technique, 4th Edition, Morgan Kaufmann Publishes, Elsevier, 2022.

Reference Book(s):

R1. Parteek Bhatia, “Data Mining and Data Warehousing Principles and Practical Techniques”, 2nd Edition, Cambridge University Press, 2019.

R2. O. P. Wali, Galit Shmueli, Peter C. Bruce, “Data Mining for Business Analytics, An Indian Adaptation: Concepts, Techniques, and Applications in R”, Wiley, 2021.

R3. Megan Squire, “Mastering Data Mining with Python – Find patterns hidden in your data”, O’Reilly, 2016.

R4. Ian H.Written, Eibe Frank, Mark A. Hall, “ Data Mining- Practical Machine Learning Tools and Techniques, 4th Edition, Morgan Kaufmann Publishers, 2016.

Web References:

1. http://www.cs.waikato.ac.nz/ml/weka/documentation.html

2. https://onlinecourses.nptel.ac.in/noc24_cs22/preview

3. https://www.coursera.org/specializations/data-mining

Course Code: 23ITI502	Course Title: Cryptography and Network Security		
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives

This course is intended to examines the strength of classical and modern cipher mechanisms, explores the societal impact of asymmetric key ciphers during their period of use, recognizes various authentication techniques employed in data communication, and analyses both wired and wireless security mechanisms.

Module I **22 Hours**

Basics of Security: CIA Triad – Threats, Attacks and Services.

Confidentiality: Substitution - Caesar cipher - Play fair cipher - Transposition Ciphers – Rail Fence cipher - Column transposition cipher.

Symmetric Key Cryptography: Data Encryption Standard – Advanced Encryption Standard: Basic Structure – Transformation – Key Expansions Process. Modes of Operation: Electronic Code Book - Cipher block chaining – Counter.

Asymmetric Key Cryptography: Introduction to Public Key Cryptography - RSA - Diffie-Hellman key exchange - Elliptic Curve Cryptography.

Module II **23 Hours**

Integrity: MAC – Requirements for Hash functions – Secure Hash Algorithm – Digital Signature Standard.

Remote User Authentication: Kerberos - Kerberos Realms - X.509 Authentication Service – X.509 Certificates.

Availability: IEEE 802.11i Wireless LAN Security- Wireless Transport Layer Security - Intrusion Detection.

Applications: IP Security – VPN -– Pretty Good Privacy - Introduction to Quantum Cryptography – Cryptography in Block Chain.

List of Experiments: **30 hours**

(Exercises can be carried out using CrypTool and C / Java / Python)

1. Implementation of Classical Encryption Techniques.
2. Illustration of DES and AES algorithms using CrypTool.
3. Illustration of various cryptographic attacks using CrypTool.
4. Implementation of RSA for confidentiality and authentication.
5. Implementation of Diffie-Hellman Key Exchange Algorithm.
6. Implementation of Digital Signature Generation and Verification.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply various cryptanalytic techniques to evaluate the strength of classical and modern cipher mechanisms.	Apply
CO2: Analyze the impact of symmetric and asymmetric key ciphers on society during the time of their use.	Analyze
CO3: Analyze cryptographic systems to ensure data integrity and authenticity, and assess the security of digital signatures against various attacks.	Analyze
CO4: Analyze the various security mechanisms of wired and wireless devices at the infrastructure level.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. William Stallings, "Cryptography and Network Security: Principles and Practices", 8th Edition, Pearson Education, 2024.

Reference Book(s):

R1. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill Ltd. 2017.

R2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill Ltd, 2013.

Web References:

1. http://williamstallings.com/Cryptography/
2. https://www.coursera.org/learn/crypto
3. https://nptel.ac.in/courses/106105031

Course Code: 23ITL501		**Course Title: Full Stack Web Development Laboratory**	
Course Category: Major		**Course Level: Higher**	
L:T:P(Hours/Week)0: 0: 3	**Credits: 1.5**	**Total Contact Hours: 45**	**Max Marks: 100**

Course Objectives

This course is intended to develop web projects using modern frameworks and best practices for two-tier and three-tier architecture and build RESTful APIs for data exchange with front-end applications.

List of Experiments: **45 hours**

1. Design and develop the site using HTML and CSS. Ensure responsiveness and include sections like "About Me," "Projects," and "Contact".
2. Implement features such as adding, editing, and deleting tasks. Use React components, state management, and hooks.
3. Create models for posts and comments, set up views and templates, and implement CRUD operations. Add user authentication for managing posts.
4. Set up a Django REST API to serve data. Create a React front-end to fetch and visualize this data using charts and tables.
5. Implement product listings with filtering and searching capabilities. Use Django to manage product data and React for the front-end interface.
6. Set up user registration, login, and logout functionality with Django. Create React components for handling authentication and user sessions.
7. Create Django models for posts and user interactions. Develop a React front-end to display posts, likes, and comments, and allow users to post and interact.
8. Develop a real-time chat application using Django Channels and React.
9. Build a task management system with notifications.
10. Deploy a full-stack application to a cloud platform.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze and create a fully functional website and deploy it on a server.	Analyze
CO2: Evaluate front-end and back-end development tools to manage product data	Analyze
CO3: Implement web applications that use optimized database access methods.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	2	-	-	-	-	-	-	-	-	-	3
CO2	-	3	-	-	3	-	-	-	-	2	-	-	3	-
CO3	3	-	-	-	-	-	-	2	2	-	2	2	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Chris Minnick, “Beginning ReactJS Foundations: Building User Interfaces with ReactJS”, Wiley Publishing, 2020.

R2. Adrian Holovaty, Jacob K. Moss, “The Definitive Guide to Django: Web Development Done Right”,Apress. 2021.

R3. Joe Lewis, Meaghan Lewis, “HTML & CSS: Level Up with Responsive Web Design”, 2020.

R4. Daniel Roy Greenfeld, Audrey Roy Greenfeld, “Two Scoops of Django 4.x: Best Practices for the Django Web Framework”, O’Reilly Media, 2021.

Web References:

1. https://developer.mozilla.org/en-US/docs/Web/HTML
2. https://docs.djangoproject.com/en/5.1/

Course Code: 23ESL501	Course Title: Professional Skills 4: Communication Skills and Interview Essentials (Common to all B.E/B.Tech Programmes)		
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives

The course is intended to equip students with the necessary skills to effectively communicate in various professional settings and excel in the interview process.

Module I **15 Hours**

Resume Building & Portfolio Management

Importance of a Strong Resume - Resume Content Development & Core Components – Formatting and Design - Tailoring and Customization – Proofreading - Portfolio Content, design and Structure : Components & Efficient portfolios – Preparing and Maintaining documents for interview – maintaining repositories - Enhancing Personal Brand - Digital Tools and Platforms

Interview - Dress code, Body Language and Grooming

Dress Code Essentials - Body Language – Facial expression, eye contact, gesture, posture, touch behavior & space- Personal Grooming

Effective Communication

Communication in Diverse Contexts - Presentations – Individual and group presentations - Public Speaking - Visual Aids and Presentation Tools

Module II **15 Hours**

Group Discussion

Introduction & types of Group Discussion – Prerequisites of GD – Techniques and tips of GD - Role of GDs in various professional contexts – GD Etiquettes – Strategies to enhance GD – Mock GD.

Interview Skills

Purpose of an interview - Types of Interviews –Interview Techniques – Interview Etiquette - Planning and Preparation - Mock Interviews with Feedback - Post-Interview Etiquette and Follow-Up

Activities:

Building Portfolio: Resume Building, Updating LinkedIn, Maintaining Repositories.

Effective Presentation:

Oral Presentation: Impromptu speech, Mini Presentation, Picture Perception (Both Speaking and Writing)

Visual presentation: Power Point Presentation, Vlog

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Communicate effectively and exhibit required competency in various professional environments and demonstrate proficiency in interview process.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	3	3	-	1	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2018

T2. Pease, Allan, and Barbara Pease. "The Definitive Book of Body Language." Bantam, 2006.

Reference Book(s):

R1. Cheryl Hamilton, “Communicating for Results: A Guide for Business and the Professions”, 11th edition (1 January 2017), Wadsworth Publishing Co Inc.

R2. Whitcomb, Susan Britton. Resume Magic: Trade Secrets of a Professional Resume Writer. JIST Works, 2010.

R3. Carnegie, D. (2009). The Quick and Easy Way to Effective Speaking. Pocket Books.

Web References:

1. https://www.linkedin.com/pulse/interview-etiquette-dos-donts-interviews-brian-vander-waal-fmy8e/
2. https://www.simplilearn.com/group-discussion-tips-article

Course Code: 23ITP501		Course Title: Reverse Engineering Project	
Course Category: Project		Course Level: Higher	
L:T:P(Hours/Week) 0: 0: 6	Credits: 3	Total Contact Hours: 90	Max Marks: 100

Course Objectives

The course is intended to understand the concepts and techniques of reverse engineering and apply the required tools and techniques related to the reverse engineering for extracting the knowledge from existing systems and also develop skills in debugging, disassembling, and modifying software and hardware projects. This is expected to provide a good initiation for the student(s) in research and development.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the components, structures, and functionalities of the existing systems.	Analyze
CO2: Apply reverse engineering methodologies to analyze and understand the existing systems.	Apply
CO3: Build the existing system with the additional requirements.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	2	2	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	2	3	-
CO3	-	-	3	-	-	3	2	2	3	-	-	-	-	3

High-3; Medium-2; Low-1

SEMESTER VI

VI Semester

Course Code: 23ITT601		Course Title: Cloud Computing and Virtualization	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to apply cloud computing concepts, models, and architecture in real-time scenarios, managing cloud resources, monitoring virtualization platforms and addressing security issues.

Module I **22 Hours**

Overview of Cloud Computing - Cloud Service Models – Multi Cloud Strategy- Setting up your AWS account - AWS management console - Designing Cloud Applications - AWS Components - AWS cloud deployment architecture - Cost Model - Application Development Environments- Setting up the AWS Infrastructure - Amazon Cloud Watch – Monitoring - Designing and Implementing Security.

Module II **23 Hours**

Virtualization – Hypervisors - Virtual Machines – Creating Virtual Machines - Installing with Windows and Linux - Memory for Virtual Machine - Storage for Virtual Machine - Copying a Virtual Machine - Managing Networking.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the cloud computing concepts to model the real time scenarios and architecture.	Apply
CO2: Analyze the deployment and management of cloud resources and services.	Analyze
CO3: Examine the Data Management and Monitoring Techniques for virtualization platforms and tools.	Analyze
CO4: Apply Security, Privacy and Compliance issues in Cloud Environments.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbooks:

T1. Adnan Aziz, Amit Prakash, “AWS Certified Solutions Architect Study Guide: Associate SAA-C02 Exam”, 1st Edition, Wiley, 2020. (Module I)

T2. Matthew Portnoy, “Virtualization Essentials”, 1st Edition, Wiley, 2018. (Module II)

Reference Books:

R1. Michael J. Kavis, “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)”, 1st Edition, Wiley, 2014.

R2. Ben Potter, Scott Ward, “Cloud Security and Compliance: A Practical Guide”, 1st Edition, Wiley, 2021.

R3. Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, “Cloud Computing and Virtualization”, 1st Edition, Wiley-Scrivener,2018.

R4. Kris Jamsa, “Cloud Computing SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More”, 1st Edition, Jones & Bartlett Learning, 2013.

Web References:

1. https://docs.aws.amazon.com/
2. https://learn.microsoft.com/en-us/azure/?product=popular
3. https://www.ucertify.com/p/virtualization-essentials.html

Course Code: 23ITI601		Course Title: Compiler Design and Automata Theory	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives

The course is intended to design and implement simple compilers and understand the underlying concepts that make modern compilers efficient and reliable.

Module I **22 Hours**

Introduction to Grammar – Phases of a Compiler – Cousins of a Compiler – Grouping of Phases – Compiler Construction Tools.

Lexical Analyser: Role of Lexical Analyser – Specification of Tokens – Recognition of Tokens – Language for Specifying Lexical Analyser – Finite Automate – RE to NFA – NFA to DFA Conversion – Minimization of Automata.

Syntax Analyser: Role of Parser – Top Down Parser: Recursive Descent Parser – Bottom Up Parser: Shift Reduce Parser – Operator Precedence Parser – LR Parser: Simple LR – SLR – CLR – LALR Parser.

Module II **23 Hours**

Semantic analyser: Syntax Directed Translation – Syntax Directed Definition – Evaluation Order - Applications

Intermediate Code Generation: Intermediate Language – Declaration – Assignment Statement – Boolean Expression – Flow Control Statement – Back Patching – Procedure Calls.

Code Optimizer: Optimization of Basic Blocks – Loops in flow graph – Global Data Flow Analysis – Peephole Optimization.

Code Generation: Issues in Design of Code Generator – Run Time Storage Management – A Simple Code generator**.**

List of Experiments: **30 hours**

(Exercises can be carried out using CrypTool and C / Java / Python)

1. Demonstration of Grammar and its types using JFLAP Tool
2. Implementation of a Symbol Table
3. Implementation of Parser phase of compiler
4. Implementation of Scanner phase of compiler
5. Implementation of Code optimization phase of compiler
6. Implementation of Code generation phase of compiler

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Evaluate deterministic finite automata and non-deterministic finite automata for language recognition.	Analyze
CO2: Apply Context-Free Grammars to design parsers and construct syntax trees for programming languages, demonstrating their use in syntax analysis and language processing.	Apply
CO3: Analyze the given code for its semantic and generate intermediate code that bridges high-level language constructs and low-level machine code.	Analyze
CO4: Apply the optimization techniques to improve the performance of code in terms of speed and memory.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, “Compilers: Principles, Techniques, and Tools”, 5th Edition, Pearson Education, 2015.

Reference Book(s):

R1. John E. Hopcroft, “Introduction to Automata Theory, Languages, and Computation”, 3rd Edition, Pearson Education, 2008.

R2. K. D. Cooper, L. Torczon, “Engineering a Compiler”, Morgan-Kaufmann, 2nd Edition, 2011.

R3. Micheal Sipser, “Introduction to the Theory of Computation”, 3rd Edition, 2014.

R4. Ramaiah K Dasaradh, “Introduction to Automata and Compiler Design”, Prentice-Hall of India Pvt.Limited. 2013.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_cs07/preview
2. https://www.udemy.com/topic/compiler-design/

Course Code: 23ITL601		Course Title: Cloud Computing and Virtualization Laboratory	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to apply cloud computing concepts, models, and architecture in real-world scenarios, while deploying and managing cloud resources and covers data management, monitoring techniques for virtualization platforms, and cloud security issues.

List of Experiments: **45 hours**

1. Setting up an account on a cloud platform (AWS, Azure, Google Cloud) and Navigation of the cloud console
2. Install Git and check-in code into Repository
3. Deploy a web application in EC2 and Elastic Beanstalk
4. Build Database Schema Deployment Pipeline with Jenkins and Sqitch
5. Deploy an application and its Content Management Systems in Cloud
6. Create Cloud Monitoring and Management Service using AWS CloudWatch
7. Create and configure a VM using a hypervisor like VMware Workstation
8. Implement encryption for data at rest and in transit
9. Implement data lifecycle policies and backup strategies.
10. Build a web application on a chosen cloud platform and document the monitoring, logging, and security measures.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the deployment of web applications with automation pipelines using AWS/Azure/Google Cloud, Git, EC2/Elastic Beanstalk, Jenkins, and Sqitch.	Analyze
CO2: Categorize the data management and monitoring techniques for virtualization platforms and tools	Analyze
CO3: Identify the data lifecycle policies, backup strategies, and building cloud-based web applications	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	-	-	2	-	2	-	-	-	2	-	-	2	-	3
CO3	3	-	-	2	-	-	-	-	-	2	-	-	-	-

High-3; Medium-2; Low-1

Reference Books:

R1. Adnan Aziz, Amit Prakash, “AWS Certified Solutions Architect Study Guide: Associate SAA-C02 Exam”, 1st Edition, Wiley, 2020.

R2. Matthew Portnoy, “Virtualization Essentials”, 1st Edition, Wiley, 2018.

R3. Michael J. Kavis, “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)”, 1st Edition, Wiley, 2014.

R4. Ben Potter, Scott Ward, “Cloud Security and Compliance: A Practical Guide”, 1st Edition Wiley, 2021.

Web References:

1. https://docs.aws.amazon.com/
2. https://learn.microsoft.com/en-us/azure/?product=popular
3. https://www.ucertify.com/p/virtualization-essentials.html

Course Code:23ESL601		Course Title: Professional Skills 5: Ace and Elevate: Aptitude and Soft Skills (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Higher	
L:T:P (Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours: 30	Max Marks: 100

Course Objectives:

This course is intended to enhance students' problem-solving skills in the aptitude segment while also equipping them with effective communication skills for professional settings and success in the interview process.

Module I Verbal Ability & Effective Communication **15 Hours**

Verbal Ability

Parts of Speech – Tenses – Subject Verb Agreement – Synonyms – Antonyms – Idioms and Phrases - One Word Substitution – Reading Comprehension – Cloze test – Error Spotting.

Verbal Enhancement

Self-Introduction – Just A Minute- Picture Perception - Writing Skills: Sentence Types (Simple, Compound, Complex), Email drafting.

Campus to Corporate

Professional Grooming –Group Discussion – Impromptu – Interview.

Module II Quantitative & Reasoning Ability **15 Hours**

Quantitative Ability

Simplification & Approximation, Number System, Percentage, Averages, Ratios and Proportion, Ages, Profit & Loss, Interest Calculation, Time and work, Time, speed and distance, Clocks and Calendar, Mixtures and alligation, Permutations and Combinations, Probability, Mensuration, Data Interpretation, Data Sufficiency

Reasoning Ability

Seating Arrangement, Blood relations, Directions Problems, Syllogisms, Number & Alpha Series, Coding and Decoding, Non Verbal Reasoning, Analogies, Cubes and Dices.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Exhibit strong problem-solving skills in the aptitude segment while enhancing their communication abilities for professional settings, enabling them to excel in interviews and placement processes.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	3	3	-	1	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1: Technical Communication, 3E: Principles and Practice book. Authors. Meenakshi Raman, Sangeeta Sharma, 2006

T2: Pease, Allan, and Barbara Pease. "The Definitive Book of Body Language." Bantam, 2006.

T3: Dr. R. S. Aggarwal. “Quantitative Aptitude for Competitive Examinations” Sultan Chand & Sons Pvt. Ltd, New Delhi, 2024

T4: Dr. R. S. Aggarwal. “A Modern Approach to Verbal and Non-Verbal”, Sultan Chand & Sons Pvt. Ltd, New Delhi, 2024

Reference Book(s):

R1: Cheryl Hamilton, “Communicating for Results: A Guide for Business and the Professions”, 11th edition (1 January 2017), Wadsworth Publishing Co Inc.

R2: Whitcomb, Susan Britton. Resume Magic: Trade Secrets of a Professional Resume Writer. JIST Works, 2010.

R3: Carnegie, D. (2009). The Quick and Easy Way to Effective Speaking. Pocket Books.

R4: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R5: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

https://www.linkedin.com/pulse/interview-etiquette-dos-donts-interviews-brian-vander-waal-fmy8e/

1. https://www.simplilearn.com/group-discussion-tips-article
2. https://talentbattle.in
3. https://www.geeksforgeeks.org/aptitude-questions-and-answers/

SEMESTER VII

Semester VII

Course Code: 23ITI701		Course Title: Artificial Intelligence Principles and Applications	
Course Category: Major		Course Level: Advanced	
L:T:P (Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours: 75	Max Marks: 100

Course Objectives

This course is intended to understand basic principles and the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception, action and Applications.

Module I **22 Hours**

Intelligent Agents: Agents and Environments-Good Behavior: The Concept of Rationality-The Nature of Environments- The Structure of Agents

Problem Solving: Solving Problems by Searching: Problem-Solving Agents- Search Algorithms- Uninformed Search Strategies- Informed (Heuristic) Search Strategies. Search in Complex Environments: Local Search and Optimization Problems- Local Search in Continuous Spaces- Search with Nondeterministic Actions. Constraint Satisfaction Problems. Adversarial Search and Games

Module II **23 Hours**

Knowledge, Reasoning and Planning: Logical Agents - Propositional Logic and Theorem – First Order Logic: Knowledge Engineering - Effective Propositional Model Checking - Inference – Forward Chaining – Backward Chaining - Resolution – Classical Planning - Knowledge Representation Techniques – Modal Logic – Temporal Logic - Reasoning Systems for Categories – Reasoning with default information

Applications of AI: Text Analysis and Mining- Text Classification- Information Retrieval-Information Extraction. Expert Systems: Knowledge Representation-Expert System Shells-Knowledge Acquisition -Applications.

List of Experiments: **30 hours**

1. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
2. Write a program to implement tic tac toe game for O and X.
3. Program to implement A* / AO* algorithm.
4. Write a program to implement water jug problem.
5. Write a program to optimize Travelling Sales Person problem
6. Implement Chat bot Application.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply foundational principles, mathematical tools, and programming paradigms of AI	Apply
CO2: Apply problem-solving techniques for complex problems	Apply
CO3: Exploit AI knowledge for reasoning, planning and decision making	Analyze
CO4: Analyze problem-solving techniques for various AI applications.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th Edition, Pearson Education, 2021. (Module I)

T2. Lavika Goel, “Artificial Intelligence Concepts and Applications”, 1st Edition, Wiley, 2021. (Module II)

Reference Book(s):

R1. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Education (India), 2013.

R2. Elaine Rich, Kevin Knight and Shivashankar, "Artificial Intelligence", McGraw Hill, 3rd Edition, 2017.

R3. Ric, E., Knight, K and Shankar, B. Artificial Intelligence, 3rd Edition, Tata McGraw Hill,2017.

R4. Luger, G.F. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th Edition, Pearson. 2008.

Web References:

1. https://www.cs.ox.ac.uk/teaching/courses/2024-2025/ai/

2. https://onlinecourses.nptel.ac.in/noc20_cs81/preview

3. https://online.stanford.edu/courses/xcs221-artificial-intelligence-principles-and-techniques

Course Code: 23ITT701		Course Title: Cyber Security Concepts	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course intended to learn cybercrime and cyber law, to understand the cyber-attacks and tools for mitigating them and describe the concepts of Computer Forensics and Cyber Terrorism.

