KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Batch: **2023-27**
School: **Computer Science and Engineering**
Program: **BE- Computer Science and Engineering (Artificial Intelligence)**

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Vision and Mission of KLE Technological University

Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavors.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

Vision and Mission Statements of the School / Department

Department Vision

The KLE Tech- School of Computer Science will excel and lead in education, research and innovation in computing and information technology, contributing to the evolving needs of the world we live in.

Department Mission

- To foster a dynamic academic environment with cutting edge curriculum and innovative educational experience to prepare graduates to succeed and lead in a wide range of computing and information technology businesses and occupations.
- To be at the forefront of research through new and exciting innovations leading to the future of computing technologies.
- To collaborate within and beyond discipline to create solutions that benefit humanity and society.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
PEO: 1. Graduates will demonstrate peer recognized technical competency to solve analyze, design, develop, deploy and maintain computing solutions for contemporary problems.
PEO: 2. Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.
PEO: 3. Graduates will be engaged in ongoing learning and professional development through pursuing higher education and self-study.
PEO: 4. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.
Program Outcomes-PO's
PO 1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
PO 2: **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3: **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 public health and safety, and cultural, societal, and environmental considerations.
PO 4: **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.
PO 5: **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.
PO 6: **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.
PO 7: **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.
PO 8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with the 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

PO 11: **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.
PO 12: **Life-long learning**: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Objectives -PSO's
PSO 1: **Domain-specific knowledge**: An ability to apply techniques to develop computer based solutions in the domain of data, system and network engineering.
PSO 2: **Software System Construction**: Apply design and development principles in the construction of software systems of varying complexity.

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Curriculum Structure-Overall

CSE-AI					Total Program Credit: 176 (44+132)			Year: 2023-27	
Courses Semester wise	I	II	III	IV	V	VI	VII	VIII	
	Single Variable Calculus 18EMAB101 (4-1-0)	Multivariable Calculus 18EMAB102 (4-1-0)	Linear Algebra 24EMAB208 (3-0-1)	Probability & Statistics 24EMAB209 (3-1-0)	Software Engineering 22ECAC301 (3-0-0)	Deep Learning 24ECAC305 (3-0-1)	Big Data & Analytics 24ECAC401 (2-0-1)	PE-6 XXECAE 4XX (3-0-0)	Internship Training 25ECAI493 (0-0-6)
	Engineering Physics 22EPHB101 (3-0-0)	Engineering Chemistry 22ECHB102 (3-0-0)	Discrete Mathematical Structures 24ECAC201 (3-1-0)	Microcontroller Programming and Interfacing 24ECAC206 (1-0-2)	Computer Networks 24ECAC302 (3-0-0)	Embedded Intelligent Systems 24ECAC306 (1-0-2)	Cryptography & Network Security (24ECAC403)(2-0-1)	OE XXECAO 4XX (3-0-0)	
	Engineering Mechanics 15ECVF101 (4-0-0)	Problem Solving with Data Structures 18ECSP102 (0-0-3)	Computer Organization and Architecture 24ECAC202 (3-0-1)	Object Oriented Programming 24ECAC207 (3-0-0)	Machine Learning 22ECAC303 (3-0-0)	Natural Language processing and Gen AI 24ECAC307 (2-0-2)	PE-4 XXECAE4XX (3-0-0)	Capstone Project 22ECAW402 / Internship Project 25ECAW494 (0-0-11)	
	C Programming for Problem Solving 18ECSP101 (0-0-3)	Engineering Exploration 22ECRP101 (0-0-3)	Design and Analysis of Algorithms 24ECAC203 (4-0-0)	Operating System Principles and Programming 24ECAC208 (4-0-1)	Internet of Things 24ECAC308 (2-0-1)	PE-2 XXECAE3XX (3-0-0)	PE-5 XXECAE4XX (3-0-0)		
	Basic Electrical Engineering 18EEEF101 (3-0-0)	Basic Electronics 18EECF101 (4-0-0)	Database Management System 22ECAC204 (4-0-0)	Principles of Compiler Design 22ECAC209 (3-1-0)	Machine Learning Lab 22ECAP303 (0-0-1.5)	PE-3 XXECAE3XX (3-0-0)	Senior Design Project 22ECAW401 (0-0-6)		
	Design Thinking for Social Innovation 20EHSP101 (0-1-1)	Basic Mechanical Engineering 22EMEF101 (2-1-0)	Database Applications Lab 22ECAP201 (0-0-1.5)	Exploratory Data Analysis 24ECAC210 (2-0-2)	Web Technologies Lab 24ECAP304 (0-0-2)	Minor Project 24ECAW304 (0-0-6)	CIPE & EVS (Audit) 15EHSA401		
	Applied Physics Lab 21EPHP101 (0-0-1)	Professional Communication 15EHSH101 (1-1-0)	Algorithms Lab 24ECAP202 (0-0-2)	Object Oriented Programming Lab 24ECAP206 (0-0-1.5)	Computer Networks Lab 22ECAP302 (0-0-1.5)				
					PE-1 XXECAE3XX (3-0-0)				
					Mini Project 22ECAW301 (0-0-3)	Professional Aptitude & Logical Reasoning 16EHSC301 (3-0-0)			
			Corporate Communication 24EHSA201 (Audit)	Problem Solving & Analysis 24EHSA202 (Audit)	Arithmetical Thinking & Analytical Reasoning 23EHSA303 (Audit)	Industry Readiness & Leadership Skills (23EHSA304)(Audit)			
Credits	**21**	**23**	**23.5**	**24.5**	**23**	**26**	**18**	**17**	