Module I **22 Hours**

Introduction: Cyber Security, History of Internet, Impact of Internet, CIA Triad; Reason for Cyber Crime, Need for Cyber Security, History of Cyber Crime, Types of Cyber Crime

Cyber Security Components: OSI Layer, Zero Day Attacks, Types of Network Attacks, Application Security, Endpoint Security, Identity and Access Management (IAM), Mobile Security, Data Security, Infrastructure Security

Fighting Cyber Attacks: Defense in Depth, Authentication, Cryptography, Firewall, Data Loss Prevention, Web Browsers, Data Backup

Module II **23 Hours**

Tools and Methods used in Cybercrime: Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, virus and worms, Trojan Horses and Backdoors, Stegnography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Computer Forensics: Computer Forensics and Steganography, Forensics and Social Networking sites, Challenges in computer Forensics, Forensics Auditing, Anti forensics

Cyber Terrorism: Intellectual Property in the Cyberspace, Ethical Dimension of Cybercrimes, Psychology, Mindset and Skills of Hackers and Other Cybercriminals, Sociology of Cybercriminals, Information Warfare

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply cybersecurity principles and defense mechanisms like firewalls and IAM to secure digital systems	Apply
CO2: Apply the principles of layered security to analyze protection methods against cyberattacks	Apply
CO3: Analyze various cybercrimes and the mindset of cybercriminals to understand their behavioral patterns	Analyze
CO4: Examine digital evidence using computer forensics and evaluate challenges in cybercrime investigations.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021. (Module I)

T2. Nina Godbole, Sunit Belapure, “Cyber security: Understanding Cybercrime, Computer Forensics and Legal perspectives”, Wiley India Pvt.Ltd, 2019. (Module II)

Reference Book(s):

R1. Aparna Viswanatha, “Cyber Law- Indian And International Perspectives On Key Topics Including Data Security, E-Commerce, Cloud Computing and Cyber Crimes”, LexisNexis Publishers, 2012.

R2. Rodney D. Ryder, " Guide to Cyber Laws", Second Edition, Wadhwa and Company, 2007.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview

2. https://www.coursera.org/courses?query=cybersecurity

3. https://www.simplilearn.com/cyber-security

Course Code: 23ITL701		Course Title: Data Science Laboratory	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 1: 0: 4	Credits: 3	Total Contact Hours: 75	Max Marks: 100

Course Objectives

The course is intended to prepare, import, process the dataset, build an application for the given dataset, apply commands for data analysis and to develop methodology to analyze and visualize the data

Module I **15 Hours**

Data Manipulation: Understanding data types in Python-Basics of Numpy arrays-Introduction to Pandas Objects: Series object, Data frame object, Index object-Data Indexing and selection-Operation of data in pandas.

Data Visualization: Line plots-Scatter plots-Histogram-Multiple subplots-3D plotting in Matplotlib-Visualization with Seaborn-Introduction SciKit-Learn -Correlation and Regression in statistics.

List of Experiments: **60 hours**

Students are suggested to use the listed packages:

Numpy, Scipy, Plotpy, Matplotlib, Pandas, Seaborn, Bokeh, Statmodels, SciKit-Learn, Glob,Os, geopandas

1. Perform reading and writing tasks for different data types including CSV, JSON, Excel, and text files. Explore datasets using summary statistics, identify missing values, and apply data cleaning and transformation techniques.
2. Analyze relationships between variables using correlation matrices and visualize them using scatter plots. Compute and visualize frequency distributions for categorical and numerical data.
3. Apply linear and multiple regression models to analyze and interpret real-world datasets.
4. Use various plotting libraries to visualize static data and derive meaningful insights.
5. Fetch data from web sources (APIs or HTML scraping) and visualize it for analysis.

6. Generate and manage lists of files/directories using automation scripts for bulk data handling.
7. Explore various statistical distributions and perform hypothesis testing to draw inferences.
8. Implement techniques for reading, writing, and navigating files and directories using built-in libraries.
9. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
    - Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
    - Bivariate analysis: Linear and logistic regression modeling
    - Multiple Regression analysis
    - Also compare the results of the above analysis for the two data sets.
10. Apply and explore various plotting functions on UCI data sets.
    - Normal curves
    - Density and contour plots
    - Correlation and scatter plots
    - Histograms
    - Three dimensional plotting

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze data handling techniques and use summary statistics with visualizations to explore data formats and interpret relationships in real-world datasets.	Analyze
CO2: Apply data visualization techniques using plotting libraries to extract insights from static and web-based data and Use web scraping and automation scripts to fetch, organize, and manage bulk data efficiently.	Apply
CO3: Analyze data using statistical methods and file handling techniques to perform hypothesis testing and manage datasets using built-in libraries.	Analyze
CO4: Evaluate statistical techniques and graphical methods to visualize data distributions and relationships for effective exploratory data analysis.	Evaluate

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Reference Book(s):

R1. Jake VanderPlas, “Python Data Science Handbook Essential Tools for Working with Data”, 3rd Edition, O REILLY Publications, 2019.

R2. Mckinney Wes, “Python For Data Analysis: Data Wrangling with Pandas Numpy and Ipython”, 2nd Edition, Shroff Publishers, 2018.

R3. Brown Martin C, “Python: Complete Reference”, 4th Edition, Tata McGraw Hill, 2018.

R4. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow” 1st Edition, O’Reilly publishers, 2019.

Web References:

1. https://realpython.com/learning-paths/data-science/

2. https://geopandas.org/en/stable/docs/user_guide.html

3. https://jakevdp.github.io/PythonDataScienceHandbook/

Course Code: 23ITP701		Course Title: Project Phase - I	
Course Category: Project		Course Level: Advanced	
L:T:P (Hours/Week) 0: 0: 8	Credits: 4	Total Contact Hours: 120	Max Marks: 100

Course Objectives

The course is intended to enable students to develop the ability to identify and formulate solutions to complex engineering problems by applying principles of science, engineering, and modern computational tools relevant to their field of study.

The assignment will normally include:

- Conducting a comprehensive review and analysis of existing literature related to the assigned topic
- Developing a preliminary approach or methodology to address the identified problem
- Performing detailed analysis, design, and implementation through modeling and/or simulation techniques
- Compiling a well-structured written report documenting the study and findings
- Delivering a final presentation before a departmental evaluation committee
    - Three dimensional plotting

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Systematically design, develop, and implement effective solutions to complex engineering problems by applying scientific principles, appropriate tools, and analytical techniques, while embracing continuous learning.	Create
CO2: Work collaboratively in diverse team roles to achieve project objectives ethically, and communicate methodologies, processes, and results effectively through reports, presentations, and suitable media formats.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	3	3	-	-	-	-	-	-	3	-
CO2	-	3	-	3	-	-	3	3	3	3	3	3	-	3

High-3; Medium-2; Low-1

SEMESTER VIII

VIII Semester

Course Code: 23ITP801		Course Title: Project Phase- II	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 0: 0: 12	Credits: 6	Total Contact Hours: 180	Max Marks: 200

Course Objectives

The course aims to develop and enhance students' problem-solving abilities by engaging them in practical, hands-on engineering projects that involve systematic analysis, critical thinking, and effective solution development.

Project Objective:

The objective of the project is to encourage students to undertake investigative studies within the broad domain of Artificial Intelligence and Data Science. The project may be theoretical, practical, or a combination of both, and will be assigned either individually or in teams of two to three students by the Department, under the supervision of a faculty guide. This initiative is intended to provide a strong foundation and exposure to research and development (R&D) practices.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop the ability to formulate, analyze, and address real-world engineering problems systematically.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3

High-3; Medium-2; Low-1

Verticals
Vertical I: Data Science

Vertical I: Data Science

Course Code: 23ITE001		Course Title: Data Visualization Techniques	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks:100

Course Objectives

This course is intended to cover the data visualization fundamentals, including techniques for spatial, multivariate, and dynamic data, with a focus on interactive visualizations and analyzing hierarchical structures, graphs, and networks.

Module I **15 Hours**

Foundation of Data Visualization: The Visualization Process-Types of Data, Structure within and between Records, Data Preprocessing-Human Perception and Information Processing-Visualization Techniques for Spatial Data: One, two, three dimensional data – Dynamic data-Combining techniques-Visualization of spatial data: Visualization of point data, line data ,area data

Module II **15 Hours**

Visualization Techniques for Multivariate Data: Point, Line and region based techniques for multivariate data-Visualization Techniques for Trees, Graphs, and Networks: Displaying Arbitrary Graphs/Networks-Text and Document Visualization-Interactive and Dynamic Visualizations-Designing Effective Visualizations-Evaluating Visualization Techniques

List of Experiments: **30 hours**

1. Create basic charts (bar, line, pie) using visualization tools.
2. Implement visualization of One, Two, and Three-Dimensional Spatial Data using Python
3. Implement pre-processing and visualization technique in dynamic data using Python
4. Implement visualization techniques for different spatial data types
5. Use advanced techniques to visualize multivariate datasets
6. Create interactive visualizations that allow dynamic user engagement.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the fundamentals of data visualization, including the visualization process, types of data and preprocessing techniques.	Apply
CO2: Apply principles of human perception and information processing to create meaningful visual representations of spatial data.	Apply
CO3: Examine the visualizations for multivariate data using point, line, and region-based techniques.	Analyze
CO4: Design effective visualizations for hierarchical structures, graphs, and networks, while developing interactive visualizations to convey relationships.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Matthew O. Ward., Georges Grinstein and Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC Press, 2015.

Reference Book(s):

R1. Matthew Ward, Georges Grinstein and Daniel Keim, “Interactive Data Visualization Foundations, Techniques, Applications”, CRC Press, 2010.

R2. Robert Spence, “Information Visualization An Introduction”, 3rd Edition, Pearson Education, 2014.

R3. Scott Murray, “Interactive Data Visualization for the Web” ", 2nd Edition, O'Reilly Media,2017.

R4. Claus O. Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”,1st Edition, Shroff/O'Reilly, 2019.

Web References:

1. https://media.espora.org/mgoblin_media/media_entries/1633/Visualizing_Data.pdf
2. https://courses.spatialthoughts.com/python-dataviz.html
3. https://www.simplilearn.com/free-data-visualization-course-online-skillup

Course Code: 23ITE002		Course Title: Neural Networks and Deep Learning	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives

This course is intended to introduces neural networks and deep learning, covering key architectures and algorithms to solve real-world problems.

Module I **22 Hours**

Introduction: Architecture of Neural Networks –Training a neural network with Back propagation – Practical issues in Neural Network Training**.**

Machine Learning with Shallow Neural Networks: Matrix Factorization with Autoencoders-Word2Vec- Machine Learning with Shallow Neural Networks.

Deep Neural Network training: Setup and Initialization Issues-Vanishing and Exploding Gradient Problems-Gradient-Descent Strategies-Gradient Clipping-Batch Normalization.

Module II **23 Hours**

Training Deep Learning Models for Better Generalization: Bias-Variance Trade-Off-Generalization Challenges in Model Tuning and Evaluation-Regularization Techniques-Ensemble Methods-Early Stopping- Regularization in Unsupervised Applications.

Deep Learning Models: Recurrent Neural Networks- Architecture -Challenges in Training – Long Short Term Memory-Gated Recurrent Units-Applications.

Convolutional Neural Networks: Basic Structure-Training – Case Studies of Convolutional Architectures-Visualization and Unsupervised Learning-Applications.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify foundational knowledge of neural networks, backpropagation training, and practical applications using shallow networks, autoencoders, and Word2Vec	Apply
CO2: Analyze initialization issues and optimize deep neural network training using advanced techniques like gradient clipping and batch normalization.	Analyze
CO3: Apply advanced neural network architectures like CNNs and RNNs to solve real-world problems	Apply
CO4: Analyze optimized deep learning models using techniques such as batch normalization and ensemble methods.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer International Publishing AG, part of Springer Nature 2023.

Reference Book(s):

R1. Ian Goodfelllow, Yoshua Benjio, Aaron Courville, “Deep Learning”, The MIT Press**,** 2016.

R2. Aurélien Géron, “Neural Networks and Deep Learning”, O'Reilly Media, 2018.

R3. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, John Wiley & Sons Inc,2000.

R4. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

Web References:

1. http://neuralnetworksanddeeplearning.com/

2. https://www.deeplearningbook.org/

3. https://www.coursera.org/specializations/deep-learning

Course Code: 23ITE003		Course Title: Big Data and Analytics	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to explore the key concepts of big data, analytics classifications, proficiency in Hadoop, MongoDB, Hive for large-scale data processing, developing practical skills in data processing using MapReduce and Pig.

Module I **15 Hours**

Big Data Analytics: Introduction - Classification of Analytics - Greatest Challenges that Prevent Businesses from Capitalizing on Big Data - Top Challenges Facing Big Data – Importance of Big Data Analytics - Data Science - Terminologies Used in Big Data Environment - Other Analytics Tools.

Introduction to Hadoop – Hadoop overview - Hadoop Distributed File System – Processing data with Hadoop – Managing Resources and Applications with Hadoop YARN – Interacting with Hadoop Ecosystem. MongoDB: Introduction – Features of MongoDB - Terms used in RDBMS and MongoDB - Data Types in MongoDB - CRUD (Create, Read, Update and Delete)

Module II **15 Hours**

Map Reduce: Introduction – Mapper – Reducer - Combiner – Partitioner – Searching – Sorting – Compression - Features of Hive - Integration and Work Flow – Architecture - Data Types - File Format - Hive Query Language - RCFILE Implementation – SERDE – UDF - Pig on Hadoop - Pig Latin Overview - Data Types in Pig - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Type - Word Count Example.

List of Experiments: **30 hours**

1. Work with HDFS commands: create, delete, list files, copy from local to HDFS, copy from HDFS to local. Load sample dataset into HDFS and explore file storage using HDFS.
2. Perform basic data analysis using Hadoop commands.
3. Implement CRUD operations by understanding MongoDB.
4. Implement word count / frequency programs using MapReduce.
5. Work with Pig to handle complex data types and functions.
6. Implement word count program that includes filtering and sorting.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply Big Data concepts and analytics frameworks to leverage Big Data technologies and methodologies across various domains.	Apply
CO2: Identify and address the primary Big Data Challenges to enhance data capabilities, improve decision-making processes.	Apply
CO3: Analyze the architecture and functionalities of Hadoop's HDFS, YARN, and Map Reduce to efficiently manage, store, and process large-scale distributed data systems.	Analyze
CO4: Analyze and interpret Pig Latin scripts to perform data transformation and analysis on large datasets within the Hadoop ecosystem	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, 1st Edition, Wiley India, 2015.

Reference Book(s):

R1. EMC Education Services, “Data Science and Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data”,1st Edition, Wiley, 2015.

R2. DT Editorial Services, “Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization”, 1st Edition, Dreamtech Press, 2016.

R3. Tom White “Hadoop: The Definitive Guide” 3rd Edition, O’reilly Media, 2012.

R4. Tyler Akidau, Slava Chernyak, Reuven Lax "Streaming Systems: The What, Where, When and How of Large-Scale Data Processing", O'Reilly Media, 2018.

Web References:

1. https://bigdatauniversity.com/
2. https://www-01.ibm.com/software/data/infosphere/hadoop/what-is-big-data-analytics.html
3. https://www.tutorialspoint.com/big_data_tutorials.htm

Course Code: 23ITE004		Course Title: Computer Vision	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to acquire fundamental knowledge in image processing and practical skills in python packages related to computer vision, applying various concepts such as segmentation, feature extraction and object detection and recognition.

Module I **15 hours**

Introduction about computer Vision-Image formation: 2D transformations, 3D transformations- Linear Filtering and Non Linear Filtering- The digital camera: Sampling and aliasing, Color, Compression-Image processing: Histogram equalization, Neighbourhood operators, Geometric transformations

Feature detection and matching: Points and Patches-Edges-Lines- Segmentation: Split and merge- Watershed, region splitting and merging- Graph-based segmentation- Graph cuts and energy-based methods- Application: Medical image segmentation

Module II **15 Hours**

Motion estimation: Parametric motion, Spline-based motion, Optical flow, Layered motion, Applications: Video stabilization, Medical image registration, Video denoising.

Object recognition: Object detection, Face recognition: Application: Personal photo collections- Instance recognition: Application: Location recognition- Context and scene understanding: Application: Image search

List of Experiments: **30 Hours**

The following experiments are done by using computer vision Library for OpenCV in Python / PyCharm

1. Implement basic image manipulation and transformation functions
2. Perform histogram equalization on a grayscale image to improve its contrast
3. Implement to detect edges in an image using edge detection algorithm.

4. Implement region-growing or watershed segmentation to partition an image based on intensity.
5. Implement motion estimation technique for real time video.
6. Implement object detection and face recognition algorithm for the real time video.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply object segmentation algorithms and basic transformations on Images	Apply
CO2: Apply feature extraction algorithms on real time Images and video	Apply
CO3: Apply the object detection and recognition in the images and video	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Richard Szeliski, “Computer Vision: Algorithms and Applications, 2nd Edition, Springer-Verlag London Limited, 2020.

Reference Book(s):

R1. Rafael C Gonzalez and Richard E Woods, “Digital Image Processing”, 4th Edition, Addition - Wesley, New Delhi, 2018.

R2. Dr Gopal Sakarkar, Dr. Riddhi Panchal, Dr. Kumar B I D, Mr. Pankaj Zanke, “Computer Vision Bridging Theory and Application with Python Programming”, 1st Edition, Walnut Publication, 2024.

R3. D. A. Forsyth, J. Ponce,” Computer Vision: A Modern Approach”, 2nd Edition, Pearson Education, 2015.

Web References:

1. http://www.cse.iitm.ac.in/~vplab/computer_vision.html
2. https://www.geeksforgeeks.org/computer-vision-projects/?ref=lbp

Course Code: 23ITE005		Course Title: Data Analytics using R	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to provide a comprehensive introduction to R, covering data structures, data exploration, and statistical modeling techniques. Learners will gain hands-on experience in data visualization using ggplot2 and advanced R graphics.

Module I **15 Hours**

Introduction to R: Usage of R – Working with R – Packages. Creating a dataset: Understanding datasets – Data structures – Data input – Annotating datasets. Graphs overview: Working with graphs - Graphical parameters - Adding text - customized axes and legends - Combining graphs

Basic Data Management: Creating new variables – Recording variables – Renaming variables – Missing values – Date values – Type conversions – Sorting data – Merging datasets – Subsetting datasets – Using SQL statements to manipulate data frames. **Advanced data management:** A data management challenge – Numerical and character functions – A solution for our data management challenge – Control flow – User-written functions – Aggregation and restructuring.

Module II **15 Hours**

Statistics: Descriptive statistics – Frequency and contingency tables – Correlations – t-tests – Nonparametric tests of group differences – Visualizing group differences

Regression: Faces of regression – OLS regression – Regression diagnostics – Unusual observations - Corrective measures – Selecting the best regression model – Cross validation

Power BI: Introduction - Data Preparation - Data Modeling - Data Analysis Expressions - Data Visualization - Advanced Analytics using R.

List of Experiments: **30 hours**

1. Explore Data structures, variables, and data types.
2. Importing data from various formats.
3. Perform descriptive analysis and visualize group differences.
4. Implement basic data management techniques.
5. Implement simple linear regression program to predict the future values and analyse the goodness of fit.
6. Create an R-powered Power BI visual.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply R functions and packages to create and manipulate datasets, exploring data using data frames and descriptive statistics.	Apply
CO2: Implement regression models in R to make predictions and evaluate model performance using functions of R.	Analyze
CO3: Analyze complex datasets by performing statistical tests such as correlations, t-tests, and nonparametric tests to interpret group differences and relationships.	Analyze
CO4: Create advanced graphical representations using ggplot2 to visualize and communicate complex data insights effectively.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Robert I.Kabacoff, “R in Action: Data analysis and graphics with R”, 3rd Edition, Dreamtech Press, 2019.

Reference Book(s):

R1. Seema Acharya, “Data analytics using R”, 1st Edition, McGraw Hill Education (India) Private Limited, 2018.

R2. Hadley Wickham and Garrett, "R for Data Science: Import, Tidy, Transform, Visualize, and Model Data" , 2nd Edition, O'Reilly Media, 2016.

R3. Alberto Ferrari and Marco Russo, “Introducing Microsoft Power BI”, 1st Edition, Microsoft Press,2016.

R4. Dhaval Maheta, “Data Analysis Using R: A Primer for Data Scientist”, 1st Edition, Notion Press, 2021.

Web References:

1. https://cran.r-project.org/manuals.html
2. http://www.cyclismo.org/tutorial/R
3. https://www.w3schools.in/r/

Course Code: 23ITE006		Course Title: Exploratory Data Analysis with Python	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course emphasizes foundational skills in exploratory data analysis and time series analysis, covering data cleaning, transformation, regression, and statistical modeling. It also introduces machine learning techniques for prediction and pattern discovery.

Module I **22 Hours**

Exploratory data analysis: Introduction - Importing the data – DataFrames - Variables - Transformation - Validation - Interpretation - Probability mass functions - Cumulative distribution functions

Modeling distributions: The exponential distribution - The normal distribution - Probability density functions - Relationships between variables - Scatter plots - Characterizing relationships - Correlation - Covariance - Pearson's correlation - Nonlinear relationships - Spearman's rank correlation - Correlation and causation

Regression: StatsModels - Multiple regression - Data mining - Prediction - Logistic regression - Estimating parameters - Implementation - Accuracy.

Module II **23 Hours**

Time series analysis: Importing and cleaning – Plotting - Linear regression - Moving averages - Missing values - Serial correlation – Autocorrelation – Prediction - Statistical **Machine Learning:** K-Nearest Neighbors - Tree Models - Bagging and the Random Forest – Boosting.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply appropriate data transformation techniques to clean, preprocess, and validate datasets for exploratory data analysis and time series forecasting.	Apply
CO2: Implement regression models and machine learning algorithms to predict outcomes and uncover patterns within datasets.	Apply
CO3: Analyze relationships between variables using correlation and covariance metrics to identify significant associations and potential causal relationships in data.	Analyze
CO4: Analyze time series data to detect trends, seasonality, autocorrelation, and evaluate the effectiveness of forecasting models for accurate prediction.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Allen B. Downey, “Think Stats: Exploratory Data Analysis”, 2nd Edition, O'Reilly Media, 2014.

Reference Book(s):

R1. Peter Bruce, Andrew Bruce & Peter Gedeck, “Practical Statistics for Data Scientists”, 2nd Edition, O'Reilly Media, 2020.

R2. Craig K. Enders, “Applied Missing Data Analysis”, 1st Edition, The Guilford Press, 2010.

R3: Wes McKinney, “Python for Data Analysis”, 3rd Edition, O’Reilly Publications, 2023.

R4: Ian H. Witten, Eibe Frank, and Mark A. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Edition, Morgan Kaufmann publishers, 2011.

Web References:

1. https://www.coursera.org/learn/exploratory-data-analysis
2. https://nptel.ac.in/courses/110106064
3. https://analyticsindiamag.com/8-online-courses-for-exploratory-data-analysis/.

Course Code: 23ITE007		Course Title: Text and Speech Analysis	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to develop practical skills in Natural Language Processing and speech technologies using statistical and machine learning methods.

Module I **22 Hours**

Natural Language Basics: Introduction– Regular Expression –Words and Transducers– Inflectional Morphology-Derivational Morphology-Cliticization-Non Concatenative Morphology-N-grams –Part of Speech Tagging- Rule Based Part of Speech Tagging-Transformation Based Tagging-Evaluation and Error Analysis

Hidden Markov and Maximum Entropy Models: Markov Chains—The Hidden Markov Model-Likelihood Computation: The Forward Algorithm- Decoding: HMM Training: The Forward – Backward Algorithm-The Viterbi Algorithm

Speech Synthesis: Text normalization – Phonetic Analysis- Prosodic Analysis. Evaluation metrics: Intelligibility: Diagnostic Rhyme Test-Modified Rhyme Test-Quality.

Module II **23Hours**

Automatic Speech Recognition: Speech recognition architecture – The Hidden Markov Model Applied to Speech- Feature Extraction: MFCC Vectors-Acoustic Likelihood Computation- The Lexicon and Language Model- Search and Decoding.

Question Answering and Dialogue Systems: Information Retrieval – Summarization: Single Document Summarization – Multi Document Summarization-Dialogue and Conversational Agents: Properties of Human Conversations- Basic Dialogue Systems-Dialogue System Design and Evaluation-Information State and Dialogue Acts-Markov Decision Process Architecture.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply statistical models such as Hidden Markov and Maximum Entropy Models for POS tagging and labeling.	Apply
CO2: Analyze the components of speech synthesis: text normalization, phonetics, and prosody.	Analyze
CO3: Apply acoustic modeling using MFCC and HMMs in automatic speech recognition systems.	Apply
CO4: Design a basic dialogue system using dialogue acts and MDP-based frameworks.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	3	3	3	3	3	3	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson, 3rd Edition, 2022.

Reference Book(s):

R1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, 1st Edition, APress,2018.

R2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 1st Edition, 2008.

R3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.

R4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, 1st Edition, O’reilly,2009.

Web References:

1.https://web.stanford.edu/class/cs224n/

2.https://www.cse.iitb.ac.in/~pjyothi/cs753/index.html

3.https://www.deeplearning.ai/courses/natural-language-processing-specialization/

Course Code: 23ITE008		Course Title: Recommender Systems	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to equip students with the skills to apply collaborative and content-based filtering techniques, implement both collaborative and hybrid recommender systems, perform effective preprocessing and feature extraction, and evaluate system performance using appropriate metrics.

Module I **22 Hours**

Introduction - Goals of Recommender Systems - **Basic Models of Recommender Systems:** Collaborative filtering models – Content-Based - Knowledge-Based - Demographic - Hybrid and Ensemble-Based Recommender Systems - Domain-Specific Challenges in Recommender Systems - **Neighborhood-Based Collaborative Filtering:** User-Based Neighborhood Models-Item-Based Neighborhood Models. **Model-Based Collaborative Filtering:** Decision and Regression Trees - Rule-Based Collaborative Filtering - Naive Bayes Collaborative Filtering - Latent Factor Models.

Module II **23 Hours**

Content-Based Recommender Systems: Basic Components of Content-Based Systems - Preprocessing and Feature Extraction - Feature Representation and Cleaning - Supervised Feature Selection and Weighting - Learning User Profiles and Filtering - **Knowledge-Based Recommender Systems:** Constraint-Based Recommender Systems - Case-Based Recommenders - **Ensemble-Based and Hybrid Recommender Systems:** Ensemble Methods from the Classification - Weighted Hybrids - Switching Hybrids - Cascade Hybrids - **Evaluating Recommender Systems:** Evaluation Paradigms - Goals of Evaluation Design - Issues in Offline Recommender Evaluation - Accuracy Metrics in Offline Evaluation - Limitations of Evaluation Measures – **Advanced Topics:** Learning to Rank - Multi-Armed Bandit Algorithms - Group Recommender Systems - Multi-Criteria Recommender Systems - Privacy in Recommender Systems

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply user-based and item-based neighborhood models to generate personalized recommendations.	Apply
CO2: Develop content-based recommendation engines by applying appropriate feature extraction and user modeling strategies.	Apply
CO3: Investigate hybrid recommendation techniques by combining collaborative and content-based methods.	Analyze
CO4: Examine evaluation metrics to assess and compare the effectiveness of various recommender algorithms.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Charu C. Aggarwal, “Recommender Systems: The Textbook”, 1st Edition, Springer, 2016.

Reference Book(s):

R1. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, “Recommender Systems: Algorithms and Applications”, 1st Edition, CRC Press, 2021.

R2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd Edition, Cambridge University Press, 2020.

R3. Jannach D., Zanker M. and FelFering A., “Recommender Systems: An Introduction”,1st Edition, Cambridge University Press, 2011.

R4. Kim Falk, “Practical Recommender Systems”, Manning, 1st Edition, 2019.

Web References:

1. https://www.cse.iitk.ac.in/users/nsrivast/HCC/Recommender_systems_handbook.pdf

2. https://www.fi.muni.cz/~xpelanek/PV254/slides/intro.pdf

3.https://openlearninglibrary.mit.edu/courses/coursev1:MITx+6.036+1T2019/courseware/Week12/recommender_systems/?activate_block_id=block-v1%3AMITx%2B6.036%2B1T2019%2Btype%40sequential%2Bblock%40recommender_systems

Course Code: 23ITE009		Course Title: Power BI for Data Visualization	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to equip learners with the skills to connect to diverse data sources, transform and model data, and create interactive, visually appealing reports and dashboards.

Module I **15 Hours**

Introduction to Business Intelligence: Overview of Power BI, Discovering and Loading Data with Power BI Desktop, Data import and data loading methods, Creating basic visualizations

Data cleaning techniques: Filtering, Sorting, and Removing errors, DAX functions, Power BI for Business Insights- Dashboard Design Principles- Real-World Use Cases and Business Applications- Power BI Mobile and Embedded

Module II **15 Hours**

Power BI Cloud: Loading data from database and data warehouse -Relational databases, SQL Server, Oracle Database

Direct Query deployment: Benefits of Direct Query, Loading data from the cloud-Azure Database, Automatic Scheduling, Advanced Features and Analytics in Tableau

List of Experiments: **30 Hours**

1. Import data from different sources and perform basic transformations.
2. Create a data model with related tables to analyze complex data
3. Implement time-based calculations using DAX
4. Create an interactive dashboard with multiple visualizations.
5. Configure a refresh schedule in Power BI Service (daily, weekly).
6. Implement custom Power BI applications that can interact with other business tools.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Efficiently connect to and import data from various sources.	Apply
CO2: Design interactive, dynamic reports and dashboards using Power BI's rich set of visualizations.	Apply
CO3: Apply Data Analysis Expressions (DAX) to create complex measures and calculations.	Apply
CO4: Implement best practices for data cleaning and transformation to ensure high-quality, accurate datasets for analysis.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Adam Aspin, “Pro Data Mashup for Power BI: Powering Up with Power Query and the M Language to Find, Load, and Transform Data”, 1st Edition, Apress, 2022.

Reference Book(s):

R1. Paul D. Fuller, “Beginning Power BI for Business Users: Learning to Turn Data into Insights,” 1st Edition, Wiley, 2023.

R2. Wyn Hopkins, “Power BI for the Excel Analyst: Your Essential Guide to Power BI”, 1st Edition, Holy Macro! Books, 2022.

R3. Marco Russo and Alberto Ferrari, “The Definitive Guide to DAX: Business Intelligence with Microsoft Excel, SQL Server Analysis Services, and Power BI”, 2nd Edition, Microsoft Press, 2020.

R4. Errin O’Connor, “Microsoft Power BI Dashboards Step by Step”, 1st Edition, Microsoft Press, 2018.

Web References:

1. https://learn.microsoft.com/en-us/power-bi/create-reports/

2. http://learn.microsoft.com/en-us/power-bi/collaborate-share/service-share-dashboards

3.https://medium.com/@cherifal2011/normalization-and-denormalization-in-power-bi-295d4dfbf3ab

Course Code: 23ITE043		Course Title: Integrated Big Data Solutions (Common to AD, AM, CS, IT & SC)	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to impart knowledge on distributed computing, NoSQL databases, and data warehousing for scalable data management, and to explore big data technologies for solving real-world problems.

Module I **22 Hours**

Distributed Computing: Introduction, Message Passing, Shared Memory, Consensus algorithms, Distributed Transactions, Mutual exclusions, dead locks, Local & Global time and state, Distributed file systems.

NoSQL: Introduction to NoSQL Databases, CAP Theorem, Type of NoSQL Databases, Key-Value Stores, Document Stores Column, Family Stores, Graph Databases.

Data Warehouse: Data Warehouse Basics, Data Warehouse Architecture, Modeling Facts, Modeling Dimensions, Schemas, Data Cleaning Techniques, ETL Process.

Module II **23 Hours**

Data Mining: Introduction, Data Mining Functionalities, Data Pre-processing, Data Cleaning, Data Integration and Transformation, Classification of Data Mining Systems.

Introduction to Big Data computing: Defining Big Data, 3 Vs, Challenges and Opportunities, Hadoop, Introduction to Apache Hadoop, Components of the Hadoop Ecosystem, Map Reduce Programming Model, HDFS: Architecture, HDFS Commands, Data Replication and Fault Tolerance.

Big Data Analytics Tools: Apache Spark, Spark's Role in Big Data Analytics, PySpark, Overview of PySpark, Data Processing with PySpark, Data Lakehouse Concepts Performance Considerations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply distributed computing concepts to design and implement solutions for parallel and scalable systems.	Apply
CO2: Analyze various data storage and retrieval techniques in NoSQL databases to determine their effectiveness in high-performance application scenarios.	Analyze
CO3: Apply data warehousing concepts and data mining techniques to extract insights and inform decision-making in real-world scenarios.	Apply
CO4: Analyze the big data using Map-reduce programming in Both Hadoop and Spark framework.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	3	3	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	3	-	-	-	3	3	-	-	3	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems”, 3rd Edition, Pearson Education, 2017. (Module 1)

T2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013. (Module 2)

Reference Book(s):

R1. Jiawei Han, Micheline Kamber and Jian Pei, “Data mining concepts and Techniques”,3rd Edition, Elsevier, 2012.

R2. Tom White, “Hadoop: The Definitive Guide”, O"Reilly Publication and Yahoo! Press, 4th Edition, 2015.

R3. George Coulouris, Jean Dollimore, and Tim Kindberg, “Distributed Systems Concepts and Design”, 5th Edition, Pearson Education, 2017.

R4. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

Web References:

1.https://onlinecourses.nptel.ac.in/noc20_cs92/

2.https://hadoop.apache.org

3. https://www.ibm.com/cloud/learn/nosql-databases

Vertical II: Web Application Development

Vertical II: Web Application Development

Course Code: 23ITE010		**Course Title: Object Oriented Analysis and Design**	
Course Category: Major		**Course Level: Higher**	
L:T:P (Hours/Week) 3: 0: 0	**Credits: 3**	**Total Contact Hours: 45**	**Max Marks: 100**

Course Objectives

This course is intended to construct the requirement specification document and analyze the classes to design the class diagrams for any given scenario and to convert the use cases into object-oriented software realizations and develop corresponding behavioural models

Module I **22 Hours**

Overview of Analysis: Problem Statement – Object Modeling – Dynamic Modeling – Functional Modeling –SRS- An Overview of the UML.

Structural Modeling: Classes – Relationships – Notes, Stereotypes-Tagged Values-Constraints - Class Diagrams – Advanced Classes – Advanced Relationships – Interfaces, Types, And Roles – Packages -Case Study: Static Model For ATM System.

Module II **23 Hours**

Behavioural diagrams: Interactions – Use Cases – Use Case Diagrams - Interaction Diagrams – Activity Diagrams. Events and Signals - State Machines - State Chart Diagrams

Architectural Modeling: Component – Deployment - Collaborations - Component Diagrams - Deployment Diagrams - Systems and Models

Case study : Platform assignment system for the trains in a railway station - ATM system - Stock maintenance - Student Marks Analysing System - ATM system – Quiz System - E-mail Client system - Cryptanalysis – Health Care systems

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify necessary conditions to be part of a requirement specification document for software design in line with the standard formats	Apply
CO2: Analyze the classes and relationships to construct advanced class diagram with the appropriate notations	Analyze
CO3: Classify use cases into object-oriented software realizations through UML tools for the real time applications	Analyze
CO4: Model the advanced behavioral models for specific applications using UML tools	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Grady Booch, James Rumbaugh, Ivar Jacobson., "The Unified Modeling Language User Guide, 2nd Edition, Pearson Education, 2015. (Module I)

T2. Ali Brahmi, “Object Oriented systems and development”, 3rd Edition, McGraw Hill Education, 2017. (Module II)

Reference Book(s):

R1. Martin Fowler, “UML Distilled, 3rd Edition, Pearson Education, 2008.

R2. James Rumbaugh, Michael Blaha, William Premeralani, Frederick Eddy and William Lorenson, “Object Oriented Modelling and Design”, 2nd Edition, Pearson Education, 2007.

R3. Grady Booch, “Object Oriented Analysis and Design with Applications”, 3rd Edition, Addison Wesley, New Delhi, 2009.

R4. Russ Miles, Kim Hamilton, “Learning UML 2.0”, O’Reilly, 2008

Web References:

1. http://staruml.sourceforge.net/docs/StarUML_5.0_Developer_Guide.pdf
2. http://www.spinellis.gr/umlgraph/doc/index.html

Course Code: 23ITE011		Course Title: Server Side JAM Stack Development	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to develop a client/server-based web application, enabling students to effectively apply these concepts in order to develop web applications that manage both static and dynamic content seamlessly.

Module I **15 Hours**

Introduction to Express – Server-side and Client-Side Applications – A Simple server with Node – Views and Layouts - Static files and Views – Dynamic content in Views – Files and Directory Structures.

Introduction to Node Js – The Request and Response Objects – Form Handling: Sending Client Data to the server – Different Approaches of Form Handling – Cookies and Sessions - Sending Email: HTML Email – Node Mailer

Module II **15 Hours**

Introduction – File System Persistence – Database Persistence: Setting Up MongoDB – CRUD operations – Routing and SEO - Route Parameters – Declaring Routes in Module - Security: Authentication and Authorization – Integrating with Third party API.

List of Experiments: **30 hours**

1. Create a simple news portal site using Node.js
2. Implement a simple file server that serves static files such as HTML, CSS, JavaScript, and images.
3. Build a weather forecasting web application that fetches data from a public weather API.
4. Create CRUD endpoints for a resource (e.g., blog posts) and connect to a database like MongoDB.
5. Build a simple user registration form and handle form submission with POST requests in Express.
6. Set up continuous integration and deployment for your Jamstack app.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of server-side and client-side applications, and effectively managing static files and dynamic content.	Apply
CO2: Analyze the request and response objects in Express, evaluating various form handling in web applications.	Analyze
CO3: Identify necessary fields to be part of a database schema in MongoDB for web applications using the Mongoose ODM.	Apply
CO4: Analyze security practices in web applications, assessing authentication and authorization methods.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Ethan Brown, “Web Development with Node and Express”, 2nd Edition, O’reilly,2020. (Module I)

T2. Simon Holmes, ”Getting MEAN with Mongo, Express, Angular, and Node”, Manning Publications, 2019 (Module II)

Reference Book(s):

R1. Nabendu Biswas, “Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS”, Orange Education Pvt Ltd, 1st Edition,2023.

R2. Mathias Biilmann, “Modern Web Development on the JAMstack”, 2nd Edition, O'Reilly Media, Inc., 2019.

R3. Aaron Autrand, "Jamstack: The Complete Guide" by, Apress, 1st Edition.2020.

R4. Daniel Herrera, "Serverless Architecture with Node.js and AWS Lambda", Manning Publications, 1st Edition, 2019.

Web References:

1.www.w3schools.com

2. https://snipcart.com/blog/jamstack

3. https://dev.to/hackmamba/build-a-full-stack-jamstack-application-5apm

Course Code: 23ITE012		Course Title: Developing Web Applications using .NET	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to enhance proficiency in .NET technologies for building scalable, high-performance web applications using ASP.NET Core, with a focus on integrating .NET applications with relational databases via Entity Framework Core and modern JavaScript frameworks such as React or Angular.

Module I **15 Hours**

Introduction to ASP.NET Core, Running the web application, Handling requests with the middleware pipeline, retrieving and validating user input, Rendering HTML using Razor Saving data with Entity Framework Core, views, Front-End Integration-HTML, CSS and Java Script

Module II **15 hours**

Develop ASP.NET Core MVC apps- Mapping requests to responses, working with Data in ASP.NET Core Apps- Entity Framework Core, Fetching and storing Data, Test ASP.NET Core MVC apps, Azure Kubernetes Service, Azure Virtual Machines.

List of Experiments: **30 hours**

1. Build and run a basic ASP.NET Core web application
2. Apply validation controls in a ASP.net web application
3. Utilize master and content page in design of a ASP.net web application
4. Design a web form to insert, update, delete & show student information through database connectivity
5. Create a web service and use it in the web site
6. Implement session management by using session libraries for ASP.net web application

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Examine various portable classes and libraries part of .NET framework suitable for web development	Analyze
CO2: Analyze necessary classes part of ASP.NET Core libraries to develop scalable and high-performance web applications	Analyze
CO3: Apply Entity Framework Core and its libraries to Integrate .NET application with relational database	Apply
CO4: Identify suitable JavaScript frameworks or libraries, such as React or Angular to be used in development of .NET web application	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbooks:

T1. Andrew Lock, “ASP.NET Core in Action”, Manning, Shelter Island, 1st Edition, Manning, 2021 (Module I)

T2. Steve “ardalis” Smith, “Architecting Modern Web Applications with ASP.NET Core and Azure”, Microsoft Developer Division, .NET, and Visual Studio Product Teams, 2023. (Module II)

Reference Books:

R1. Dino Esposito, “Programming ASP.NET Core”, 1st Edition, Pearson, 2021.

R2. Jon P. Smith, “Entity Framework Core in Action”,2nd Edition, Manning Pubns Co, 2022.

R3. Rami Vemula, “Real-Time Web Application Development With ASP.NET Core, SignalR, Docker, and Azure”, 1st Edition, Apress, 2017.

R4. James Chambers, David Paquette, Simon Timms, “ASP.NET Core Application Development Building an Application in Four Sprints”, 1st Edition, Pearson Education, 2016.

Web References:

1. https://docs.microsoft.com/en-us/aspnet/core/
2. https://learn.microsoft.com/en-us/training/browse/?products=dotnet
3. https://www.pluralsight.com/.net

Course Code: 23ITE013		Course Title: Responsive Web Design	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to provide the fundamentals and libraries behind a responsive web page design, Use appropriate design libraries along with web elements that can adapt its layout to fit various screen sizes across devices.

Module I **15 Hours**

Responsive Web Design Nutshell – HTML for Responsive sites – CSS for Responsive sites Media queries: Structure - Grid layout items – Images: ways to display images – Image file formats – content images – Responsive images – Responsive Workflow - Content Before Layout – Prototypes –Responsive design tools– web typography – Using Fonts – Changing Typeface for screen size – Responsive Navigation – Navigations Patterns – Header – Performance as Design – Measuring performance – Hosting – RESS.

Module II **15 Hours**

Grid system –Nested Columns – Offset - Bootstrap components: Forms – Tabs – Carousel – Navbar – jQuery: Introduction & Examples, Selectors, Operations, Event handling

List of Experiments: **30 hours**

1. Develop a Simple Webpage with HTML5, CSS3 and Fluid Layouts
2. Implement Media Queries, Typography and Images on a web page
3. Apply a Responsive Navigation Menu, Flexbox layouts for a web page
4. Implement a Responsive Layout in a web page with CSS Grid
5. Apply Responsive Form Design and Validation in a web page
6. Capstone project for a real time application using HTML 5, CSS3, Bootstrap and QUERY

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the core principles of responsive web design, including fluid grids, flexible images, and media queries.	Apply
CO2: Analyze website performance on mobile devices; assess areas for optimization and improvements.	Analyze
CO3: Develop a responsive web page using Bootstrap for web application	Apply
CO4: Design a responsive web page using JQUERY for web application	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Clarissa Peterson," Learning Responsive Web Design", 1st Edition, O'Reilly Media, Inc, 2014. (Module I)

T2. Larry Sanchez "Web Programming with HTML, CSS, Bootstrap, JavaScript, jQuery, PHP, and MySQL", 2nd Edition, Amazon Digital Services LLC - KDP Print US, 2019. (Module II)

Reference Book(s):

R1. David Flanagan, "JQUERY Pocket Reference", O' Reilly, 2011.

R2. Michael Bowers, Dionysios Synodinos, Victor Sumner, "Pro HTML5 and CSS3 Design Patterns", 1st Edition, Apress, 2011.

R3. Chris Ward, "Jump Start Responsive Web Design", 2nd Edition, SitePoint, 2017.

R4. Jake Spurlock, "Bootstrap Responsive Web Development", 1st Edition, O'Reilly Media, 2013.

Web References:

1. www.w3schools.com
2. www.tutorialspoint.com
3. https://www.javatpoint.com/java-tutorial

Course Code: 23ITE014		Course Title: UI and UX Design	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to apply core principles of UI and UX design, Design Thinking stages, wireflows, prototypes, and usability testing, with a focus on research methodologies.

Module I **15 Hours**

Foundational Elements of UI/UX: User Interface: Definition and Importance **-** Relationship between UI and UX **-** UI vs. UX Design: Key Differences **-** Roles in UI/UX Design: Key Responsibilities **-** Core Stages of Design Thinking **-** Divergent and Convergent Thinking **-** Usability Goals and Measures

UI Design Process: Visual and UI Principles **-** UI Elements and Patterns **-** Interaction Behaviors and Principles **-** Design Process: Introduction and Phases **-** Small Devices: Design Considerations **-** Audio Menus and Dialog Boxes

Module II **15 Hours**

UX Design Process: Introduction to User Experience **-** UX Principles and Guidelines **-** What Do Users Want: Analyzing User Needs **-** User Psychology and Emotional Design **-** Research in UX Design: Tools and Methods **-** User Experience Research Techniques

Wireframing, Prototyping and Core UX: Introduction to Wireframes **-** Design Patterns and Layout **-** Creating Low-Fidelity Wireframes **-** Prototyping: Concepts and Tools **-** Building High-Fidelity Mockups **-** Designing Efficiently with Tools - Problem Statements and Research Methods.

List of Experiments: **30 hours**

The tools used for lab experiments include Penpot, Pencil Project, OpenUX and Morae

1. Design a mobile app UI applying core UI principles and considering small device design elements like audio menus and dialog boxes.
2. Implement wireframes for a responsive website using grid layouts for mobile and desktop, incorporating interaction behaviors and UI design patterns.