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Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	18EMAB101	Single Variable Calculus	BS	4-1-0	5	6	50	50	100	3 hours
2	22EPHB101	Engineering Physics	BS	3-0-0	3	3	50	50	100	3 hours
3	15ECVF101	Engineering Mechanics	ES	4-0-0	4	4	50	50	100	3 hours
4	18ECSP101	C Programming for Problem solving	ES	0-0-3	3	6	80	20	100	3 hours
5	18EEEF101	Basic Electrical Engineering	ES	3-0-0	3	3	50	50	100	3 hours
6	20EHSP101	Design Thinking for Social Innovation	HSS	0-1-1	2	3	80	20	100	3 hours
7	21EPHP101	Applied Physics Lab	BS	0-0-1	1	2	80	20	100	3 hours
Total				**14-2-5**	**21**	**27**	**440**	**260**	**700**	

ISA: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

Date: Program Head

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Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	18EMAB102	Multivariable Calculus	BS	4-1-0	5	6	50	50	100	3 hours
2	22ECHB102	Engineering Chemistry	BS	3-0-0	3	3	50	50	100	3 hours
3	18ECSP102	Problem Solving with Data Structures	ES	0-0-3	3	6	80	20	100	3 hours
4	22ECRP101	Engineering Exploration	ES	0-0-3	3	6	80	20	100	3 hours
5	18EECF101	Basic Electronics	ES	4-0-0	4	4	50	50	100	3 hours
6	22EMEF101	Basic Mechanical Engineering	ES	2-1-0	3	4	50	50	100	3 hours
7	15EHSH101	Professional Communication	HSS	1-1-0	2	3	50	50	100	3 hours
Total				**14-3-6**	**23**	**32**	**410**	**290**	**700**	

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Date: Program Head

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Semester: III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EMAB208	Linear Algebra	BS	3-0-1	4	4	63	37	100	3 hours
2	24ECAC201	Discrete Mathematical Structures	PC	3-1-0	4	5	50	50	100	3 hours
3	24ECAC202	Computer Organization and Architecture	PC	3-0-1	4	5	63	37	100	3 hours
4	24ECAC203	Design and Analysis of Algorithms	PC	4-0-0	4	4	50	50	100	3 hours
5	22ECAC204	Database Management System	PC	4-0-0	4	4	50	50	100	3 hours
6	22ECAP201	Database Applications Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
7	24ECAP202	Algorithms Lab	PC	0-0-2	2	4	80	20	100	3 hours
8	24EHSA201	Corporate Communication	HSS	0-0-0	0	1	100	0	100	3 hours
TOTAL				**17-1-5.5**	**23.5**	**30**	**530**	**264**	**800**	

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Date: Program Head

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Semester: IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EMAB209	Probability & Statistics	BS	3-1-0	4	5	50	50	100	3 hours
2	24ECAC206	Microcontroller Programming and Interfacing	PC	1-0-2	3	5	67	33	100	3 hours
3	24ECAC207	Object Oriented Programming	PC	3-0-0	3	3	50	50	100	3 hours
4	24ECAC208	Operating System Principles and Programming	PC	4-0-1	5	6	60	40	100	3 hours
5	22ECAC209	Principles of Compiler Design	PC	3-1-0	4	5	50	50	100	3 hours
6	24ECAC210	Exploratory Data Analysis	PC	2-0-2	4	6	50	50	100	2 hours
7	24ECAP206	Object Oriented Programming Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
8	24EHSA202	Problem Solving & Analysis	HSS	0-0-0	0	1	100	-	100	3 hours
				16-2-6.5	**24.5**	**34**	**506**	**294**	**800**	

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Semester: V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22ECAC301	Software Engineering	PC	3-0-0	3	3	50	50	100	3 hours
2	24ECAC302	Computer Networks	PC	3-0-0	3	3	50	50	100	3 hours
3	22ECAC303	Machine Learning	PC	3-0-0	3	3	50	50	100	3 hours
4	24ECAC308	Internet of Things	PC	2-0-1	3	4	67	33	100	2 hours
5	22ECAP303	Machine Learning Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
6	24ECAP304	Web Technologies Lab	PC	0-0-2	2	4	80	20	100	3 hours
7	22ECAP302	Computer Networks Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
8	XXECAE3XX	Professional Elective-1	PE	3-0-0	3	3	50	50	100	3 hours
9	22ECAW301	Mini Project	PW	0-0-3	3	3	50	50	100	3 hours
10	23EHSA303	Arithmetical Thinking & Analytical Reasoning	HSS	0-0-0	0	1	100	0	100	3 hours
			TOTAL	**14-0-9**	**23**	**30**	**656**	**344**	**1000**	

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Date: Program Head

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Semester: VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24ECAC305	Deep Learning	PC	3-0-1	4	5	63	37	100	3 hours
2	24ECAC306	Embedded Intelligent Systems	PC	1-0-2	3	6	67	33	100	2 hours
3	24ECAC307	Natural Language Processing and Gen AI	PC	2-0-2	4	5	50	50	100	3 hours
4	XXECAE3XX	Professional Elective-2	PE	3-0-0	3	3	50	50	100	3 hours
5	XXECAE3XX	Professional Elective-3	PE	3-0-0	3	3	50	50	100	3 hours
6	24ECAW304	Minor Project	PW	0-0-6	6	3	50	50	100	3 hours
7	16EHSC301	Professional Aptitude & Logical Reasoning	HSS	3-0-0	3	3	50	50	100	3 hours
8	23EHSA304	Industry Readiness & Leadership Skills	HSS	0-0-0	0	1	100	-	100	3 hours
				15-0-11	**26**	**29**	**479**	**321**	**800**	

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Date: Program Head

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Semester- VII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24ECAC404	Big Data & Analytics	PC	2-0-1	3	4	67	33	100	2 hours
2	24ECAC403	Cryptography & Network Security	PC	2-0-1	3	4	67	33	100	2 hours
3	XXECAE4XX	Professional Elective-4	PE	3-0-0	3	3	50	50	100	3 hours
4	XXECAE4XX	Professional Elective-5	PE	3-0-0	3	3	50	50	100	3 hours
5	22ECAW401	Senior Design Project	PW	0-0-6	6	3	50	50	100	3 hours
6	15EHSA401	CIPE & EVS (Audit)	HSS	0-0-0	0	2	50	50	100	3 hours
			Total	**10-0-8**	**18**	**19**	**316**	**284**	**600**	

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Date: Program Head

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Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	XXECAE4XX	Professional Elective-6	PE	3-0-0	3	3	50	50	100	3 hours
2	XXECAO4XX	Open Elective	OE	3-0-0	3	3	50	50	100	3 hours
3*	25ECAI493	Internship Training	PW	0-0-6	6	12	50	50	100	3hours
4*	25ECAW494	Internship Project	PW	0-0-11	11	22	50	50	100	3 hours
	22ECAW402	Capstone Project								
		Total		**6-0-17**	**17**	**34**	**100**	**100**	**200**	

*Note students can either choose (1, 2 & 4(Capstone project) or (3-Industry training & 4-Industry project).)