3. Conduct user research and develop personas based on interview data, utilizing appropriate UX research methods.
4. Build a mobile app prototype with key interaction flows, applying wireframing and prototyping techniques.
5. Perform usability testing on an interface and propose improvements based on user feedback, focusing on usability goals and measures.
6. Redesign an interface for accessibility, ensuring compliance with WCAG guidelines and considering user psychology and emotional design.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply foundational UI and UX principles to differentiate and design interfaces for various applications	Apply
CO2: Analyze various stages in design thinking in order to ideate and create user-centered UI/UX solutions	Analyze
CO3: Develop wireframes, prototypes, and high-fidelity mockups using appropriate UI/UX tools	Apply
CO4: Analyze user research and usability testing data to optimize and improve the user experience	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Shneiderma, Plaisant, Cohen, Jacobs, “Designing the User Interface - Strategies for Effective Human-Computer Interaction”, 6th Edition, Pearson, 2018. (Module I)

T2. Joel Marsh, “UX for Beginners”, 1st Edition, O’Reilly, 2016. (Module II)

Reference Book(s):

R1. David Platt, “The joy of UX: User Experience and interactive design for developers”, Pearson, 2016.

R2. Edward Skull, “UX Fundamentals for Non-UX Professionals_ User Experience Principles for Managers, Writers, Designers, and Developers”, Apress, 2018.

R3. Steve Krug, “Don’t Make Me Think, Revisited: A Common sense Approach to Web & Mobile”, 3rd Edition, New riders, 2015

R4. Sharanpreet Kaur “UI/UX Design for Professionals: Create Impactful, User-Centric Designs with Research and Collaboration Techniques for Seamless Responsive Web Interfaces”, 1st Edition, Orange Education Pvt Ltd, 2024.

Web References:

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

Course Code: 23ITE015		Course Title: Server Side Programming	
Course Category: Major		Course Level: Higher	
L: T : P (Hours/Week)2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to apply the fundamentals of server-side programming to develop dynamic, database-driven web applications by efficiently handling HTTP requests and responses, implementing user authentication, and managing sessions within a client-server model.

Module I **15 Hours**

Server-Side Language: HTML PHP Embedding – Dynamic Content Creation – Storing Retrieving Data – Arrays – String Manipulations – Regular Expressions – PHP Functions - Object Oriented PHP – Error and Exception Handling

Module II **15 Hours**

Web Database: MySQL Database Architecture and Design – Web Database Creation – Working with Web Database - Webpage Database Access - Database Administration – Prepared Statements - Storage Engines – Stored Procedures

List of Experiments: **30 hours**

1. Build a simple server that responds with dynamic content based on routes
2. Create a simple form-based application that handles GET and POST requests
3. Implement a user authentication system with session management
4. Enhance the security of an existing web application by identifying and mitigating common vulnerabilities
5. Build a file-upload feature in a web application
6. Develop a web application project using PHP and MySQL

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Examine a web server and its functionalities that handles web pages of an application for any given business requirement	Analyze
CO2: Identify various web elements in a form that reads data and stores data in relational tables on a web server database	Apply
CO3: Analyze web database architecture and steps involved in access of database from the web application.	Analyze
CO4: Apply stored procedures and prepared statements to perform access control and speed up execution of queries in web database.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Welling Luke; Thomson Laura, “PHP and MySQL Web Development”, 5th Edition, Addison-Wesley, 2018**.**

Reference Book(s):

R1. Duckett, Jon, “PHP AND MYSQL: Server-Side Web Development”, 1st Edition, John Wiley & Sons Inc, 2022.

R2. Tatroe, Kevin; MacIntyre, Peter, “Programming PHP: Creating Dynamic Web Pages”, 4th Edition, O'Reilly Media, 2020

R3. Steven Holzner, “PHP: The Complete Reference”, 1st Edition, McGraw Hill Education, 2017.

R4. Kevin Tatroe, Peter MacIntyre, "Programming PHP: Creating Dynamic Web Pages", 4th Edition, Greyscale Indian Edition, 2020.

Web References:

1. https://www.w3schools.com/php/

2. https://www.w3schools.com/MySQL/default.asp

3. https://www.php.net/manual/en/introduction.php

Course Code: 23ITE016		Course Title: Search Engine Optimization	
Course Category: Major		Course Level: Higher	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course intended to apply core Search Engine Optimization principles such as keyword research, on-page and off-page optimization, analytics, and emerging trends to improve website visibility and search engine rankings.

Module I **22 Hours**

Introduction and Search Engines: SEO Overview - Search Engine Evolution - Crawling, Indexing, Ranking - SEO in Digital Strategy - Key Algorithms (Google, Bing)

Keyword Research and Mapping: Keyword Types - Search Intent - Keyword Tools (Google Planner, Moz) - Site Architecture Mapping - Keyword Evaluation

On-Page Optimization Techniques: Titles, Meta Tags, Headers - Content Optimization - URLs and Canonicalization - Internal Links - Image SEO

SEO-Friendly Website Architecture: Site Structure Planning - Mobile Optimization - Structured Data (Schema) - Page Speed and UX

Module II **23 Hours**

Technical SEO Fundamentals: Robots.txt & Meta Tags - Sitemaps - URL Parameters - Canonicalization - Redirects & Broken Links - Crawl Error Diagnosis

Content Marketing for SEO: SEO Content Creation - E-A-T Guidelines - Blogging for SEO - Gap & Competitor Analysis - Content Updates

Link Building and Off-Page SEO: Backlink Types - Link Building Techniques - Toxic Link Cleanup - Anchor Text - Outreach & PR Links

Measuring SEO Performance: SEO KPIs - Google Analytics/Search Console - SEO Dashboards - Full SEO Audits (Screaming Frog, Ahrefs) - Traffic & SERP Analysis

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply keyword research techniques to identify and target effective search terms	Apply
CO2: Implement on-page optimization strategies to enhance website visibility and user engagement	Apply
CO3: Develop and execute off-page SEO strategies to build domain authority and improve search rankings	Apply
CO4: Analyze SEO performance metrics to inform and adjust optimization strategies effectively	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Eric Enge, Stephan Spencer, and Jessie Stricchiola, "The Art of SEO: Mastering Search Engine Optimization," 4th Edition, O'Reilly Media, 2023.

Reference Book(s):

R1. Jason McDonald, "SEO Workbook: Search Engine Optimization Success in Seven Steps," 1st Edition, Independently Published, 2023.

R2. Matthew Capala, "SEO Like I'm 5: The Ultimate Beginner's Guide to Search Engine Optimization," 3rd Edition, Independently Published, 2023.

R3. Peter Kent, "SEO For Dummies," 7th Edition, For Dummies, 2023.

R4. Brian Clifton, "Successful SEO and Search Marketing in a Week," 1st Edition, Teach Yourself, 2023.

Web References:

1. https://pce.sandiego.edu/courses/seo-principles-and-onsite-optimization/

2. https://www.coursera.org/learn/search-engine-optimization

3. https://www.cityu.edu.hk/catalogue/ug/202021/course/IS4340.pdf

Course Code: 23ITE017		Course Title: Progressive Web Framework	
Course Category: Major		Course Level: Higher	
L: T :P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to understand the web page scripting and application design fundamentals using latest web development, database management tools and technologies to effectively develop cutting edge web applications.

Module I **22 Hours**

Vue JS: MVVM design pattern – Reactive Application –Vue, JavaScript Comparison – Core Vue concepts - Vue Instance Creation – Life Cycle – Bind Data – v model Binding – Directives: Conditional – Loop – Components – Local, Global Registration - Dynamic Components – Async Components – Vue CLI

React JS: ReactJS Introduction – React JSX – Understanding Components, Props - React State – Component Lifecycle – Hooks – Event Delegation – React Forms – React CSS – React Router – State Management with Redex – Fetch API – Handling Errors

Module II **23 Hours**

Mongo: MONGO-DB: Understand NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – Simple applications

Next.JS: NextJS Introduction – Setup and Run NextJS – Multi Page App – Routing – Design Patterns – State Management – API Endpoint for NextJS Application – Internal Page Implementation - CRUD Operations

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop interactive and dynamic webpages using Vue JS following Model View - View Model paradigm.	Apply
CO2: Experiment with React JSX and its components to develop front end user interface and working with React forms.	Apply
CO3: Identify attributes for simple model design and handle web application data using MongoDB databases	Apply
CO4: Apply design patterns using Next.JS to develop modern, scalable and maintainable web applications.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Erik Hanchett, Benjamin Listwon, “Vue.js in Action”,1st Edition, Manning, 2018.

T2. Andrei Tazetdinov, "Next.js Cookbook: Learn how to build scalable and high-performance apps from scratch," 1st Edition, BPB Online, 2023.

T3. Greg Lim, “Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App”, 1st Edition, Independent Publishing, 2021.

Reference Book(s):

R1. Manu Sharma, “MongoDB Complete Guide”, 1st Edition, BPB Publications, 2021.

R2. Mike Zephalon, “React JS Reimagined: Bridging Concepts, Hooks, and Real-World Projects”, 1st Edition, Independent Publishing, 2024

R3. Alex Libby, “Practical Next.js for E-Commerce”, 1st Edition, Apress, 2023

Web References:

1. https://www.edx.org/learn/web-development/ibm-introduction-to-web-development-with-html5-css3-and-javascript
2. https://www.mongodb.com/resources/products/fundamentals/mongodb-tutorials
3. https://www.mongodb.com/developer/languages/javascript/nextjs-with-mongodb/

Vertical III: Security and Data Privacy

Vertical III: Security and Data Privacy

Course Code: 23ITE018		Course Title: Ethical Hacking with vulnerability	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to explore the concepts and techniques of security testing, including reconnaissance, scanning for open ports, identifying and exploiting network vulnerabilities, and detecting web application vulnerabilities, using the necessary tools and knowledge to protect against hackers and attackers.

Module I **15 Hours**

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Network and Computer Attacks - Malware - Protecting Against Malware Attacks. Foot printing Concepts – Using Web Tools for Foot printing - Social Engineering – Introduction to Port Scanning - Port-Scanning Tools.

Module II **15 Hours**

Enumeration Concepts - NetBIOS Enumeration - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Tools for Identifying Vulnerabilities in Linux Vulnerabilities of Embedded OS

Hacking Web Servers – Understanding Web Application - its Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

Network Protection System - Understanding Routers – Understanding Firewall – Understanding Intrusion Detection and Prevention System

List of Experiments: **30 hours**

1. Study the different types of reconnaissance.
2. Extract metadata and expand the target list using FOCA / Search Diggity tool.
3. Aggregates information from public databases using Paterva's Maltego tool.
4. Gather Information about the networking domain, IP address using Robtex tool.
5. Scan the target system using Nessus tools to identify potential vulnerabilities and weaknesses.
6. Automate dig for vulnerabilities and match exploits using Armitage FOCA tool.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Determine the ability to use publicly available tools to gather information about potential targets during the reconnaissance phase of penetration testing	Analyze
CO2: Apply the scanning techniques to identify open ports and services on network systems.	Apply
CO3: Analyze skills to identify network vulnerabilities and confirm their exploitability through practical testing.	Analyze
CO4: Develop the ability to ethically assess and secure systems, applying the knowledge within legal and organizational boundaries.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Simpson, Michael T, Kent Backman, and James Corley, "Hands-on Ethical Hacking and Network Defence", Course Technology Press, Cengage Learning, 3rd Edition, 2020.

Reference Book(s):

R1. Hickey, Matthew, and Jennifer Arcuri, "Hands on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming ", 1st Edition, John Wiley & Sons, 2020.

R2. Hoffman, Andrew, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications",2nd Edition, O'Reilly Media, 2020.

R3. Seitz, Justin, and Tim Arnold, "Black Hat Python: Python Programming for Hackers and Pentesters", 2nd Edition, No starch press, 2021.

R4. Edwin Cano, “Mastering Ethical Hacking”,1st Edition, 2024.

Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105217/
2. https://www.udemy.com/topic/ethical-hacking/

Course Code: 23ITE019		Course Title: Web Application Security	
Course Category: Major		Course Level: Higher	
L: T:P (Hours/Week)2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to utilize hacking techniques to conduct vulnerability assessments, analyze web application security architecture, and manage vulnerabilities by identifying steps to detect, mitigate, and defend against input-related threats, while modeling secure front-end components like scripting engines and client-side code through experimentation.

Module I **15 Hours**

Web Application Fundamentals: Web application Introduction – Modern Web Application structure – Domain – API Analysis – Third party dependencies – Weak area identification in Web application

Security Attacks: Web application hacking – Cross Site Scripting - Cross Site Request Forgery – XML External Entity Attack – SQL Injection – Denial of Service - Exploit Third Party Dependency

Module II **15 Hours**

Security Defense: Modern Web Application Security & Architecture - Vulnerability: Discovery & management – Anti Cross Sheet Exploitation Practices – Anti Cross Site Request Forgery mitigation –Tool for DoS Mitigation – SQL Injection Detection & Mitigation – Third Party Dependency tree Evaluation

Modern Tools Overview: Nexpose: Network vulnerability scanner – Open Vas: Vulnerability Assessment Overview –– Burp suite: Penetration Testing Overview – MetaSploit: Open Framework Overview

List of Experiments: **30 hours**

1. Use Wireshark and explore the various protocols
    a. Analyze the difference between HTTP vs HTTPS
    b. Analyze the various security mechanisms embedded with different protocols
2. Create simple REST API using python for following operation
    a. GET b. PUSH c. POST d. DELETE
3. Implement necessary security techniques such as authentication, encryption, access control for developed REST API application
4. Use Open VAS tool in any Linux platform and perform vulnerability scan and tests
5. Identify the following vulnerabilities using Burp Suite:
    a. SQL injection b. cross-site scripting (XSS)
6. Implement steps to perform penetration testing and vulnerability assessment on the systems using MetaSploit framework.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Examine various threats and vulnerabilities and access security risks in the web application architecture	Analyze
CO2: Identify secure coding practices to mitigate the input validation errors, poor session management in web application	Apply
CO3: Analyze security defense strategies that protect against attacks like Cross-Site Scripting, Cross-Site Request Forgery and other web application threats	Analyze
CO4: Apply necessary security design, develop and maintain secure web applications that implement security best practices effectively	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Hoffman, Andrew, “Web Application Security: Exploitation and Counter Measures for Modern Web Applications”, 1st Edition, O’Reilly Media, Inc., 2020 (Module I)

T2. Madden, Neil, “API Security in Action “, 1st Edition, Manning Publications, 2020 (Module II)

Reference Book(s):

R1. Malcolm McDonald, Web Security for Developers: Real Threats, Practical Defense, Illustrated Edition, No Starch Press, United States, 2020.

R2. Sullivan, Bryan, Vincent, Liu, “Web Application Security, A Beginner’s Guide”. McGraw Hill Professional, 2011.

R3.John Paul Mueller, "Security for Web Developers: Using Javascript, Html, and CSS", O'Reilly Media, 1st Edition, 2015

R4. Andrew Homan, “ Web Application Security Exploitation and Countermeasures for Modern Web Applications”, O’Reilly Media, Inc, 1st edition, 2020.

Web References:

1. https://metamug.com/article/java/maven/spring-boot-maven-setup-rest-api.html
2. https://portswigger.net/burp/documentation/contents
3. https://tsmith6421.medium.com/info-gathering-with-metasploit-44fd77754cf7
4. https://tsmith6421.medium.com/pentest-phase-2-crafting-an-exploit-63fffaca2f1c
5. https://owasp.org/www-project-top-ten/

Course Code: 23ITE020		Course Title: Quantum Computing	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to learn Fundamentals of Quantum computing, Quantum algorithms and QML Techniques.

Module I **15 Hours**

Fundamentals of Quantum Computing: The Essentials of Quantum Computing-Quantum Operators and Gates - No-Cloning Theorem- Grover's Algorithm- Shor's Algorithm.

Quantum Algorithm-1: Quantum Complexity - Quantum Feature Maps- Information Encoding- Deutsch-Jozsa Algorithm- Deutsch-Jozsa with Cirq.

Module II **15 Hours**

Quantum Algorithm-2: Schmidt Decomposition - Quantum Metrology - Linear Models-Quantum k-Means Clustering - Quantum k-Medians Algorithm.

QML Techniques: HHL Algorithm (Matrix Inversion)-QUBO-Supervised Learning: Quantum Support Vector Machines - Quantum Computing with D-Wave.

List of Experiments: **30 hours**

1. Implementation of Shor's Algorithm for Factorization of given integer.
2. Apply Grover's algorithm to solve a real-world optimization problem.
3. Implementation of Deutsch's Algorithm for finding a constant function.
4. Implementation of Deutsch-Jozsa's Algorithm for checking the function is balanced or not.
5. Implementation of Quantum k-Means Clustering to compute the distance between quantum data points and quantum centroids.
6. Implementation of HHL Algorithm for Solving Linear Systems and analysis of error.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply quantum computing concepts to solve problems using key algorithms.	Apply
CO2: Utilize quantum algorithms and QML techniques to address practical applications.	Apply
CO3: Implement the Shor's, Grover's, and Deutsch's algorithms to evaluate their effectiveness in solving complex computational problems.	Analyze
CO4: Implementation of Quantum k-Means Clustering and the HHL algorithm for solving linear systems to assess their effectiveness and performance in utilizing quantum computing.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1: Santanu Ganguly, “Quantum Machine Learning: An Applied Approach: The Theory and Application of Quantum Machine Learning in Science and Industry”, 1st Edition, Apress Publisher, 2021.

Reference Book(s):

R1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, 10th Edition, Cambridge University Press, 2021.

R2. Jack D. Hidary, “Quantum Computing: An Applied Approach”, Springer, 2023.

R3. Chris Bernhardt, “Quantum Computing for Everyone”, MIT Press, 2023.

R4. Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, 1st Edition, 2020.

Web References:

1. https://qiskit.org/textbook/preface.html (2022)
2. https://onlinecourses.nptel.ac.in/noc24_cs67/preview

Course Code: 23ITE021		Course Title: Malware Analysis and Tools	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week)3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to introduce the fundamentals of malware, including its types and effects which enables learners to analyse various malware through static and dynamic analysis.

Module I **22 Hours**

Introduction: Malware Analysis- Goals of Malware Analysis-Malware Analysis Techniques-Types of Malware-General Rules for Malware Analysis.

Basic Static Techniques: Anti-Virus Scanning- Hashing- Finding Strings- Packing and Obfuscation- PE file format, Static, Linked Libraries and Functions- Static Analysis tools.

Malware and Dynamic Analysis: Virtual Machines and their usage in malware analysis, Basic dynamic analysis: Sandboxing, Running Malware-Process Monitoring- Viewing Processes-Registry Snapshots - Faking a Network - Packet Sniffing with Wireshark.

Advanced Static & Dynamic Analysis: Levels of Abstraction- Reverse-Engineering- The x86 Architecture-IDA Pro- Dynamic Analysis: Source-Level vs. Assembly-Level Debuggers -Kernel vs. User-Mode Debugging- Using a Debugger- Exceptions- OLLYDBG.

Module II **23 Hours**

Malware Functionality: Downloaders and Launchers – Backdoors-Credential Stealers-Persistence Mechanisms- Covert Malware Launching- Launchers-Process Injection-Process Replacement-Hook Injection-Detours -APC injection.

Anti-Reverse-Engineering: Anti-Disassembly- Anti-Debugging- Anti-Virtual Machine Techniques- Packers and Unpacking.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply various static and dynamic malware analysis techniques to identify and understand the behavior of different types of malware.	Apply
CO2: Apply static analysis tools to malware samples to understand file structures, linked libraries, and functions.	Apply
CO3: Analyze advanced malware functionalities, such as backdoors, downloaders, and privilege escalation mechanisms, to assess their impact on system security.	Analyze
CO4: Analyze anti-reverse-engineering techniques to evaluate their effectiveness in protecting software from reverse engineering.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. M. Sikorski and A. Honig, “Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software”, 1st Edition, No Starch Press San Francisco, CA. (ISBN No.: 9781593272906), United States, 2012.

Reference Book(s):

R1. Abhijit Mohanta, Anoop Saldanha, “Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware”, 1st Edition, Apress (ISBN 978-1-4842-6192-7), United States, 2020.

R2. B. Dang, A. Gazet, E. Bachaalany, S Josse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 1st Edition, Wiley, 2014.

R3. Michael Sikorski, Andrew Honig, “Practical Malware Analysis”, No Starch Press, 2012.

R4. Joshua Saxe, Hillary Sanders, “Malware Data Science Attack Detection and Attribution”, No Starch Press,2018.

Web References:

1. https://www.oreilly.com/library/view/practical-malware-analysis/9781593272906/
2. https://www.udemy.com/course/malware-analysis-course-for-it-security/

Course Code: 23ITE022		Course Title: Blockchain Technologies	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to explore the introduction of blockchain, Architecting Block Chain Solutions and blockchain implementation using ethereum and hyperledger fabric.

Module I **23 Hours**

Introduction to Block Chain Concepts: Block Chain Characteristics – Evolution of Blockchain- Chaining of Blocks - Hashing - Merkle Tree - Consensus – Mining and Finalizing Blocks - Currency Aka Tokens - Security on Block chain - Data Storage on Block chain - Wallets - Coding on Block chain: Smart Contracts - Peer-to-Peer Network - Types of Block chain Nodes - Risk Associated with Block chain Solutions - Life Cycle of Block chain Transaction.

Architecting Block Chain Solutions: Block chain Relevance Evaluation Framework – Block chain Solutions Reference Architecture- Cryptographic Tokens- Architecture Considerations – Architecture with blockchain platforms – Approach for designing blockchain applications.

Module II **22 Hours**

Ethereum Blockchain implementation: Ethereum Ecosystem – Ethereum Development – Ethereum Tool Stack – Ethereum Virtual Machine – Smart contract Programming – Integrated Development Environment

Hyperledger Blockchain implementation: Hyperledger Fabric – Fabcar Use case implementation – Invoking Chain code Functions using Client Application

Advanced Concepts in Blockchain: Inter Planetary File System – Zero- Knowledge Proofs – Oracles – Self- Sovereign Identity – Blockchain with IoT and AI/ ML – Quantum Computing and Blockchain – Initial Coin Offerings – Blockchain Cloud Offerings – Blockchain and its future Potential.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply blockchain concepts and principles to implement Merkle trees and consensus algorithms for cryptocurrency transactions.	Apply
CO2: Identify the architecting blockchain solutions for designing blockchain applications.	Apply
CO3: Implement Ethereum and Hyperledger blockchain frameworks to develop decentralized applications..	Apply
CO4: Analyze the advanced concepts of blockchain like Inter Planetary File System, Quantum Computing and its future Potential.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Choudhari Ambadas Tulajadas, Ariff Arshad Sarfarz, Sham M R, “Blockchain for Enterprise Application Developers”, 1st Edition, Wiley India Pvt. Ltd., 2020.