Date: Program Head

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	23	23.5	24.5	23	26	18	17	176

List of Open Electives

Sr. No	Name of the Course	Course Code
1.	Distributed and Cloud Computing (2-0-1)	22ECAO401
2.	Database Management System (2-0-1)	22ECAO404
3.	High Performance Computing for Engineering Applications (3-0-0)	22ECAO402
4.	Essentials of IT (0-0-3)	22ECAO405
5.	Software Engineering (3-0-0)	22ECAO403
6.	Big Data Analytics (3-0-0)	22ECAO406

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List of Program Electives

Sr. No	Name of the Course	Course Code
3rd Year (Professional Electives- 1, 2 & 3)		
Data Intelligence		
1.	Digital Image and Video Processing (2-0-1)	24ECAE310
2.	Computer Vision (3-0-0)	24ECAE336
3.	Reinforcement Learning (3-0-0)	22ECAE312
4.	Bioinformatics(3-0-0)	22ECAE314
5.	Computer Graphics(3-0-0)	22ECAE315
6.	Multimedia Computing(3-0-0)	22ECAE316
7.	Ethics in AI (3-0-0)	23ECAE325
8.	Augmented and Virtual Reality (2-0-1)	24ECAE303
9.	Parallel Computing(3-0-0)	22ECAE320
10.	Computational Medicine(3-0-0)	24ECSE340
Networking and Security		
1.	Cloud Computing (2-0-1)	24ECAE338
2.	Data Integration and Cloud Services(1-0-2)	24ECAE319
3.	Cyber Security (3-0-0)	24ECAE337
4.	Web Security (2-0-1)	24ECAE302
5.	Security Operations (2-0-1)	25ECAE330
6.	Software Defined Networks(3-0-0)	25ECAE331
7.	Edge Computing (2-0-1)	25ECAE332
System and Software Development		
1.	Advanced Java Programming (2-0-1)	24ECAE329
2.	Blockchain and Distributed Ledgers (2-0-1)	24ECAE339
3.	Algorithmic Problem Solving(2-0-4)	24ECSE309
4.	DevOps and MLOps (0-0-2)	23ECAE335
5.	Microservice Architecture using JAVA(2-0-1)	24ECAE304
6.	Multicore architecture and Programming (2-0-1)	25ECAE334

4th Year (Professional Electives- 4, 5 & 6)		
Data Intelligence		
1.	Advanced Computer Graphics(0-0-3)	22ECAE407
2.	Social Network Analysis(2-0-1)	24ECAE405
3.	Information Retrieval(2-0-1)	24ECAE406
4.	Multi Modal Learning (2-0-1)	25ECAE416
5.	Augmented and Virtual Reality (2-0-1)	25ECAE417
6.	Quantum Computing(3-0-0)	25ECAE421
7.	Agentic AI (2-0-1)	25ECAE426
Networking and Security		
1.	AI for Cyber Security (2-0-1)	25ECAE419
2.	Mobile and Wireless Networks (3-0-0)	22ECAE412
System and Software Development		
1.	C# and .NET (2-0-1)	25ECAE422
2.	Robotic Process Automation Design and Development (2-0-1)	25ECAE423
3.	Software Testing (3-0-0)	25ECAE424
4.	Software Architecture and Design Thinking (3-0-0)	25ECAE425
5.	Advanced Parallel Computing (3-0-0)	22ECAE414
6.	Scalable AI(3-0-0)	22ECAE415

Curriculum Content- Course wise

Semester - I

Program: Bachelor of Engineering		**Semester - I**
Course Title: Single Variable Calculus		**Course Code: 18EMAB101**
L-T-P: 4-1-0	**Credits: 05**	**Contact Hours: 6hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Tutorial/Practical: 28hrs**	**Exam Duration: 3hrs**

	Unit I	
1	**Introduction to Mathematical Modeling:** What is Mathematical modeling, why Mathematical modeling, use of Mathematical modeling, Process of mathematical modeling, types of modeling with simple examples	**04 hrs**
2	**Functions, Graphs and Models:** Functions, types of functions, transformations and models (Linear, exponential, trigonometric). **MatLab**: Graphing functions, Domain-Range and Interpreting the models	**05 hrs**
3	**Calculus of functions and models:** Limit of a function, Infinite limits-graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton-Raphson Method Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L-Hospital's rule-Examples **MatLab:** optimization problems. Curvature problems	**11 hrs**
	Unit II	
4	**Infinite Series:** Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series **MatLab:** Convergence of series	**06 hrs**
5	**Integral calculus:** Tracing of standard curves in Cartesian form, Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's 1/3 rule **MatLab**: problems on arc length, area, volume and surface area	**14 hrs**
	Unit III	

6	**Ordinary differential equations of first order:** (a) Introduction to Initial Value problems. Linear and Bernoulli's equations, Exact equations and reducible to exact form, Numerical solution to Initial Value problems- Euler's method, Modified Euler's method and Runge-Kutta method (b) Applications of first order differential equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies. **MatLab:** Solve differential equations	**10 hrs**

Text Books

1. Early Transcendentals Calculus- James Stewart, Thomson Books, 7e 2010

Reference Books:

1. Hughues- Hallett Gleason, Calculus Single and Multivariable, 4ed, Wiley India, 2009.
2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

BACK

Program: Bachelor of Engineering		Semester - I
Course Title: Engineering Physics		Course Code: 22EPHB101
L-T-P: 3-0-0	Credits:3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: --	Exam Duration: 3 Hrs

Unit I

1	**Conduction in semiconductors: Atomic theory:** The atom, electron orbits and energy levels, energy bands, **Conduction in solids:** Electron motion and hole transfer, conventional current and electron flow **Conductors, semiconductors and insulators:** Bonding force between atoms, Energy bands in different materials. **n-type and p-type Semiconductors:** Doping, n-Type material, p-Type material, Majority and minority charge carriers, Effects of heat and light, charge carrier density. **Semiconductor conductivity:** Drift current, diffusion current, charge carrier velocity, conductivity, Hall Effect. (Text 1 Page No 1-33)	**05 hrs**
2	**Junctions: The pn-Junctions:** Junction of p-Type and n-Type, Barrier voltage, depletion region, Qualitative theory of p-n Junction **Biased junctions:** Reverse biased junction, forward biased junction, junction temperature effects. **Junction currents and voltages:** Shockley equation, junction currents, junction voltages. **p-n Junction Diode characteristics and parameters:** Forward and reverse characteristics, diode parameters. **Diode approximations:** Ideal diode and practical diodes, piecewise linear characteristics, DC equivalent circuits. **DC load line analysis:** DC load line, Q-Point, calculating load resistance and supply voltage. **Temperature Effects:** Diode power dissipation, forward voltage drop, dynamic resistance. **Diode AC models:** Junction capacitance, AC-equivalent circuits (Reverse biased and forward biased), reverse recovery time. **Diode specifications:** Diode data sheets, low power diodes, rectifier diodes **Diode testing:** Ohmmeter tests, use of digital meter, plotting diode characteristics.	**10 Hrs**

	Zener diodes: Junction break down, circuit symbols and packages, characteristics and parameters, data sheet, equivalent circuits. (Text 1 Page No 34-71)	
	Unit II	
3	**Electrostatics: Review on vectors:** Coordinate Systems, Vector and Scalar Quantities, Properties of Vectors, Components of a Vector and Unit Vectors (Text 2 Page No 59-77) **Electric Fields:** Properties of Electric Charges, Charging Objects by Induction, Coulomb's Law, Analysis Model: Particle in a Field (Electric), Electric Field of a Continuous Charge Distribution, Electric Field Lines Motion of a Charged Particle in a Uniform Electric Field **Gauss's Law:** Electric Flux, Gauss's Law, Application of Gauss's Law to Various Charge Distributions, Conductors in Electrostatic Equilibrium **Electric Potential:** Electric Potential and Potential Difference, Potential Difference in a Uniform Electric Field, Electric Potential and Potential Energy Due to Point Charges, Obtaining the Value of the Electric Field from the Electric Potential, Electric Potential Due to Continuous Charge Distributions Electric Potential Due to a Charged Conductor, Applications of Electrostatics **Capacitance and Dielectrics:** Definition of Capacitance, Calculating Capacitance, Combinations of Capacitors, Energy Stored in a Charged Capacitor, Capacitors with Dielectrics, Electric Dipole in an Electric Field, An Atomic Description of Dielectrics (Text 2 Page No 690-807)	**15 Hrs**
	Unit – III	
4	**Electromagnetics: Magnetic Fields:** Analysis Model: Particle in a Field (Magnetic), Motion of a Charged Particle in a Uniform Magnetic Field, Applications Involving Charged Particles Moving in a Magnetic Field, Magnetic Force Acting on a Current-Carrying Conductor, Torque on a Current Loop in a Uniform Magnetic Field, **Sources of the Magnetic Field:** The Biot–Savart Law, The Magnetic Force Between Two Parallel Conductors, Ampere's Law, The Magnetic Field of a Solenoid, Gauss's Law in Magnetism, Magnetism in Matter **Faraday's Law:** Faraday's Law of Induction, Motional emf, Lenz's Law, Induced emf and Electric Fields Generators and Motors, Eddy Currents	**10 Hrs**