Reference Book(s):

R1. Nakul Shan, “Blockchain for Business with Hyperledger Fabric: A complete guide to enterprise blockchain implementation using Hyperledger Fabric”, BPB Publications, 2019.

R2. Andreas M. Antonopoulos, “Mastering Blockchain”, 2nd Edition, O‘Reilly Media, 2017.

R3. Melanie Swan, "Blockchain - Blueprint for a New Economy", O‘Reilly Media, New Delhi, 2015.

R4. Kumar Saurabh, “Block chain technology: concepts and applications”, 1st Edition, Wiley,2020.

Web References:

1. https://nptel.ac.in/courses/106/105/106105184/
2. https://www.coursera.org/courses?query=blockchain
3. https://tech.seas.harvard.edu/free-blockchain

Course Code: 23ITE023		Course Title: Secure Mobile Development with Flutter	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to equip participants with essential skills to identify and mitigate security threats in mobile applications. It covers secure coding practices, data protection, and authentication mechanisms, emphasizing hands-on experience.

Module I **15 Hours**

Introducing Flutter, Widget Lifecycle events, Widget Tree & Element Tree, Dart Basics- Variables, Operators, Flow statements, Functions, Packages, Classes. Basic Widgets- Container, Row, Columns, Buttons, Form widgets, Orientations, Decorators, Animations

Module II **15 Hours**

Saving Data with Local persistence- JSON Format, Database classes, Serialize JSON dates, Cloud Firebase Database and Implementation security –Authentication & Authorization - Data Validation

List of Experiments: **30 hours**

1. Develop a simple Flutter app that tracks user interaction
2. Build a responsive UI that adapts to different screen sizes and orientations.
3. Examine how JSON data is structured and manipulate it within a Flutter app.
4. Develop a CRUD application using API for local data persistence.
5. Develop flutter app with Firebase basic configuration
6. Build a secure Flutter application with Firebase authentication and data validation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the Flutter widget lifecycle events and evaluate their impact on application performance and state management.	Analyze
CO2: Examine the structure of JSON data and evaluate how it can be effectively manipulated within a Flutter application	Analyze
CO3: Apply the configuration steps taken to integrate Firebase into a Flutter application, assessing the security	Apply
CO4: Identify the security practices implemented in a Flutter application, particularly authentication mechanisms	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbooks:

T1. Marco L. Napoli, “Beginning Flutter: A Hands-On Guide to App Development”, 1st Edition, John Wiley & Sons, 2020.

Reference Books:

R1. Andrew M. Smith, “Mobile Application Security: The Definitive Guide”, 2023.

R2. Mark G. Graff, Kenneth R. van Wyk, “Secure Coding: Principles and Practices”, 2022.

R3. Dafydd Stuttard, Marcus Pinto, “The Mobile Application Hacker's Handbook: Finding and Exploiting Security Flaws”, 2021.

R4. Heather Adkins, Betsy Beyer, Chris Jones, Jennifer Petoff, “Building Secure and Reliable Systems: Lessons from Google SRE”, 2020.

Web References:

1. https://owasp.org/www-project-mobile-app-security/
2. https://firebase.google.com/docs/rules
3. https://www.nist.gov/cyberframework

Course Code: 23ITE024		Course Title: Information Security	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to impart foundational and advanced knowledge of information security principles, practices, and threat assessment and encourage critical thinking about emerging trends and technologies in information security.

Module I **22 Hours**

Introduction and Information Security Risk Analysis: Introduction to Information Security – Balancing Information Security and Access - Approaches to Information Security Implementation – Security SDLC – Ethical and Professional Issues. Importance of Risk Management – Integration of Risk Management in SDLC – Risk Assessment – Risk Determination – Risk Level Matrix – Control Recommendations – Case Study.

Security Models: Bell-LaPadula Model – Biba Model – Clark-Wilson Model – Brewer and Nash Model – Graham-Denning Model – Harrison Ruzzo Ullman Model.

Module II **23 Hours**

Security Technology: Introduction – Intrusion Detection and Prevention System - Honeypots, Honeynets, and Padded Cell Systems - Scanning and Analysis Tools - Access Control Devices – Case Study - Physical Security - Security and Personnel - Security Management Maintenance Models.

Biometrics control for Security: Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply appropriate security models and risk management techniques to identify and mitigate threats and vulnerabilities in information systems.	Apply
CO2: Identify and analyze various security threats, vulnerabilities, and attacks on systems and networks.	Apply
CO3: Apply various security technologies to detect, prevent, and analyze potential intrusions in information systems.	Apply
CO4: Implement the use of biometric authentication techniques by applying the matching and enrollment processes for secure user identification.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Michael E. Whitman, Herbert J. Mattord, “Principles of Information Security”, 6th Edition, Cengage Learning, 2018.(Module I)

T2. Nina Godbole, “Information Systems Security-Security Management, Metrics, Frameworks and Best Practices”, Wiley India Pvt. Ltd., New Delhi, 1st Edition, 2009. (Module II)

Reference Book(s):

R1. Mark Stamp,” Information Security: Principles and Practice”, 3rd Edition, Wiley,2021.

R2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, 4th Edition, Tata McGrawHill, 2003

R3. Matt Bishop, “Computer Security Art and Science”, 1st Edition, Pearson/PHI, 2002.

R4. William Stallings, “Cryptography and Network Security: Principles and Practice”, 8th Edition, Pearson Education, 2023.

Web References:

1. https://tryhackme.com/hacktivities

2.https://www.bartleby.com/subject/engineering/computer-science/concepts/types-of-security-models

Course Code: 23ITE025		Course Title: Social Network Security	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objective

This course is intended to apply semantic web technologies to build social web applications with data extraction, behaviour prediction, and secure, privacy aware access control.

Module I **22 Hours**

Fundamentals of Social Networking: Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis.

Web data and semantics in social network applications: Electronic sources for network analysis: Electronic discussion networks - Blogs and online communities - Web based networks - Knowledge Representation on the Semantic Web - Ontologies and their role in the Semantic Web - Ontology languages for the Semantic Web.

Security Issues in Social Networks: The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

Module II **23 Hours**

Predicting Human Behavior and Privacy Issues: 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.

Extraction and Mining Communities in Web Social Networks: Online Identities and Social Networking - Detecting Communities in Social Networks - Tools for Detecting Communities - Methods for community detection and mining - Applications of community mining algorithms.

Visualization and Applications of Social Networks: Visualization of Social Networks - Visualizing Online Social Networks - Applications of Social Network Analysis - Online Advertising in Social Networks.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Construct basic applications utilizing Semantic Web principles	Apply
CO2: Categorize the processes involved in extracting and mining data from social networks	Analyze
CO3: Examine the prediction of human behavior within social communities	Analyze
CO4: Organize and Visualize social networks	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Peter Mika, “Social Networks and the Semantic Web”, 1st Edition, Springer 2007. (Module I)

T2. Borko Furht, Handbook of Social Network Technologies and Application, 1st Edition, Springer, 2010. (Module II)

Reference Book(s):

R1. Easley D. Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly Connected Worl”, 1st Edition, Cambridge University Press, 2010.

R2. Jackson, Matthew O., “Social and Economic Network”, 1st Edition, Princeton University Press, 2008.

R3. GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and application, 1st Edition, Springer, 2011.

R4. John G. Breslin, Alexander Passant, and Stefan Decker, “The Social Semantic Web”, 1st Edition, Springer, 2009.

Web References:

1. https://www.becybersafe.com/more/links.html

2. https://www.nicybersecuritycentre.gov.uk/social-media-how-secure-your-accounts

3. https://www1.udel.edu/security/bestpractices/socialnetworking.html

Vertical IV: Artificial Intelligence and Machine Learning

Vertical IV: Artificial Intelligence and Machine Learning

Course Code: 23ITE026		Course Title: Soft Computing	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to make students to understand the basic concepts of techniques like fuzzy logic, neural networks and genetic algorithms.

Module I **23 Hours**

Introduction to Neuro – Fuzzy and Soft Computing: Fuzzy Set Theory: Fuzzy sets- Extension Principle and Fuzzy Relations - Fuzzy If-Then Rules - Fuzzy Reasoning. Fuzzy Inference Systems: Mamdani Fuzzy Models - Sugeno Fuzzy Models - Tsukamoto Fuzzy Models. Least-Squares Methods for System Identification – Derivative-Free Optimization.

Module II **22 Hours**

Neural Networks - Adaptive Networks: Architecture – Backpropagation for Feedforward Networks – Extended Backpropagation for Recurrent Networks – Hybrid Learning Rule. Supervised Learning Neural Networks: Perceptrons – Adaline - Backpropagation Multilayer Perceptrons - Radial Basis Function Networks. Unsupervised Learning and Other Neural Networks: Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning – Principal Component Networks – Hopfield Network. Neuro Fuzzy Modeling: ANFIS: Adaptive Neuro-Fuzzy Inference Systems.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the various soft computing frame works for real time applications.	Apply
CO2: Analyze the performance of various fuzzy logic problems using Fuzzy Set Theory.	Analyze
CO3: Apply the concept of neural networks and their relationship with other learning models.	Apply
CO4: Analyze the different applications of Neuro-Fuzzy and Soft Computing.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Jyh Shing Roger Jang, Chuen Tsai San, Eiji Mizutani, “Neuro fuzzy and soft computing” 1st Edition, Pearson Education 2018.

Reference Book(s):

R1. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 3rd Edition, Wiley India, 2023.

R2. Karray Fakhreddine O, Silva Clarence De W, “Soft Computing and Intelligent Systems Design”, Addison-Wesley, 2022.

R3. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Education, 2007

R4. George J. Klir, Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1st Edition, Pearson Education India, 2002.

Web References:

1. http://www.myreaders.info/html/soft_computing.html
2. http://www.vssut.ac.in/lecture_notes/lecture1423723637.pdf
3. NPTEL Course on “Introduction to Soft Computing”,
4. https://archive.nptel.ac.in/courses/106/105/106105173/

Course Code: 23ITE027		Course Title: Natural Language Processing	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to apply core principles like text processing, language models, word embeddings, and deep learning for sequence-to-sequence tasks.

Module I **15 Hours**

Introduction to Natural Language Processing: Basics of NLP: Definition and Applications – Text pre-processing – Regular Expression

Text Processing Techniques: Tokenization - Word Normalization, Lemmatization and Stemming - Minimum Edit Distance – N-gram Language model

Text Representation: Bag-of-word: TF/IDF - Word2Vec and GloVe

NLP Libraries: Introduction to NLP Libraries and Tools (e.g., NLTK, SpaCy)

Module II **15 Hours**

Syntax and Parsing Techniques: Overview of Syntax and Parsing - Parsing Algorithms and Techniques

Semantic Analysis and Sentiment Analysis: Semantic Analysis: Word Sense Disambiguation, Coreference Resolution - Sentiment Analysis and Opinion Mining

Deep Learning for NLP: Introduction to Deep Learning for NLP - Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) Networks - Transformer Models: BERT and GPT

Sequence-to-Sequence Models and Applications: Sequence-to-Sequence Models and Applications - Named Entity Recognition (NER) with Deep Learning

NLP in Real-World Applications: Text Classification and Clustering - NLP in Real-World Applications: Chatbots, Text Summarization

List of Experiments: **30 hours**

The tools used for lab experiments include NLTK, SpaCy, and GloVe.

1. Implement text preprocessing steps, including tokenization, word normalization, and stemming/lemmatization on a sample text.
2. Build unigram, bigram, and trigram language models using a text dataset and calculate the probabilities of specific word sequences.
3. Implement Bag-of-Words and TF-IDF vectorization for a text corpus, performing document similarity analysis using cosine similarity.
4. Develop a Named Entity Recognition (NER) system to extract entities from a sample text.
5. Implement a syntactic parser to analyze the dependency structure of sentences using NLTK or SpaCy.
6. Build a sentiment analysis model using Word2Vec or GloVe embeddings and evaluate the model's performance on a labeled dataset.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply core principles of NLP and text processing techniques to solve basic language-related problems.	Apply
CO2: Implement the language models, vector space models, and word embeddings for text data using NLP libraries.	Apply
CO3: Develop the deep learning models for sequence-to-sequence tasks and real-world NLP applications.	Apply
CO4: Analyze research methodologies to enhance the performance and evaluation of NLP systems.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing”, 3rd Edition, Prentice Hall, 2022.

Reference Book(s):

R1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, 1st Edition, Springer, 2006.

R2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

R3. Christopher D. Manning, Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.

R4. Siddiqui Tanveer, “Natural Language Processing and Information Retrieval”, OUP India, 1st Edition, 2008.

Web References:

1. https://www.nltk.org/
2. https://spacy.io/
3. https://stanfordnlp.github.io/CoreNLP/

Course Code: 23ITE028		Course Title: Swarm Intelligence	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to train students to critically analyse and solve complex problems using swarm intelligence methodologies and apply swarm intelligence algorithms for solving optimization problems.

Module I **15 Hours**

Introduction to Optimization – Particle Swarm Optimization (PSO) - Artificial Bee Colony Algorithm (ABC) –Ant Colony Algorithm (ACA) – Grey wolf Optimizer (GWO) - Whale Optimization Algorithm (WOA) - Firefly Algorithm - Bat algorithm - Applications.

Module II **15 Hours**

Ant Lion Optimization Algorithm (ALO) – Grasshopper Optimisation Algorithm (GOA) - Butterfly Optimization Algorithm (BOA) – Moths-Flame Optimization Algorithm - Genetic Algorithm - Artificial Neural Network – Applications - Future of Nature Inspired Algorithm, Swarm and Computational Intelligence.

List of Experiments: **30 hours**

1. Implement the PSO algorithm to select the best subset of features for building machine learning models, enhancing model accuracy, and reducing overfitting.
2. Implement the ABC algorithm to solve the Knapsack Problem.
3. Implement the ACO algorithm to solve the Traveling Salesman Problem
4. Implement the Firefly Algorithm to a job shop scheduling problem for solving multi-objective optimization problems.
5. Implement the ALO algorithm to optimize investment portfolios by selecting the best combination of assets to maximize returns while minimizing risk.
6. Implement the BOA algorithm to select the most relevant features from Iris datasets.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the basic concepts of Swarm Intelligence methodologies.	Apply
CO2: Design Swarm Intelligence Algorithms to solve various computational problems.	Apply
CO3: Analyze the performance of swarm intelligence techniques to solve complex real-world optimization problems like scheduling, routing, resource allocation and multi-agent coordination.	Analyze
CO4: Develop solutions using multi-agent systems in simulated environments.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Modestus O. Okwu, Lagouge K. Tartibu, “Metaheuristic Optimization: Nature-Inspired Algorithms Swarm and Computational Intelligence, Theory and Applications”, Springer International Publishing, Switzerland,2021.

Reference Book(s):

R1. Xin-She Yang, “Nature-Inspired Computation and Swarm Intelligence: Algorithms, Theory and Applications”, Elsevier Science, United Kingdom, 2020.

R2. Abhishek Sharma, Abhinav Sharma, “Swarm Intelligence: Foundations, Principles and Engineering Applications”, CRC Press, 2022

R3. Kalyanmoy Deb, "Multi-objective optimization using evolutionary algorithms", John Wiley & Sons, USA, 2011.

R4. Eiben A.E and Smith J.E, "Introduction to Evolutionary Computing", 2nd Edition, Springer, New York, 2015

Web References:

1. https://shorturl.at/6JL4t
2. https://link.springer.com/journal/11721
3. https://en.wikipedia.org/wiki/Swarm_intelligence
4. https://www.researchgate.net/topic/Swarm-Intelligence

Course Code: 23ITE029		Course Title: Machine Learning with Python	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week)2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to cover the fundamentals of machine learning, including data preprocessing, feature engineering, and the implementation and evaluation of both supervised and unsupervised algorithms, and exploring advanced techniques.

Module I **15 Hours**

Introduction - Scikit-learn-Essential Libraries and Tools-Machine Learning Types

Supervised Learning: Generalization, Overfitting, and Underfitting- Linear Models –Naive Bayes Classifiers–Ensembles of Decision Trees- Kernelized Support Vector Machines

Unsupervised Learning: Types of Unsupervised Learning - Preprocessing and Scaling– Dimensionality Reduction: Principal Component Analysis (PCA)-Manifold Learning with t-SNE

Module II **15 Hours**

Data Representation and Feature Engineering: Categorical Variables- Binning, Discretization, Linear Models, and Trees-Interactions and Polynomials- Automatic Feature Selection

Model Evaluation and Improvement: Cross Validation- Grid Search- Evaluation Metrics and Scoring: Metrics for Classification- Regression Metrics- Algorithm Chains and Pipelines

Recent advancement: Introduction to Transformers and its architecture- Text Processing Transformers-Vision Transformer

List of Experiments: **30 hours**

1. Work with NumPy, Panda by Loading Dataset in Python and Implement visualization with Matplotlib and Seaborn.
2. Implement Support Vector Machine (SVM) for Classification on a real-world dataset

3. Implement Ensemble Learning Techniques: Bagging and Boosting
4. Implement Dimensionality Reduction using PCA and t-SNE
5. Implement image classification using Pretrained Vision Transformers
6. Develop a mini project focused on predictive modeling.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the fundamentals of supervised and unsupervised learning to implement key algorithms and solve real-world problems.	Apply
CO2: Implement machine learning models like linear models, decision trees, and support vector machines using scikit-learn.	Apply
CO3: Apply dimensionality reduction techniques like PCA and t-SNE for data preprocessing and feature extraction.	Apply
CO4: Analyze the model performance through techniques like feature engineering and model optimization.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Andreas C. Muller, Sarah Guido, “Introduction to Machine Learning with Python”, 4th Release,O’Reilly,2018.

T2. Uday Kamath, Kenneth Graham, Wael Emara, “Transformers for Machine Learning: A Deep Dive” ,1st Edition, CRC Press, 2022

Reference Book(s):

R1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, “Practical Machine Learning with Python”, 1st Edition,Apress, 2018

R2. John D. Kelleher ,Brian Mac Namee , Aoife D'Arcy, “Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies”, 2nd Edition,The MIT Press,2020.

R3. Oliver Theobald, **“**Machine Learning for Absolute Beginners”, 3rd Edition, Scatterplot Press, 2017.

R4. Ethem Alpaydin, “Introduction to Machine Learning”, 4th Edition, The MIT Press, 2020.

Web References:

1. https://scikit-learn.org/stable/
2. https://www.tutorialspoint.com/machine_learning_with_python/index.html
3. https://www.w3schools.com/python/python_ml_getting_started.asp

Course Code: 23ITE030		Course Title: Intelligent systems	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to equip students with theoretical and practical skills in intelligent systems, covering neural networks, evolutionary algorithms, fuzzy logic and autonomous systems.

Module I **15 Hours**

Evolution of modern Computational Intelligence, Problem Solving by Search: Heuristic Search-Iterative Search-Adversarial Search- Knowledge Representation and Reasoning.

Module II **15 Hours**

Rule-based Expert Systems -Fuzzy Expert Systems -Neural Networks- Evolutionary Algorithms - Autonomous Systems-Hybrid Intelligent Systems-Emerging Trends and Research in Intelligent Systems.

List of Experiments: **30 hours**

1. Implement and compare different search algorithms for solving a maze.
2. Apply heuristic search techniques to solve the traveling salesman problem.
3. Develop a simple rule-based expert system for diagnosing plant diseases.
4. Implement a neural network for handwritten digit recognition.
5. Develop a simple simulation for an autonomous mobile robot.
6. Develop a hybrid system combining neural networks and fuzzy logic for traffic prediction.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply search algorithms to solve real-world problems in intelligent systems.	Apply
CO2: Analyze the evolution and impact of computational intelligence on intelligent systems.	Analyze
CO3: Evaluate the performance of intelligent systems based on accuracy, efficiency, and scalability.	Evaluate
CO4: Apply a hybrid intelligent system using fuzzy logic and neural networks for complex problems.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Crina Grosan and Ajith Abraham, “Intelligent Systems-A Modern Approach”, Springer,2011.

Reference Book(s):

R1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 1st Edition , 2016.

R2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley, 4th Edition , 2016

R3. Kosko B, “Neural Networks and Fuzzy Systems: A dynamical system approach to machine intelligence”, Prentice Hall of India, 2009.

R4. Luger, George F, "Intelligent Systems: A Modern Approach", Pearson,2008.

Web References:

1. https://www.coursera.org/specializations/deep-learning
2. https://onlinelibrary.wiley.com/journal/26404567
3. https://towardsdatascience.com

Course Code: 23ITE031		Course Title: Prompt Engineering	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to impart knowledge on foundational and advanced text generation techniques using OpenAI's models and LangChain for effective prompting strategies and diverse output methods to enhance their text generation workflows.

Module I **15 Hours**

Introduction: The Five Principles of Prompting- Large Language Models for Text Generation- OpenAI's Generative Pretrained Transformers

Standard Practices for Text Generation with ChatGPT: Generating Lists- Hierarchical List - Generating JSON- Diverse Format Generation-with ChatGPT- Summarization - Chunking Text – Chunking Strategies

Module II **15 Hours**

Advanced Techniques for Text Generation with LangChain: Introduction to LangChain - Chat Models- Streaming Chat Models- Creating Multiple LLM Generations- LangChain Prompt Templates – LCEL – Using Prompt Template with Chat Models – Output Parsers – LangChain Evals – OpenAI Function Calling – Parallel Function Calling – Query Planning – Creating Few-Shot Prompt Templates – Text Splitters - Text Splitting by Length and Token Size - Text Splitting with Recursive Character Splitting – Text Decomposition – Prompt Chaining

List of Experiments: **30 hours**

1. Develop Text generation using a mock ChatGPT model
2. Generate a text summarization for the given text using summarization techniques
3. Implementation of text chunking using the Natural Language Toolkit (NLTK)
4. Implementation of Approaches in Prompt Engineering
    - Interview Pattern Approach
    - Resume Preparation
5. Implementation of Effective Text Prompts for Image Generation
6. Demonstrates various text splitting methods to split text into sentences, words, and chunks of a specified length

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply prompt engineering techniques that optimize performance and guide the behavior of generative AI models effectively	Apply
CO2: Apply advanced techniques like function calling and text splitting strategies to optimize text generation workflows for specific use cases.	Apply
CO3: Analyze the advanced text generation techniques using LangChain, covering key concepts such as chat models, prompt templates, output parsers, and various text splitting methods	Analyze
CO4: Examine the parallel function calling, few-shot prompting, and prompt chaining to enhance the capabilities of language models.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. James Phoenix, Mike Taylor, “Prompt Engineering for Generative AI”, O’Reilly, 1st Edition, 2024.

Reference Book(s):

R1. Michael Ferguson, “Prompt Engineering: The Future of Language Generation”, January 2023

R2. Gilbert Mizrahi, “Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro”, 2024.

R3. Aras Bozkurt, Ramesh C. Sharma, “Transforming Education with Generative AI”, IGI Global, 1st Edition, 2024.

R4. Kapila Arora, Geetu Garg, Gaurav Aroraa, “Prompt Engineering for Beginners”,1st Edition, Arcchie Publications,2024.

Web References:

1. https://www.promptingguide.ai/
2. https://platform.openai.com/docs/guides/prompt-engineering/strategy-give-models-time-to-think
3. https://www.coursera.org/learn/generative-ai-introduction-and-applications?specialization= generative-ai-foreveryone

Course Code: 23ITE032		Course Title: Cognitive Computing	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to introduce the foundational concepts and design principles of cognitive computing systems and provide an understanding of the role of machine learning, natural language processing, and semantic web technologies to build the applications in cognitive systems.

Module I **22 Hours**

Foundation of Cognitive Computing: Cognitive Computing as a new generation – Uses of Cognitive systems – Understanding Cognition – Complex relationships – Elements of Cognitive systems – **Design Principles:** Components – Building the corpus – Bringing data into the Cognitive systems – Machine Learning – Hypotheses Generation and scoring – **NLP:** Role of NLP – Semantic Web – Natural Language Technologies. **Big data and Cognitive Computing:** Architectural Foundation for Big Data – Analytical data ware house – **Representing knowledge in taxonomies and Ontologies**: Models for Knowledge Representation.

Module II **23 Hours**

Applying advanced analytics: Key capabilities – Relationship between statistics, data mining and Machine learning – Predictive Analytics – Text Analytics – Image Analytics – Speech Analytics – Create values. **Role of cloud and distributed computing**: Characteristics of cloud computing – Models – Delivery models of the cloud. **Business implications:** New disruptive models – Building business specific solutions. **Process of building a cognitive application:** Define Objective, Domain, Intended Users, Attributes - Exploring Insights - Creating and Refining the Corpora - Emerging Cognitive Computing areas – Applications: DeepQA and Hypothesis Generation - **Cognitive training tools:** Chatbots (ChatGPT), Smart Assistants (Siri,Alexa), Data Analysis (SparkPredict, AlphaGo).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the fundamental components and principles of cognitive computing to real-world scenarios and systems.	Apply
CO2: Analyze the role of cognition, machine learning, and natural language processing in the development of intelligent cognitive applications.	Analyze
CO3: Apply advanced analytical techniques to process and interpret multimodal data, including text, image, and speech, within a cognitive computing framework.	Apply
CO4: Design and develop a basic cognitive computing application by utilizing Cognitive training tools and frameworks.	Create

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive Computing and Big data Analytics”, 1st Edition, Wiley Publishers, 2015.

Reference Book(s):

R1. Adnan Masood, Adnan Hashmi “Cognitive Computing Recipes: Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow”, 1st Edition, Apress, 2019.

R2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, C.R. Rao, “Cognitive Computing: Theory and Applications”, 1st Edition, Elsevier, 2016.

R3. R2. R. S. S. R. Anjaneyulu, “Cognitive Computing and Big Data Analytics: Applications and Future”, 1st Edition, Wiley, 2020.

R4. Raj Reddy, “Cognitive Computing: Theory and Applications”, 1st Edition, Springer, 2019.

Web References:

1. https://en.wikipedia.org/wiki/Cognitive_computing

2. https://www.coursera.org/learn/ibm-cognitive-class

3. https://cs221.stanford.edu

Course Code: 23ITE033		Course Title: Knowledge Engineering	
Course Category: Major		Course Level: Advanced	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course intends to provide students with foundational knowledge in knowledge engineering by covering ontology development, rule-based systems, and reasoning under uncertainty, while enabling them to design intelligent systems using machine learning and evidence-based techniques.

Module I **22 Hours**

Introduction – Abductive reasoning – Probabilistic reasoning -Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

Methodology and Modeling: 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.

Ontologies: Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation of N-ary Features – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.

Module II **23 Hours**

Ontology Design and Development: Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification

Reasoning with Ontologies and Rules: 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.

Learning for Knowledge-based Agents and Rule Refinement: Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Rule Learning: Modelling, Learning and Problem Solving – Rule learning:

Overview – Rule Generation and Analysis – Hypothesis Learning- Rule Refinement: Incremental Rule Refinement- Learning with an Evolving Ontology- Hypothesis Refinement- Characterization of Rule Learning and Refinement.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply abductive, probabilistic, and evidence-based reasoning to develop intelligent agents that make decisions under uncertainty and solve complex problems.	Apply
CO2: Implement methods to build intelligent agents using learning technologies and reusable ontologies for solving dynamic problems.	Apply
CO3: Apply advanced ontology concepts like hierarchies, inheritance, and matching to build knowledge representations for intelligent systems.	Apply
CO4: Analyze production system architectures and assess inference engines and reasoning rules to improve intelligent system performance.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, “Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning”, 1st Edition, Cambridge University Press, 2016.

Reference Book(s):

R1. Ela Kumar, “Knowledge Engineering”, 1st Edition, I K International Publisher House, 2018.

R2. Ronald J. Brachman, Hector J. Levesque: “Knowledge Representation and Reasoning”, 1st Edition, Morgan Kaufmann, 2004.

R3. John F. Sowa: “Knowledge Representation Logical, Philosophical, and Computational Foundations”, 1st Edition, Brooks Cole, Thomson Learning, 2000.

R4. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.

Web References:

1. https://www.sciencedirect.com/topics/computer-science/knowledge-engineering

2. https://study.com/learn/lesson/knowledge-engineering-process-examples.html

Course Code: 23ITE034		Course Title: Reinforcement Learning	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to provide a comprehensive understanding of Reinforcement Learning, covering its foundational concepts, algorithms, solution techniques and applying these methods to real-world problems.

Module I **22 Hours**

Reinforcement Learning: Introduction - Elements of Reinforcement Learning – History of Reinforcement Learning - Limitations and Scope - Challenges in Reinforcement Learning - Multi-Arm Bandits.

Finite Markov Decision Processes: Overview - The Agent - Environment Interface - The Markov Property - Markov Decision Processes - Optimal Value Functions - Optimality and Approximation.

Reinforcement Learning Problem using Dynamic programming approach – Policy Evaluation – Policy Improvement – Policy Iteration – Value Iteration.

Module II **23 Hours**

Monte Carlo Methods: Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Incremental Implementation.

Temporal Differencing Learning (TDL): TD prediction – Advantages - TD Policy Evaluation – The Forward View of TD - The Backward View of TD - Equivalences of Forward and Backward Views.

Approximate Solution Methods: On-policy Approximation of Action Value – Off-policy Approximation of Action Values - Q-Learning Algorithm: Introduction to Q-Learning - – Concepts and Implementation - Applications: Grid World - Elevator Dispatching - Dynamic Channel Allocation - Job-Shop Scheduling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of Reinforcement Learning to model agent environment interactions using Finite Markov Decision Processes and optimal value functions.	Apply
CO2: Analyze the effectiveness of different solution strategies for solving Reinforcement Learning problems.	Analyze
CO3: Apply Temporal Difference and Monte Carlo methods to estimate value functions and policies in unknown environments.	Apply
CO4: Examine the real-world applications of Reinforcement Learning algorithms to determine suitable solution approaches.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Richard S.Sutton and Andrew G.Barto, “Reinforcement learning: An introduction”, 2nd Edition, MIT Press, 2020.

Reference Book(s):

R1. Laura Graesser, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data &Analytics series, 2020.

R2. Michael Hu, “The Art of Reinforcement Learning – Fundamentals, Mathematics and Implementations with Python”, 1st Edition, Apress, 2024.

R3. Dimitri P. Bertsekas, “Dynamic Programming and Optimal Control”, 4th Edition, Athena Scientific, 2012.

R4. Phil Winder, “Reinforcement Learning: Industrial Applications of Intelligent Agents”, 1st Edition, O'Reilly Media, 2020.

Web References:

1. http://incompleteideas.net/book/the-book.html
2. https://www.deepmind.com/research
3. https://spinningup.openai.com/en/latest/

Vertical V: Programming and Computing Systems

Vertical V: Programming and Computing Systems

Course Code: 23ITE035		Course Title: Game Programming	
Course Category: Major		Course Level: Advanced	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to apply the 3D game development skills using the Torque Game Engine, creating game environments, programming gameplay, and designing missions with key tools.

Module I **22 Hours**

Introduction to 3D Game Development: 3D Game Genres and Styles - Game Platforms - Game Developer Roles - Publishing Your Game - Elements of a 3D Game - Game Engine - Graphical User Interface - The Torque Game Engine.

3D Programming Concepts: 3D Concepts - Coordinate Systems - 3D Models - 3D Shapes - Displaying 3D Models – Transformation – Rendering - 3D Programming -Programmed Translation - Programmed Rotation -Programmed Scaling - Programmed Animation.

Game Programming: Torque Script – Strings – Objects – Data Blocks - Game Structure - Server versus Client Design Issues - Common Functionality.

Module II **23 Hours**

Game Play and Network: The Changes – Control Modules - Client Control Modules - Server Control Modules - Direct Messaging – Triggers – Game Connection Messages.

Introduction to Textures and Skins: Using Textures - Paint Shop Pro - UV Unwrapping - The Skin Creation Process - Making a Soup Can Skin - Making a Vehicle Skin - Making a Player Skin.

Making the Game World Environment: Skyboxes - The Sky Mission Object - Cloud Layers – Storms - Water Blocks – Terraforming - Audacity – OpenAL – Koob.

Creating the Game Mission: Game Design - Torque Mission Editor - Building the World.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze various concepts part of game design and development in order to generate reusable assets	Analyze
CO2: Apply 3D programming to create, transform, and render models using game engines like Torque	Apply
CO3: Inspect texture library, UV unwrapping tools that create skin for 3D objects using texturing techniques	Analyze
CO4: Utilize gaming concepts and assets to design and develop 3D games	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. C. Finney, Kenneth, “3D Game Programming All in One”, 3rd Edition, Thomson Course Technology PTR, 2012.

Reference Book(s):

R1. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

R2. Mike Mc Shaffry, David Graham, “Game Coding Complete”, 4th Edition, Cengage Learning, PTR, 2012.

R3. Paul Craven, “Python Arcade games”, Apress Publishers,2016.

R4. Wallace Wang,” Programming for Game Design”, Apress Publisher, 2024.

Web References:

1. unity3d.com/learn/tutorials
2. https://www.edureka.co/blog/pygame-tutorial

Course Code: 23ITE036		Course Title: Industry 5.0	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to enhance the previous industrial revolution, Industry 5.0 focuses on developing human-centric technologies that empower workers rather than replacing them with machines, addressing the needs of students across all engineering disciplines and helping to mitigate challenges in current industrial sectors.

Module I **22 Hours**

Industry Transformation and Revolutions: Industrial Transformation- Business Transformation - Key Elements of Business Transformation-Transformation in Industrial Manufacturing - Future Industrial Transformation - Process Automation - Digital Process Automation and Process Transformation.

Introduction to IIoT: Introduction to Industrial Internet - IIoT Reference Architecture - Designing Industrial Internet Systems - Examining the Access Network Technology and Protocols - Middleware Software Patterns - Software Design Concepts - Smart Factories.

Module II **23 Hours**

Technological Innovations of Industrial Revolution: First Industrial Revolution - Second Industrial Revolution - Third Industrial Revolution - Fourth Industrial Revolution - Fifth Industrial Revolution - Challenges of Industry 5.0 - Benefits of Industry 5.0.

Transformation in Automotive Sector : Process Revolution - Business Necessity for Process Transformation - Process Transformation Revolution - Implementing PLM for SMEs - Implementing Process Control Systems for SMEs - Business Challenges in Process Transformation.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Analyze the impact of Process Transformation and Digital Automation.	Analyze
CO2. Explain the significance of IoT in the context of Industry 5.0.	Apply
CO3. Identify the transformation revolution within Industry 5.0.	Apply
CO4. Examine the advancements in the automotive sector through Industry 5.0.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Uthayan Elangovan, Industry 5.0, "The Future of the Industrial Economy", 1st Edition, Taylor & Francis, CRC Press, ISBN: 978-1-032-04127-8, 2022. (Module I & II)

T2. Alessandro Massaro, "Industrial Internet of Things, Alasdair Gilchrist, Apress 2016, ISBN-13(pbk),978-1-4842-2046-7 (Module I)

Reference Book(s):

R1. Bartodziej, Christoph Jan,"The Concept Industry 4.0", Springer, 2017.

R2. Klaus Schwab,"The Fourth Industrial Revolution", 1st Edition, Penguin Books Limited, 2016

R3. Gowrishankar Krishnamoorthy," Mastering AI for Smart Manufacturing Excellence", 1st Edition, October 2023.

R4. Aziza Chakir,"Industry 5.0 and Emerging Technologies", Springer, 2024.

Web References:

1. https://www.i-scoop.eu/industry-4-0/
2. https://www.routledge.com/Industry-50-The-Future-of-the-Industrial-Economy/ Elangovan/ p/book/9781032041285?srsltid=AfmBOoqwetiKT1b524Uei8NuvOYNbVrRNKplcEprm18G 11U-SW0xtFP7

Course Code: 23ITE037		Course Title: Internet of Things	
Course Category: Major		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course intended to provide a comprehensive understanding of Internet of Things, covering its foundational concepts, hardware components, design methodologies with hands on experience in IoT system design and development.

Module I **22 Hours**

Internet of Things: Introduction – Predecessors of IoT - Emergence of IoT - IoT Processing Topologies - Characteristics & Types of Sensors - Characteristics & Types of Actuators

Connectivity Technologies: IEEE 802.15.4 – Zigbee – RFID – Wi-Fi – Bluetooth.

IoT Communication Technologies: Introduction - Infrastructure Protocols: IPv6 - 6LoWPAN - Discovery Protocols - Data Protocols: MQTT – SOAP – REST – WebSocket.

Module II **23 Hours**

Design Methodology: Steps in design methodology – IoT Deployment levels.

IoT Hardware: Arduino vs. Raspberry Pi - Choosing a board - Installation and setup – Basic Programs: Printing on the console - LED interface – Using sensors.

Data Analytics for IoT: Introduction - Apache Hadoop - Using Hadoop Mapreduce for Batch Data Analytics - Apache Oozie - ApacheSpark - Apache Strom - Using Apache Strom for Batch Data Analytics – Real time analysis: ThingSpeak

Applications: Home Automation – Cities – Environment – Energy – Agriculture – Industry.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply appropriate sensors, actuators, and connectivity technologies to build functional IoT systems tailored to specific applications	Apply
CO2: Analyze the differences between various IoT communication protocols and processing topologies to select suitable options for a given deployment scenario.	Analyze
CO3: Implement IoT solutions using development boards like Arduino and Raspberry Pi for tasks such as device control and data monitoring.	Apply
CO4: Interpret the functionalities of data analytics platforms like Hadoop and Spark to process and analyze IoT-generated data effectively.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Misra, Sudip, Anandarup Mukherjee, and Arijit Roy, “Introduction to IoT”, 1st Edition, Cambridge University Press, 2021. (Module I)

T2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, 1st Edition, Universities Press, 2015. (Module II

Reference Book(s):

R1. Adrian Mcewen , Hakin Cassimally “Designing The Internet of Things” , 1st Edition, Wiley publications, 2015.

R2. Oliver Hersent ,David Boswarthick , Omar Elloumi , “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley publications, 2015.

R3. Cuno Pfister , “Getting Started with the Internet of Things”, Shroff; 1st Edition, 2019.

R4. Halfacree, Gareth. The official Raspberry Pi Beginner's Guide: How to use your new computer. Raspberry Pi Press, 5th Edition 2023.

Web References:

1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

2. https://www.coursera.org/specializations/internet-of-things

3. https://onlinecourses.nptel.ac.in/noc17_cs22/preview

Course Code: 23ITE038		Course Title: Multimedia Systems	
Course Category: Major		Course Level: Higher	
L :T : P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to create engaging multimedia content, it's essential to integrate elements such as text, audio, images, animations, and video using compatible hardware and software.

Module I **15 Hours**

Introduction- Multimedia Definition-Text- Fonts and Faces- Font Editing and Designing Tools-Hypermedia and Hypertext- Images-Making Still Images-Color. Sound-Digital Audio-MIDI Audio- MIDI vs Digital Audio-Multimedia System Sounds -Audio file format- Vaughan's Law of Multimedia Minimums- Adding Sound to Your Multimedia Project. Animation-The Power of Motion-Principles of Animation-Animation by Computer- Making Animations that Work.

Module II **15 Hours**

Video- Working of Video-Digital Video Containers. Making Multimedia-The Stages of a Multimedia Project-Intangibles-Authoring Systems. Multimedia Skills. Planning and Costing-The Process of Making Multimedia- Scheduling- Estimating. Designing and producing.

List of Experiments: **30 hours**

1. Implementation of Inkscape image editing tool for to enhance images, and create logos and banners for website homepages.
2. Implementation of Audacity audio editing tool for sound mixing, and applying effects like fade-ins and fade-outs, while performing audio compression with the appropriate codec.
3. Implementation of OpenShot video editing tool for content creation, mixing audio, removing noise, creating special effects, and adding captions, as well as compressing and converting video files to popular formats.
4. Design a simple home page with banners, logos, tables, and quick links using WordPress authoring tool
5. Create a simple 2D animation with sprites and perform basic 3D animation using keyframes and kinematics using Blender tool.
6. Implementation of screen recording and editing using EdApp tool.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the concepts of multimedia and its key elements	Apply
CO2: Identify the process involved in incorporating sound and animation	Apply
CO3: Implement video effectively in multimedia project development, ensuring hardware and software compatibility.	Apply
CO4: Determine the role of the internet in multimedia applications.	Analye

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Tay Vaughan, “Multimedia: Making it work”, 10th Edition, McGraw Hill, 2019.

Reference Book(s):

R1. Fred Halsall “Multimedia Communications, Applications, Networks, Protocols and Standards” Pearson Education Asia, Pearson, 2014

R2. Ze-Nian Li, Mark S. Drew, “Fundamentals of Multimedia”, 3rd Edition, Springer Texts in Computer Science, 2021.

R3. Ralf Steinmetz, Klara Nahrstedt – "Multimedia Systems", 2nd Edition, Springer, 2022.

R4. Prabhat K. Andleigh, Kiran Thakrar – "Multimedia Systems Design", Pearson, 2015.

Web References:

1. https://opensource.com/article/18/2/open-source-audio-visual-production-tools
2. https://camstudio.org/
3. https://developer.android.com/training/animation/overview

Course Code: 23ITE039		Course Title: Augmented Reality and Virtual Reality	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to offer historical and modern perspectives on virtual reality, encompassing the fundamentals of sensation and perception, along with the technical and engineering aspects of virtual reality systems.

Module I **15 Hours**

The Geometry of Virtual Worlds - Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information

Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions

Module II **15 Hours**

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached

Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction..

List of Experiments: **30 hours**

1. Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2. Implementation of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.
3. Develop a scene in Unity that a cube, plane and sphere, apply transformations on the three game objects.

4. Create a scene in Unity that features a cube, plane, and sphere. For each Game Object, design a unique material and texture. Alter the color, material, and texture of each Game Object individually within the scene. Additionally, write a C# program in Visual Studio to dynamically change the color and material/texture of the GameObjects upon a button click.
5. Create a Unity scene featuring a sphere and a plane. Apply a Rigidbody component, material, and Box Collider to the Game Objects. Additionally, write a C# program to enable grabbing and throwing the sphere using a VR controller.
6. Develop a simple UI (User interface) menu with images, canvas, sprites and button. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze the fundamental principles and technologies behind AR and VR.	Analyze
CO2: Examine the AR and VR applications using popular platforms and tools such as Unity, Unreal Engine, ARKit, and ARCore.	Analyze
CO3: Apply the functional AR and VR projects that demonstrate the ability to build immersive and interactive experiences	Apply
CO4: Identify user experience (UX) design principles specifically for AR and VR, ensuring that applications are intuitive, engaging, and user-friendly	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Textbooks:

T1. Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2nd Edition, 2020.

Reference Books:

R1. Alan B. Craig, “Understanding Augmented Reality: Concepts and Applications”, 1st Edition, Morgan Kaufmann, 2013.

R2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles and Practice”, 1st Edition, Addison-Wesley, 2016.

R3. José M. de la Fuente, Josiane S. Silva, “Introduction to Virtual Reality”, CRC Press, 2021.

R4. Wolfgang Broll, Ralf Doerner, Bernhard Jung, Paul Grimm, “Virtual and Augmented Reality (VR/AR)”, Springer International Publishing, 2022.

Web References:

1. https://arpost.co/
2. developer.oculus.com/blog
3. https://developer.apple.com/augmented-reality/

Course Code: 23ITE040		Course Title: Graphics and Multimedia	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to establish line and circle drawing algorithms, to master two dimensional graphics, three dimensional concepts, multimedia technologies, and interactive application design to create engaging user experiences.

Module I **15 Hours**

Graphics Primitives: Coordinate Reference Frames - Fill-Area - Pixel-Array - Character. Point - Line - Curve. Bresenham's - Circle Generating Algorithm.

Two Dimensional Transformations: Basic Transformations - Matrix Representations and Homogeneous Coordinates - Composite Transformations -Transformations between Coordinate Systems. Clipping Window -Point - Line Clipping: Cohen Sutherland - Liang-Barsky -Curve -Text.

Three Dimensional Geometric Transformations: Translation -Rotation – Scaling - Transformations between Three Dimensional Coordinate systems.

Module II **15 Hours**

Multimedia System Design: Elements - Applications - Architecture-Evolving Technologies for Multimedia Systems - Objects for Multimedia systems - Data Interface Standards.

Data and File Format Standards: TIFF File Format – RIFF – MIDI - JPEG DIB - AVI Indeo – MPEG standards -TWAIN**.**

Multimedia Application Design: Multimedia Application Classes -Types of Multimedia Systems - Virtual Reality Design - Components of Multimedia Systems - Application workflow Design Issues.

List of Experiments: **30 hours**

1. Implementation of Line Drawing algorithm
2. Implementation Circle Drawing algorithm.
3. Design two dimensional geometric transformations such as translation, rotation, scaling
4. Implementation of a video processing software to perform various operations. (Trim video clips, crop video, rotate video, join video, add subtitles, edit video dimension, bit rate, frame rate, sample rate and channel on a video)

5. Implement an operation on image using image editing Software

6. Develop interactive animation using animation software

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Implement line ,circle drawing algorithms to develop applications	Apply
CO2: Design the 2D Clipping and 3D objects using graphics algorithm	Apply
CO3: Examine the concepts of multimedia ,elements and file format standards	Analyze
CO4: Design interactive multimedia applications using designing tools	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Donald Hearn, Pauline Baker, "Computer Graphics with OPENGL - C Version", 4th Edition, Pearson Education, 2016(Module I)

T2. Andleigh,P.K and Kiran Thakrar, ”Multimedia Systems and Design”, 1st Edition, Pearson Education,2015(Module II)

Reference Book(s):

R1. J. Vince,"Mathematics for Computer Graphics, Undergraduate Topics in Computer Science ", 6th Edition, Springer-Verlag, 2022.