	(Text 2 Page No 868-969)	

Text Book:

1. David A Bell, “Electronics Devices and Circuits”, Fifth Edition, Oxford University Press.
2. Serway and Jewett, “Physics for Scientists and Engineers-with Modern Physics”, 9th Edition, CENGAGE learning. 2014

References:

1. Jacob Millman and Christos Halkias, “Electronic Devices and Circuits” TMH
2. R P Feynman, Robert B Leighton, Matthew Sands, The Feynman Lectures on Physics Vol-II, Norosa Publishing House (1998).
3. Ben G Streetman, Solid State Electronic Devices, Prentice Hall, 1995

BACK

Program: Bachelor of Engineering		**Semester - I**
Course Title: Engineering Mechanics		**Course Code: 15ECVF101**
L-T-P: 4-0-0	**Credits:4**	**Contact Hrs: 4hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 50	**Tutorial/Practical: --**	**Exam Duration: 3 hours**

	Unit I	
1	**Overview of Civil Engineering: Evolution of Civil Engineering** Specialization, scope and role. **Impact of Civil Engineering on** National economy, environment and social & cultural fabric. **Challenges and Opportunities for Civil Engineers** Civil Engineering Marvels, Future challenges, Higher education and Research.	**04 hrs**
2	**Coplanar concurrent force system: Introduction to Engineering Mechanics:** Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition, Newton's laws of motion. Classification of force systems **Resultant of coplanar concurrent force system:** Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces. **Equilibrium of coplanar concurrent force system:** Conditions of equilibrium, Action & Reaction, Free body diagram, Lamis' theorem. Numerical problems on equilibrium of forces.	**12 hrs**
3	**Coplanar non-concurrent force system :** Resultant of a force system: Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignons principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems.	**05 hrs**
	Unit II	
4	**Equilibrium of a force system (Chapter 3 contd..)** : Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam.	**5 hrs**
5	**Static Friction:** Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge and belt friction theory. Derivation of belt friction formula. Numerical problems on, impending motion on horizontal and inclined planes (including connected bodies); wedge friction; Ladder friction and Belt friction.	**8 hrs**

6	**Simple Stress and Strain:** Introduction, Properties of Materials, Stress, Strain, Elasticity, Elastic limit, Hooke's law & Young's modulus, Stress – Strain Diagram for structural steel, working stress and Factor of safety. Deformation of a bar due to force acting on it. Law of super position. Stresses in bars of uniform & varying cross sections. Composite sections. Problems connected to above topics.	**6 hrs**
	Unit – III	
7	**Centroid of Plane Figures:** Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle and sector of a circle etc,.) using method of integration, Numerical problems on Centroid of simple built up sections.	**5 hrs**
8	**Second moment of area (Plane figures):** Introduction, Definition, Method of determining the second moment of area, Section Modulus, Radius of gyration, perpendicular and Parallel axis theorems, Polar second moment of area, second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using method of integration, Numerical problems on MI of simple built up sections.	**5 hrs**

Text Book:

1. Beer, F.P. and Johnston, R., Mechanics for Engineers: Statics, McGraw Hill Company, New York, 1988.
2. Bhavikatti, S.S., and Rajasshekarappa K.G., Engineering Mechanics, 3Ed., New Age International Pub. Pvt. Ltd., New Delhi, 2008.
3. Kumar, K.L., Engineering Mechanics, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2003.
4. Punmia, B.C., Jain, A. and Jain, A., Mechanics of Materials, Lakshmi Publications, New Delhi, 2006

References:

1. Jagadeesh, T.R. and Jayaram, *Elements of Civil Engineering*, Sapna Book House, Bangalore, 2006.
2. Ramamrutham, S., *Engineering Mechanics*, Dhanpat Rai Publishing Co., New Delhi, 1998.
3. Singer, F.L., *Engineering Mechanics*, 3rd edition Harper Collins, 1994.
4. Timoshenko, S.P. and Young, D.H., *Engineering Mechanics*, 4th edition, McGraw Hill Publishing Company, New Delhi, 1956.
5. Irving H Shames, *Engineering Mechanics*, 3rd edition, Prentice-Hall of India Pvt. Ltd, New Delhi- 110 001, 1995.