R2. F.S.Hill,”Computer Graphics using OPENGL”, 2nd Edition, Pearson Education, 2009

R3. Kamisetty Rao, Zoran Bojkovic, Dragorad Milovanovic, "Introduction to Multimedia Communications: Applications, Middleware, Networking ", Wiley, 2006.

R4. Dr. Deepali A. Godse, Atul P. Godse, “Computer Graphics and Multimedia”, 1st Edition,Technical Publications, 2021.

Web References:

1. http://www.opengl-tutorial.org/beginners-tutorials/
2. https://helpx.adobe.com/photoshop/topics.html
3. https://www.sketchup.com/learn

Course Code: 23ITE041		Course Title: Spring Boot and Micro Services	
Course Category: Major		Course Level: Higher	
L: T :P (Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to equip learners with the knowledge and practical skills required to design, develop, deploy, and maintain robust and scalable microservices using Spring Boot Framework.

Module I **15 Hours**

Spring Boot: Introduction – Foundational Features – Spring Intializr -Command Line tools Integrated Development Environment - Project Setup – REST API - Annotation – Dependency Injection - Automatic Configuration – Customizing Configuration – Actuator - Java Persistence API (JPA) – Template Based Service using Redis – Repositories using H2 – Repositories using MySQL

Module II **15 Hours**

Micro Services: Monolith Approach - Key Concepts – Micro Services Architecture – Microservices Connection - Event Driven Architecture – Loose Coupling - Fault Tolerance Orchestration - Monitoring– Rabbit MQ Events – Event Modelling – Event Dispatch using Spring AMQP Code – Kafka – Components – Installation and Configuration – Producers – Consumers – Junit Testing – annotations - Unit Testing – Integration Testing

List of Experiments: **30 hours**

1. Create a basic Spring Boot app that returns a welcome message using @RestController and @GetMapping using Spring Initializr.
2. Implement POST request registeration form with validation, user input validation using Bean using @valid, @NotNull, @ExceptionHandler.
3. Implementation of CRUD operation using API for the application that lists employee information with Spring Data JPA with @Entity, @Repository, @Service
4. Implementation of REST API with pagination and sorting using Spring JPA’s Pageable and Sort interfaces.
5. Create two Microservices communication using Spring REST Template with call /service1/{id} from second service.

6. Implementation of event publishing and consuming between microservices using service broker RabbitMQ using asynchronous messaging.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Examine the core concepts of Spring Boot frame work and develop modern applications.	Analyze
CO2: Inspect the entity classes with relationships and their implementation using JPA annotations.	Analyze
CO3: Make use of RESTful services and components to transition SpringBoot application into Microservices architecture.	Apply
CO4: Apply asynchronous messaging to publish events from one service to another service consumption using RabbitMQ message broker.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Mark Heckler, “Spring Boot Up & Running”, 1st Edition, Oreilly, 2021..(Module I)

T2. Moises Macero, “Learn Microservices with Spring Boot”, 1st Edition, Apress, 2017. (Module II)

Reference Book(s):

R1. Craig Walls, “Spring Boot in Action”, 1st Edition, Manning, 2016.

R2. Sam Newman, “Building Microservices”, 2nd Edition, O’Reilly Media, 2021.

R3. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen “Microservice Architecture”, 1st Edition, Oreilly, 2016.

R4. John Carnell, “Spring Microservices in Action”, 1st Edition, Manning, 2017.

Web References:

1. https://www.baeldung.com/spring-boot-application-configuration
2. https://docs.spring.io/spring-boot/docs/current/reference/html/
3. https://www.callicoder.com/spring-boot-microservices-series/

Course Code: 23ITE042		Course Title: Hybrid Mobile App Programming	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to create cross-platform mobile applications using React Native, enabling to design, develop, and deploy hybrid apps on both iOS and Android platforms.

Module I **15 Hours**

Basics of Mobile application development: Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Navigating and Routing in React Native, Managing States, Dynamic properties

Module II **15 Hours**

React Native App with Rest API: Fetch Method, Axios Method, CRUD operations ,local storage

Comparison of different App frameworks: Build Performance, App Performance, debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

List of Experiments: **30 Hours**

1. Develop a simple cross-platform To-Do List app that allows users to add, edit, and delete tasks, with persistent storage.
2. Develop a hybrid mobile weather application that fetches live weather data from a public API and displays it to the user.
3. Create a login and registration system using Firebase Authentication to manage user authentication in a hybrid mobile app.
4. Develop a hybrid chat application that supports real-time messaging using Firebase Realtime Database.
5. Develop a fitness tracking application that allows users to track their daily activities, set fitness goals, and monitor their progress.
6. Develop an app that fetches data from a movie API and displays a list of movies. Users should be able to search for movies, view details like ratings and cast, and save movies to their favourites list

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop cross-platform mobile apps that incorporate persistent storage	Apply
CO2: Implement secure login and registration systems in mobile apps.	Apply
CO3: Implement real-time chat applications that utilize Firebase Realtime Database for instant messaging.	Apply
CO4: Create cloud service integration and scalable hybrid mobile applications.	Create

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1.. Shaun Lewis and Mike Dunn, " Native Mobile Development: A Cross-Reference for iOS and Android", 1st Edition, O'Reilly Media, Inc 2021.

Reference Book(s):

R1. Pawan Lingras, Matt Triff, and Rucha Lingras, "Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach", 1st Edition, Taylor & Francis, 2019

R2. Shaun Lewis and Mike Dunn," Native Mobile Development: A Cross-Reference for iOS and Android", 1st Edition, O'Reilly Media, 2019.

R3. Neil Smyth, "Android Studio Development Essentials – Android 12 Edition", 1st Edition, Payload Media, 2022.

R4. Wallace Jackson, "Android Apps for Absolute Beginners", 5th Edition, Apress, 2020.

R5. "Head First Android Development" by Dawn Griffiths, O'Reilly Media, 3rd Edition, 2021

Web References:

1. https://reactnative.dev/docs/colors

2. https://necolas.github.io/react-native-web/docs/

3. https://www.npmjs.com/package/react-native-web

Course Code: 23ITE044		Course Title: AWS Services with Devops Tools (Common to AM, CS, IT & SC)	
Course Category: Major		Course Level: Higher	
L:T:P(Hours/Week) 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

This course is intended to equip students with practical skills in managing and deploying cloud infrastructure using AWS services and DevOps tools, focusing on automation with PowerShell scripting and monitoring cloud environments using Grafana for efficient and scalable operations.

Module I **15 Hours**

AWS Introduction - Identity and Governance - AWS Administration - Network Connectivity - AWS Storage S3- EC2- Auto Scaling -Load Balancing -VPC -RDS - Route53 -Containers and Serverless Computing – Monitoring - Introduction to DevOps – GIT – Ansible – Jenkins – Dockers – Terraform – Maven

Module II **15 Hours**

PowerShell Introduction-Data Structures-Objects-Conditional-Loops-Functions and Pipelines- Script Execution-Error Handling-Input / Output - Text Processing – SMTP Notification and Regular Expressions-Configuration using XML- Grafana Architecture - Grafana Dashboard Basics- PromQL Command.

List of Experiments: **30 hours**

1. Design a web application in EC2 & Elastic Beanstalk
2. Create Cloud Monitoring and Management Service using AWS CloudWatch
3. Install Git and check-in code into Repository
4. Build Infrastructure for EC2 instance and S3 using Terraform
5. Deploy Django app & its Content Management Systems in Cloud
6. Create an automated CI/CD pipeline in Jenkins using declarative pipelines using powershell.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement core AWS services for scalable application deployment and management.	Apply
CO2: Automate infrastructure provisioning, configuration, and continuous integration/delivery pipelines using Devops tools.	Apply
CO3: Apply PowerShell scripting fundamentals to automate system administration and configuration tasks.	Apply
CO4: Create monitoring dashboards and write queries for effective visualization and analysis of cloud infrastructure metrics.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Reference Book(s):

R1. Mark Wilkins, “Learning Amazon Web Services (AWS) A Hands-On Guide to the Fundamentals of AWS Cloud”, Pearson Education, Inc, 2020.

R2. Raoul Alongi, “AWS: The Most Complete Guide to Amazon Web Services from Beginner to Advanced Level”, published by MCP, 2020.

R3. Theo H King, “Aws: The Ultimate Guide from Beginners to Advanced for The Amazon Web Services”, 2020.

R4. Lee Holmes, “PowerShell Cookbook: Your Complete Guide to Scripting the Ubiquitous Object-Based Shell”, 4th Edition, Shroff/O'Reilly,2021.

R5. Gene Kim, Jez Humble, Patrick Debois, John Willis and Nicole Forsgren “The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations”, 2nd Edition, Shroff/IT Revolution,2024.

Web References:

1. https://aws.amazon.com/free/?

2. https://git-scm.com/docs/git#_git_commands

3. https://www.pdq.com/powershell/

Diversified Electives

Diversified Electives

Course Code: 23ITE045		Course Title: Principles of Management	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to provide a foundation in management principles and enhance decision-making and leadership skills through interactive discussions and case studies.

Module I **23 Hours**

Introduction to Management: Organization - Role of Managers - Evolution of Management Thought – Organization and the Environmental Factors - Managing Globally - Strategies for International Business. Case Study: Flight Plans.

Planning and Decision Making: Nature and Purpose of Planning - Planning Process - Types of Plans – Management by Objective (MBO) Strategies - Types of Strategies - Policies -Types of Decision– Decision Making Process - Rational Decision- Making Process - Decision Making Under Different Conditions. Case Study: Underwater Chaos.

Organizing: Nature and Purpose of Organizing - Organization Structure - Formal and Informal Groups Organization - Line and Staff Authority - Depart mentation - Span of Control - Centralization and Decentralization - Delegation of Authority - Staffing - Selection and Recruitment - Orientation – Job Design - Career Development - Career Stages – Training - Performance Appraisal.

Module II **22 Hours**

Directing: Foundations of individual and group behaviour -Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Job satisfaction - Job enrichment -Leadership Theories- Communication - Hurdles to Effective Communication - Communication and IT -Organization Culture - Elements and Types of Culture - Managing Cultural Diversity.

Controlling: System and process of controlling -Controlling for Organizational Performance- Budgetary and NonBudgetary Control Techniques - Productivity problems and management -Tools for Measuring Organizational Performance –Contemporary Issues in Control. Case Study: Smooth Ride.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Utilize Social Responsibilities as Engineers and Managers in Planning and Decision-Making	Apply
CO2: Examine the ways and means of managing the organization process for staffing	Analyze
CO3: Analyze various organizations and motivation strategies to develop self-motivation among the engineers	Analyze
CO4: Compare various controlling techniques and tools for measuring organizational performance	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Stephen P. Robbins and Mary Coulter, “Management”, 13th Edition, Pearson Education, 2016.

Reference Book(s):

R1. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

R2. V.S.Bagad,Anjali Bagad’ Principles of Management’,5th Edition, Technical Publishers, 2014.

R3. Harold Koontz, Heinz Weihrich and Mark V Cannice, “Management - A Global & Entrepreneurial Perspective”,12th Edition, Tata Mcgraw Hill, 2007.

Web References:

1. https://www.tutorialspoint.com/management_principles/index.html

Course Code: 23ITE046		Course Title: Total Quality Management Techniques	
Course Category: Minor		Course Level: Higher	
L:T: P(Hours/Week)3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to achieve continuous improvement and customer satisfaction, by employing various management methodologies and tools to pinpoint quality issues.

Module I **22 Hours**

Introduction - Basic Approach - Gurus of TQM - TQM Framework- Awareness- Defining quality- Barriers of TQM –Benefits of TQM.

Principles of TQM- Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning. Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality- Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal- Continuous process improvement - Juran Trilogy, PDSA cycle and Kaizen.

Supplier partnership – Partnering, supplier selection, Supplier Rating and Relationship development. Performance Measures-Strategy-Performance Measure Presentation-Cost of Quality-Analysis-Improvement Action Strategy and Plan-Limitations of Quality Cost-Performance Excellence.

Module II **23 Hours**

TQM Tools & Techniques- Quality Function Deployment-Benefits-Affinity Diagram-process. Six Sigma-Teams-Tools - FMEA – Intent, Team, Documentation, Stages: Design FMEA and Process FMEA.

Quality Systems-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.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the fundamentals of total quality management based on the TQM principles for the modern organizations.	Apply
CO2: Utilize appropriate principles and techniques to design the quality system	Apply
CO3: Analyze traditional tools and techniques to evaluate their effectiveness in identifying customer needs in the software industry.	Analyze
CO4: Examine quality system standards to assess their impact on improving processes in the software industry.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Dale H. Besterfield, Carol Besterfield-Michna, Glen Besterfield, Mary Besterfield- Sacre, "Total Quality Management", 3rd Edition, Pearson Education in South Asia, 2012.

Reference Book(s):

R1. Janakiraman B, Gopal R.K, "Total Quality Management – Text and Cases", Prentice Hall (India)Pvt. Ltd, 2015

R2. Suganthi L, Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

Web References:

1. https://asq.org/quality-resources/total-quality-management
2. https://management.org/quality/total-quality-management.
3. https://www.bmc.com/blogs/tqm-total-quality-management

Course Code: 23ITE047		Course Title: Intellectual Property Rights (Common to all B.E/B.Tech Programmes)	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to learn the fundamental concepts of Intellectual Property Law, including patent classifications, trademark strategies, and copyright protections.

Module I **22 Hours**

Intellectual Property: An Introduction: Intellectual Property Law: Patent Law-Copyright Law-Trademark Law- Trade secret Law-Right of Publicity-Paralegal tasks in Intellectual Property Law-Ethical obligations of the paralegal in Intellectual Property Law-Trade secrets: Protectible as a trade secret-Maintaining trade secrets-Protecting an Idea.

Patents: Rights and Limitations: Sources of patent law-Subject matter of Patents: Utility Patents-Plant Patents-Design Patents-Design Patents and copyright-Design Patents and trademarks-Computer Software, Business methods and Patent Protection-Rights under Patent Law-Patent Requirements-Limitations on Patent Rights-Patent Ownership.

Module II **23 Hours**

Patents: Research, Applications, Disputes, and International Considerations: Patent Search Process-Patent Application Process-Patent Infringement-Patent Litigation, International Patent laws.

Principles of Trademark: Trademarks and Unfair Competition-Acquiring Trademark Rights-Types of Marks, Strong Marks Versus Weak Marks-Selecting and Evaluating a Trademark-International Trademark Laws.

Principles of Copyrights: Sources of Copyright Law- The Eight Categories of Works of Authorship-Derivative Works and Compilations- Rights and Limitations: Grant of Exclusive Rights–Copyrights Ownership- International Copyright Laws.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the fundamental concepts of Intellectual Property Law to real-world scenarios.	Apply
CO2: Demonstrate an understanding of the Rights and Limitations of various patents through practical examples.	Apply
CO3: Analyze the process of patent searching and application filing to assess its effectiveness in protecting intellectual property.	Analyze
CO4: Examine the principles of trademark and copyright to differentiate their roles and implications in intellectual property law.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Richard Stim, “Intellectual Property: Copyrights, Trademark and Patents”, Cengage learning, 2nd edition 2012.

Reference Book(s):

R1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, 3rd Edition, 2013.

R2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2017.

R3. David Llewelyn, Tanya Frances Aplin, “Intellectual Property Patents, Copyrights, Trademarks & Allied Rights”, Sweet & Maxwell, 2023.

R4. William F. Patry ,"Principles of Intellectual Property: Patents, Trademarks, and Copyrights", Wolters Kluwer, 2023.

Web References:

1. https://ipindia.gov.in/writereaddata/Portal/ev/sectionsindex.html

Course Code: 23AUE050		Course Title: Entrepreneurship Development (Common to all B.E/B.Tech Programmes)	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to develop entrepreneurial mindset and skills by identifying and validating problems through human-centered design, analyzing markets and customers to create value propositions and MVPs, exploring business models with financial and feasibility analysis, and preparing investible pitch decks to attract stakeholders.

Module I **22 Hours**

Entrepreneurial Mindset

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society.

Opportunities

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society – Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities

Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

Prototyping & Iteration

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques. Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

Module II **23 Hours**

Business Models & Pitching

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching Techniques: Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback

Entrepreneurial Ecosystem

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply entrepreneurial mindset principles to identify societal problems and transform them into viable business opportunities.	Apply
CO2: Develop prototypes using suitable tools and techniques for the validated opportunities through iterative processes.	Apply
CO3: Demonstrate a Business Model Canvas using the Lean approach and pitch the startup idea effectively using storytelling and presentation skills	Apply
CO4: Analyze customer segments, market size, and niche markets to validate entrepreneurial opportunities through market research and customer interviews	Analyze

CO5: Evaluate the role and components of the entrepreneurial ecosystem to identify and engage the right ecosystem partners and funding models for startup success.	Analyze

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Reference Book(s):

R1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha "Entrepreneurship", McGrawHill, 11th Edition,2020.

R2. Ries, E., The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business,2011.

R3. Blank, S. G., & Dorf, B. , The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch,2012.

R4. Roy, R., Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press,2017.

R5. Osterwalder, A., & Pigneur, Y., Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons,2010.

Course Code: 23AUE051	Course Title: Design Thinking and Innovation (Common to all B.E/B.Tech Programmes)		
Course Category: Minor		Course Level: Higher	
L:T:P: 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to equip learners with practical skills in design thinking, empathy, prototyping, testing, and implementation for user-centered innovation and effective product development.

Module I **(17+ 6 hrs)**

Introduction- Importance of Design Thinking, Human Centered Design, Six-Step Design Thinking Process-Framework for Innovation-DT-a nonlinear process.

Empathy-importance of empathy in design thinking- empathy vs sympathy- steps of empathize-understanding customer needs-empathy methods and tools-empathy map-5W 1H framework-empathize in UX/UI Design-users Interview

Module II **(18+4 hrs)**

Prototype: Introduction to Proof of concept-MVP-Prototype and its types-prototype methodology- innovation and its types-Tools for prototyping: concept sketching/CAD/3D Printing.

Testing: Importance of testing in product development-design validation-market analysis: TAM-SAM-SOM-EVG.

Implementation - redesign of solution and iterative process.

List of activities

Core Stream

Empathy

1. What challenges does the user face daily commuting to work place?
2. What are the user's biggest frustrations when interacting with vehicle maintenance engineer?
3. Understand the user for building old age home.

Define

1. A construction site supervisor needs better real-time communication tools because delayed updates cause safety risks. (Provide the empathy data)
2. “Drivers get confused by inconsistent road signs,” create: “How might we improve road sign clarity to reduce driver confusion?”
3. A daily commuter needs a safer way to cross busy intersections because current pedestrian signals are confusing and slow. (Provide the empathy data)

Ideate

1. Develop a creativity safer vehicle dashboard design
2. Develop an improved road drainage system
3. Design an innovative solution to reduce urban flooding caused by heavy rains.
4. Design a Hybrid engine designs incorporating solar panels on the car roof.

Prototype

1. Prototype development (both low fidelity and high fidelity) on any real world problem

IT and Circuit Stream:

Activity 1:

Students role-play as designers and users- create an empathy map with 4 quadrants: *Says, Thinks, Does, Feels*

Circuit Stream- Empathy Interview and Persona Creation

Define- development of problem Statement-Elements of a Good Problem Statement-Tools: Point-of-View (POV) Statements-How Might We (HMW) Questions-User Personas.

Ideation in Design Thinking-Importance of Ideation-Metrics of ideation -tools: Brainstorming-Mind Mapping-SWOT.

Activity 2:

IT Stream- SWOT analysis on software project idea.

Circuit Stream -Idea Pitch Canvas using Brainstorming + Mind Mapping

Convert ideas into quick prototypes and validate through early testing.

Activity 3:

IT Stream -Build a simple algorithm to test feasibility- TAM-SAM-SOM market analysis chart

Circuit Stream -MVP Canvas and Concept Sketching

Circuit Stream -Iterative Redesign and Peer Testing Sprint

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply design thinking tools like empathy mapping, problem definition, and ideation to create user-centered innovative solutions.	Apply
CO2: Apply prototyping, innovation, testing, and iterative redesign techniques in product development and market analysis..	Apply
CO3: Apply design thinking to develop, prototype, and validate innovative engineering solutions in capstone projects for real-world applications.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. Sabell Osann, Lena Mayer , Inga Wiele ,The Design Thinking Quick Start Guide: A 6-Step Processfor Generating and Implementing Creative Solutions, Wiley, 2020.

T2. Christian Müller-Roterberg, Handbook of Design Thinking, Kindle Direct Publishing,2018.

Reference Book(s):

R1. Teun den Dekker, Design Thinking, Taylor & Francis, International edition, 2020.

R2. Kaushik Kumar, Divya Zindani, J.Paulo Davim, Design Thinking to Digital Thinking, Springer, 2019.

R3.S. Balaram, Thinking Design, SAGE Publications, 2011.

Course Code:23MEE008		Course Title: PLM for Engineers (Common to all B.E/B.Tech Programmes)	
Course Category: Minor		Course Level: Higher	
L:T:P (Hours/Week): 2: 0: 2	Credits: 3	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to apply Product Lifecycle Management (PLM) fundamentals and principles to develop strategies, manage product lifecycles, optimize engineering processes, configure Bills of Materials, and leverage digital manufacturing environments for practical applications and customer-centric use cases.

Module I **22 Hours**

Business Strategy in the PLM

Definition, PLM Lifecycle Model, Threads of PLM, Need for PLM, Opportunities and Benefits of PLM, Components and Phases of PLM, PLM feasibility Study, PLM Visioning, Strategy, Impact of strategy, Implementing a PLM strategy, PLM Initiatives to Support Corporate Objectives, Infrastructure Assessment.

Business Processes in the PLM and Product Development Concepts

Characteristics of PLM, Environment Driving PLM, PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM. Engineering Vaulting, Product Reuse, Smart Parts, Engineering Change Management, Workflow Management.

Bill of Materials (E-BOM, M-BOM, S-BOM) and Process Consistency, Product Structure, Configuring BOM

Module II **23 Hours**

Digital Mock Up and Validation

Simulation Process Management, Variant Management, Digital Mock-Up and Prototype Development, Design for Environment, Virtual Testing and Validation, Marketing Collateral

Digital Manufacturing in the PLM

Digital Manufacturing, Benefits of Digital Manufacturing, Manufacturing the First-One, Ramp Up, Virtual Learning Curve, Manufacturing the Rest, Production Planning.

Customer Use Cases of the PLM

Impact and Challenges faced while implementing a successful PLM strategy -Rolls Royce, Nissan Motor, Sunseeker International , Xtrac ,kesslers international and monier and weatherford international.

List of Exercises: **15 Hours**

1. Demonstrate the 2-Tier & 4-Tier Architectures and Basic Team center applications like Organization, Project, and Schedule Manager.
2. Create CAD and Non-CAD datasets (MS Office, Notepad, etc.) by using explicit and implicit Check-In and Check-Out to create multiple iterations
3. Create the access control (Read, Write, and Delete) for the given dataset and block the access rights to other group members belongs to the same department. Also Perform the Impact Analysis (Where Used and Where Referenced) of a given dataset which is used in multiple assemblies.
4. Create the Product Structure in Structure Manager with 5 components assembled in first level and 3 components Assembled in second, third and fourth level with the sub-assemblies and export the assembly in local drive. Also, demonstrate the Variant Management.
5. Export the CAD dataset as a JT file and perform the various visualization tasks like Measurements, Sectioning, PMI, and Mark-up using JT2GO application

Course Outcomes	**Cognitive Level**
At the end of the course students will able to	
CO1: Apply the fundamentals of PLM principles to develop a PLM strategy for a system.	Apply
CO2: Apply PLM principles to manage product lifecycles, optimize engineering processes, and configure Bill of Materials with consistent workflows	Apply
CO3: Apply the Digital Manufacturing environment using PLM for use cases.	Apply
CO4: Develop and present a report individually by applying various modules of PLM software for an engineering project.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book(s):

T1. John Stark, “Product Lifecycle Management: Volume 1: 21st Century Paradigm for Product Realisation”, Springer International Publishing Switzerland, 4th Edition, 2020.

T2. Grieves Michael, “Product Lifecycle Management- Driving the Next Generation of Lean Thinking”, McGraw-Hill, 2010.

T3. Wang, Lihui; Nee, Andrew Y.C. (Eds.) Collaborative Design and Planning for Digital Manufacturing, Springer, 2009.

Reference(s):

R1. Elangovan, U., “Product Lifecycle Management (PLM)”. Boca Raton, CRC Press, 2020.

R2. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006.

R3. Antti Saaksvuori, “ Product Life Cycle Management” - Anselmi Immonen, Springer, 3rd Edition, 2008.

Open Electives

Open Electives

Course Code: 23ITO001		Course Title: Enterprise Resource Planning	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to provide an overview of ERP systems, exploring their benefits, risks, key technologies in business processes and emphasizes practical application through implementation strategies and analysis of various ERP modules.

Module I **22 Hours**

Introduction: ERP – Basic Concepts. Benefits of ERP: Justifying ERP Investments-Quantifiable Benefits. Risks of ERP: People Issues-Process-Technological -Implementation Issues-Operation & Maintenance Issues-Managing Risks on ERP Projects. ERP and Technologies: Business Process Reengineering (BPR)-Data Warehousing & Data Mining - On-line Analytical Processing (OLAP) - Product Life Cycle Management (PLCM) - Supply Chain Management (SCM) - Customer Relationship Management (CRM) - Advanced Technology and ERP Security. ERP Marketplace and Marketplace Dynamics: Overview – Marketplace Dynamics– The changing ERP Market.

Module II **23 Hours**

Function Modules: Function Modules of ERP Software – Integration of ERP, Supply Chain and Customer Relationship Application. ERP Implementation: Introduction-Technological, Operational and Business Reasons for implementing ERP- Challenges –Life Cycle-Strategies - Process - Project Team-Success & Failure Factors of an ERP Implementation. Present and Future: ERP and eBusiness: Introduction of ERP and eBusiness – eBusiness – Supply Chain Integration– The eBusiness Process Model – Components of the eBusiness supply chain – ERP, Internet and WWW – Introduction of ERP II: ERP to ERP II –Bringing ERP to the Entire Enterprise – Best Practices of ERP II-Future Directions and Trends ERP.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Describe the basic of ERP along with its benefits and risks for different Projects	Apply
CO2: Demonstrate the ERP related technologies for business process and ERP related security issues	Apply
CO3: Examine the implementation strategies & methodologies of ERP for the different project team	Analyze
CO4: Analyze the various ERP related business modules for ERP Maintenance and management	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	3	-	-	-	2	2	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Alexis Leon, “Enterprise Resource Planning”, 3rd Edition Tata McGraw-Hill, 2011.

Reference Book(s):

R1. Vinod Kumar Grag and N.K. Venkitakrishnan, “ERP- Concepts and Practice”, 2nd Edition Prentice Hall of India, 2011.

R2. Sinha P. Magal and Jeffery Word, “Essentials of Business Process and Information System”,Wiley India, 2012.

Web References:

1. https://www.infosys.com/industries/high-technology/case-studies/Pages/oracle-implementation-global.aspx
2. https://www.odoo.com/
3. https://www.top10erp.org/Case-Study-Library.aspx

Course Code: 23ITO002		Course Title: Multimedia Systems and Applications	
Course Category: Minor		Course Level: Advanced	
L :T : P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to provide the fundamentals of Multimedia concepts by designing and developing Multimedia projects and utilizing relevant hardware and software tools in practical scenarios.

Module I **22 Hours**

Introduction to Multimedia: Definitions - Multimedia: Past and Present – Multimedia Software Tools - Distributed Multimedia systems – challenges - security - storage, retrieval, processing, computing- Multimedia metadata - Multimedia databases – Hypermedia - Multimedia Learning.

File formats: Text file formats - Using Text in Multimedia - Image file formats - Making Still Images - Digital audio and Video file formats - MIDI vs. Digital Audio - Color in image and video - Color Models, Color applications - Multimedia data and file formats for the web.

Games and Animation: The power of Motion- Principles of Animation - Animation by Computer - Animation Techniques.

Module II **23 Hours**

Network Services and Protocols for Multimedia Communications: Protocol Layers of Computer Communication Networks - Internet Technologies and Protocols - Protocols for Multimedia Transmission and Interaction – Content Distribution Networks.

Cloud Computing for Multimedia Services: Cloud Computing Overview - Multimedia Cloud Computing – Cloud Assisted Media Sharing – Computation Offloading for Multimedia Services - Multimedia streaming cloud - Interactive Cloud Gaming.

Online social networking: Multimedia ontology- Content based retrieval from digital libraries - Stages of Multimedia Project - Intangibles, Hardware, Software, Authoring Systems.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate an understanding of multimedia concepts by implementing its key elements in various applications.	Apply
CO2: Apply multimedia hardware and software tools to edit and author multimedia applications	Apply
CO3: Examine the effectiveness of different compression algorithms in various multimedia applications.	Analyze
CO4: Analyze the role of internet technologies in multimedia project development.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	-	3	-	-	-	2	2	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Tay Vaughan, “Multimedia: Making it work”, 10th Edition, McGraw Hill, 2019.

Reference Book(s):

R1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, 3rd Edition, Springer Texts in Computer Science, 2021.

R2. Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.

R3. Gaurav Bhatnagar,”Introduction to Multimedia Systems”, 1st Edition, Academic Press Inc, November 2021.

R4. Kiran Thakrar, ”Multimedia System Design”, 1st Edition, Pearson Education India, January 2015.

Web References:

1. www.cse.wustl.edu/~jain/refs/mul_refs.htm
2. http://guides.lib.umich.edu/c.php?g=282762&p=1884093
3. www.eduproindia.in/ multimedia-communications.html
4. https://itsfoss.com/

Course Code: 23ITO003		Course Title: Cyber law and Information Security	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course aims to explore cybercrime and cyber law, enhance understanding of cyber-attacks and mitigation tools, and examine the principles of information security and security investigations.

Module I **22 Hours**

Cyber law: Cybercrime – Need for Cyber law – cyber law-cybercrime and law-copyright law -Trade mark law-Online Contract and Law-Privacy acts and Policy.

Emerging trends in Cybercrime and its Evolution: Financial Crime-Online Gambling-Email Spoofing- Email Bombing- DoS Attack- Viruses and Worms- Cyber Terrorism-Cyber attacks on the Healthcare sector.

Module II **23 Hours**

Introduction: Information Security - Components of an Information System-Security and the Organization.

Need for Information Security and Management: Business Needs – Threats & Attacks-Categories of Threats- Management of Information Security - Information Security Planning-Policy, Standards and Practices- Security Education, Training and Awareness Program.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the necessity of cybercrime laws, examining the influence of copyright and trademark regulations and the role of legal authorities in resolving civil and criminal cybercrime offenses.	Analyze
CO2: Examine the emerging trends in cybercrime and cyber-attacks.	Analyze
CO3: Utilize the information security concepts and organizational security roles to identify and mitigate threats and vulnerabilities.	Apply
CO4: Analyze the need for security and information security management.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	3	-	-	-	2	2	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Dr.Siddhartha Goswami & Dr.Partha Sarathi Goswami , “Cyber Crimes And Laws”, BFC Publications, 2024.(Module I)

T2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Cengage Learning, 2022. (Module II)

Reference Book(s):

R1. Vikas Sharma , Browsing the Cyber Laws of India A User’s Guide, 2023.

R2. Matt Bishop, —Computer Security Art and Science, Pearson/PHI, 2018.

R3. Dr. A. K. Singh, "Cybersecurity and Cyberlaw: A Comprehensive Guide to Legal and Ethical Issues in Information Security", Sage Publications, 2023.

R4. Mark S. Merkow, "Information Security: Principles and Practices", Pearson,2023.

Web References:

1. http://www.cyberlawsindia.net/internet-crime.html

2. http://www.computerforensicsworld.com

Course Code: 23ITO004		Course Title: Database Technology	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to provide a thorough understanding of database systems by exploring architectures, relational database design, object-based databases, transaction processing, and emerging technologies.

Module I **22 Hours**

Introduction: Database System Applications - Purpose of Database Systems - View of Data - Database Languages - Relational Databases - Database Architecture: Data Storage and Querying - Transaction Management - Database Users and Administrators - The Entity Relationship Model – Entity Relationship Diagrams-Primary Key. Relational Databases: Structure of Relational Databases - Database Schema – Keys - Schema Diagrams - Overview of the SQL Query Language: SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations – Aggregate Functions-Modification of the Database – Views - SQL Data Types and Schemas - Integrity Constraints

Module II **23 Hours**

Database System Architectures: Centralized Database Systems -Server System Architectures-Parallel Systems - Distributed Systems -Cloud Based Services. Complex Data Types: Semi Structured Data – Object Orientation-Textual Data-Spatial Data. Application Development: Programs and User Interface-Web Fundamentals-Architecture-Performance-Security. Big Data: Storage Systems-Map Reduce Paradigm- Algebraic Operations-Streaming data -Graph Database. Data Analytics: Overview-Data Warehousing-OLAP-Data Mining. Advanced Application Development: Performance Tuning-Performance Benchmarks.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of database architecture and technology to real-world applications.	Apply
CO2: Design the relational databases using SQL queries.	Apply
CO3: Apply different database system architectures to solve specific problems.	Apply
CO4: Analyze object-based databases for their suitability in multimedia applications.	Analyze
CO5: Examine transaction processing techniques and evaluate emerging technologies in the database domain.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	2	2	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 7th Edition, Tata McGraw Hill, March 2019.

Reference Book(s):

R1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, 6th Edition, McGraw Hill, 2011

R2. Ramez Elmasri & Shamkant B.Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson Education, New Delhi, 2015.

R3. Thomas M. Connolly, Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation, and Management”, 6th Edition, Pearson Education, New Delhi, 2019.

Web References:

1. www.tutorialspoint.com

Course Code: 23ITO005		Course Title: Software Engineering and Design	
Course Category: Minor		Course Level: Higher	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Description:

This course is intended to explore software engineering principles, covering methodologies, design patterns, project management, quality assurance, user interface design, and evaluation through effective testing strategies.

Module I **23 Hours**

Introduction to Software Engineering - Process Framework-Process Models: Waterfall Model Incremental Model-Evolutionary model- Object Oriented Model- Introduction to Agility-Agile process model: XP.

Requirements Engineering: Requirements Engineering Tasks-Software Requirements Specification(SRS).

Software Design Engineering – Design process – Architectural styles, Component Level Design: Designing Class based components, Designing traditional Components, User Interface Design: User interface analysis and design- Design Model - User Interface Design issues.

Module II **22 Hours**

Structural Modeling: Classes – Relationships – Notes, Stereotypes-Tagged Values-Constraints - Class Diagrams – Advanced Classes – Advanced Relationships – Interfaces, Types, And Roles – Packages- Case Study: Class Diagram for ATM System

Behavioural Modeling: Interactions – Use Cases – Use Case Diagrams - Interaction Diagrams – Activity Diagrams. Events and Signals - State Machines - State Chart Diagrams-Case Study: Interaction Model for Online Registration System

Architectural Modeling: Component – Deployment - Collaborations - Component Diagrams - Deployment Diagrams.

Software Testing and Quality Assurance - Unit Testing, Integration Testing, System Testing, Acceptance Testing- Software Quality Assurance- Software Reviews-Software Configuration Management.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Use the suitable software process model for specific scenario	Apply
CO2: Utilize software requirement specification for the given scenario	Apply
CO3: Analyze use cases to convert them into object-oriented software realizations, employing UML tools to model and represent real-time applications effectively.	Analyze
CO4: Interpret the selected testing strategy and maintenance to the developed software	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	2	3	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Roger S.Pressman, Bruce.R.Maxim, “Software Engineering - A Practitioner’s Approach II”, 8th Edition, McGraw-Hill International Edition, New Delhi, 2015. (Module I)

T2. Grady Booch, James Rambaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, 2nd Edition, Pearson Education, 2015. (Module II)

Reference Book(s):

R1. Ian Sommerville, “Software Engineering II”, 10th Edition, Pearson Education Asia, 2015.

R2. Martin Fowler, “UML Distilled II”, 3rd Edition, Pearson Education, 2008.

R3. Grady Booch, “Object Oriented Analysis and Design with Applications”, 3rd Edition, Addison Wesley, New Delhi, 2009.

Web References:

1.http://freevideolectures.com/Course/2318/Software-Engineering

2.http://www.nptel.ac.in/courses/122105022/27

3.http://www.creativeworld9.com/2011/02/study-videos-of-object-oriented_24.html

Course Code: 23ITO006		Course Title: Big Data Management & Analytics	
Course Category: Minor		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to provide a comprehensive understanding of data management and effective statistical analysis methods, including Bayesian approaches and time series analysis.

Module I **22 Hours**

Data Management: Age of Information Pioneered Product-Analytics Revolution-Big Data Management and Architecture-Big Data Ethics: Stakeholders-Industry-Ethics Elements-Ethical Framework-Ethics Test-Audit and Case Studies.

Data centre OS: Introduction- Hadoop Architecture-Ecosystem and Offerings-Hadoop Cluster Architecture-Distributed Computing: MapReduce. Data Stock: Beginning of the data stock-Transaction-OLTP, OLAP and NoSQL.

Hive and HBase: Hive-Data Model- System Architecture and Components-HBase.

Module II **23 Hours**

Pig and Data Lookout: Pig Latin Application Flow-Pig Latin Statements and Execution Environment-Pig Data types-UDF Scripting with Pig Latin-Data Lookout Readiness: Data Lookout- Sqoop- SQL to Hadoop-Flume-designing Flume Topology.

Supervised & Unsupervised Learning: Linear Regression Technique- Classification-Unsupervised Learning: Business Use case-Unlabelled Data-K-means Clustering-Hierarchical Clustering-Caution.

Big Data Business Leadership Model: Big Data Stakeholders-Big Data Industry-Big Data Business Leadership Model.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply big data management architecture using Hadoop and MapReduce for efficient data processing.	Apply
CO2: Utilize Hive, HBase, and Pig to analyze and manage complex datasets.	Apply
CO3: Interpret supervised and unsupervised learning models to address business problems.	Apply
CO4: Analyze the Big Data Business Leadership Model to evaluate stakeholder roles and assess ethical challenges in big data initiatives.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	2	2	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Nitin Upadhyay, “Big Data Management and Analytics”, Cengage India,1st Edition, 2018.

Reference Book(s):

R1. S.P.Gupta, “Statistical Methods”, Sultan Chand and sons, 2019

R2. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, 1st Edition, Wiley India, 2015

Web References:

1. https://bigdatauniversity.com/
2. https://www-01.ibm.com/software/data/infosphere/hadoop/what-is-big-data-analytics.html
3. http://www.real-statistics.com/

Course Code: 23ITO007		Course Title: Electronic Commerce	
Course Category: Minor		Course Level: Advanced	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to provide an understanding of E-Commerce fundamentals, electronic payment systems, and organizational workflows, while also exploring evolving marketing strategies and multimedia applications.

Module I **22 Hours**

E-Commerce and its Technological Aspects: Overview of developments in Information Technology and Defining E-Commerce: The scope of E-commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce. World Wide Web and Electronic Payment Systems. **Consumer Oriented E-Commerce:** E-Retailing: Traditional retailing and e retailing, Benefits of e-retailing, Key success factors, Models of e-retailing, Features of e-etailing. E-services: Categories of e-services, Web-enabled services, matchmaking services, Information-selling on the web, e-entertainment, Auctions and other specialized services. Business to Business Electronic Commerce

Module II **23 Hours**

Electronic Data Interchange (EDI): Components of EDI - Applications of EDI - Features of EDI - Advantages and Dis- Advantages of an EDI System – Implementing EDI. - Types of EDI Communication - Implementation of EDI Communication with Tcp/Ip Protocols - Electronic payment methods - Types of Electronic Payment Systems - Electronic Funds Transfer.

Advertising and Marketing on the Internet - Information Based Marketing-Advertising - on- Line Marketing Process; History of Software Agents - Characteristics and Properties of Agents Technology -Telescript Agent Language-Safe – Tcl - Applets, Browsers and Software Agents- Software Agents in Action. **Mobile Commerce** - Wireless Device for Mobile Commerce - Location Based Services – Classification Framework - Wireless Application Protocol-Mobile Business Services - Mobile Portals.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify various E-Commerce frameworks while analyzing current trends, technologies, and practices shaping the digital commerce landscape.	Apply
CO2: Apply the various technologies that support e-commerce, such as online payment systems, security protocols, and e-commerce platforms	Apply
CO3: Analyze and compare various e-commerce business models by examining their structures, revenue strategies, target audiences, and operational approaches.	Analyze
CO4: Analyze diverse e-commerce business models by exploring their structural frameworks, revenue generation methods, target markets, and operational mechanisms.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	-	-	-	-	3	-	-	-	-	-
CO3	-	-	2	3	-	-	-	-	2	-	-	-
CO4	-	2	-	-	3	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Ravi Kalakota ,Andrew B Whinston, “Frontiers of Electronic Commerce", 1st Edition, Pearson Education Asia, 2013.

T2. Elias M. Awad, Electronic Commerce, 1st Edition, Prentice-Hall of India Pvt. Ltd., 2002.

Reference Book(s):

R1. Kenneth C. Laudon,Carol Guercio Traver, "E-Commerce-Business, Technology, Society", Pearson India, 13th edition, 2017.

R2. Brenda Kienan, Managing E-Commerce Business, 1st Edition, PHI, 2001.

Web References:

1. https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf

2. https://swayam.gov.in/nd1_noc19_mg54/preview.

3. http://www.techtutorials.info/ecommerce. html

4. http://en.wikipedia.org/wiki/Electronic_data_interchange

Course Code: 23ITO008		Course Title: Graphical User Interface Design	
Course Category: Minor		Course Level: Advanced	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

This course is intended to explore various user interfaces, design principles, and graphical interface controls. It also covers multimedia components and layout testing techniques.

Module I **22 Hours**

Introduction – Popularity of Graphics - Direct & Indirect Manipulation - Graphical system advantages & disadvantages - Characteristics of Graphical User Interface - Web User Interface – Popularity of Web – Characteristics of Web Design - Principles of Web Design.

Human Computer Interaction: Obstacles and Pitfalls – Usability - Human Characteristics in Design – Human Interaction Speed - Business Functions - Requirement Analysis – Direct & Indirect Methods – Basic Business Functions - Design Standards – Human Consideration in Screen Design - Structures of Menus - Functions of Menus - Contents of Menus – Formatting of Menus - Phrasing the Menu - Selecting Menu Choices.

Windows: Characteristics – Components - Presentation Styles – Types of Windows – Managements - Organizations – Operations - Web Systems – Device Based Controls: Characteristics.

Module II **23 Hours**

Screen Based Controls: Operable Control - Text Boxes - Selection Control - Combination Control - Custom Control - Presentation Control.

Multimedia: Text for Web Pages - Effective Feedback, Guidance & Assistance – Internationalization and Accessibility – Icons – Image - Multimedia – Graphics - Colors.

Windows Layout: Interface Testing - Test, Test, and Retest – Test Conduct and Data Collection

Case Study: Information Search - Visualization - Hypermedia -WWW - Interface Design Tools - Software Testing Tools.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply development methodologies, evaluation techniques, and user interface building tools to design and assess effective user-centered interfaces.	Apply
CO2: Explore a representative range of design guidelines by examining principles and standards.	Analyze
CO3: Apply design guidelines effectively to create and refine user interface design solutions for practical tasks.	Apply
CO4: Demonstrate the ability to design Human-Computer Interfaces and conduct usability testing to evaluate interface effectiveness.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	3	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	2	-	-	-	-	2	-	-
CO4	-	-	-	3	-	3	-	-	2	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Wilbent. O. Galitz ,"The Essential Guide to User Interface Design", 2nd Edition, John Wiley& Sons, New Delhi, 2014.

T2. Alan Cooper, "The Essential of User Interface Design", 1st Edition, Wiley – Dream Tech Ltd., New Delhi, 2007.

Reference Book(s):

R1. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, "Human – Computer Interaction", 3rd Edition, Pearson Education, New Delhi, 2004.

R2. Ben Sheiderman, "Design the User Interface", 3rd Edition Pearson Education, New Delhi, 1998**.**

R3. Jenny Preece, Yvonne Rogers, and Helen Sharp, "Interaction Design: Beyond Human-Computer Interaction", 5th Edition, Wiley, 2019.

R4. Jonathan Lazar, Jinjuan Heidi Feng, and Harry Hochheiser, "Research Methods in Human-Computer Interaction", 2nd Edition, Morgan Kaufmann, 2017.

Web References:

1. https://www.walkme.com/blog/graphical-user-interface-examples/

2. https://www.interaction-design.org/literature/article/ui-design-examples

3. https://www.ofspace.co/blog/user-interface-examples