BACK

Program: Bachelor of Engineering		**Semester - I**
Course Title: C Programming for Problem Solving		**Course Code: 18ECSP101**
L-T-P: 0-0-3	**Credits: 3**	**Contact hrs: 6 Hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching : --	**Tutorial/Practical: 84hrs**	**Exam Duration: 3 Hrs**

1	**Introduction to Problem Solving** Introduction to algorithms / flowcharts and its notations, top down design, elementary problems.	**3 hrs**
2	**Basics of C programming language** Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.	**15 hrs**
3	**Decision Control Statements** Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements**:** break, continue. Introduction to Debugging Skills Introduction to Test Driven Programming.	**12 hrs**
4	**Iterative Statements** while, do while, for, nested statements	**10 hrs**
5	**Functions** Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros. Introduction to Coding Standards	**10 hrs**
6	**Arrays and Strings** Introduction, Declaration, Accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays, Introduction to Code Optimization and refactoring	**15 hrs**
7	**Pointers** Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.	**08 hrs**
8	**Structures and Unions** Introduction, passing structures to functions, Array of structures, Unions	**05 hrs**

Text Books

1. R.G. Dromey, How to Solve it by Computer, 1ed, PHI, 2008.
2. Yashvant Kanetkar, Let us C, 15th ed, BPS Publication, 2016.

Reference Books:

1. B W Kernighan, D M Ritchie, The Programming language C, 2ed, PHI, 2004.
2. B S Gottfried, Programming with C, 2ed, TMH, 2006.
3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.

BACK

Program: Bachelor of Engineering		Semester - I
Course Title: Basic Electrical Engineering		Course Code: 18EEEF101
L-T-P: 3-0-0	Credits: 3	Contact: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching : 40 Hrs	Tutorial/Practical: --	Exam Duration: 3 Hrs

	Unit-I	
1	**Overview of Electrical Engineering:** Specialization, scope & role, impact of Electrical Engineering on national economy, environment, Sources of generation, sustainability, challenges and opportunities for electrical engineers, electrical engineering marvels, future challenges.	**02 hrs**
2	**DC Circuits:** Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Time-domain analysis of first-order RL and RC circuits.	**05 hrs**
3	**AC Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. power measurement using two watt meters	**08 hrs**
	Unit-II	
4	**Electrical Actuators** Electromagnetic principles, Solenoid, Relays, classification of Electric motors, DC motors-shunt, series, compound, separately excited, PMDC motors – Speed Control, Stepper Motors, BLDC motors, three phase induction motor, Characteristics and applications, selection of motors for various applications.	**9 hrs**
5	**Power Electronics** (Text1, chapter 45): Introductory, Thyristor, Some thyristor circuits, Limitations to thyristor operation, The thyristor in practice, The fully controlled AC/DC converter, AC/DC inversion, Switching devices in inverters, Three-phase rectifier networks, The three-phase fully controlled converter, Inverter-fed induction motors, Soft-starting induction motors, DC to DC conversion switched-mode power	**6 hrs**

Unit-III		
6	**Electrical Wiring, Safety and protection(Ref :Text3-page 1 to 10):** Types of wires and cables for internal wiring, Types of switches and Circuits, Types of wiring, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Importance of grounding and earthing, Methods for earthing, Fuses, MCB, ELCB and Relays, Lockout and Tagout, Electrical Codes and Standards.	**05 hrs**
7	**Batteries:** Basics of lead acid batteries, Lithium Ion Battery , Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing. Numericals.	**05 hrs**

Text Books

1. Hughes, Electrical & Electronic Technology, 8th , Pearson Education, 2001
2. P C Sen, Principals of Electrical Machines and Power Electronics, 2nd, Wiley Publications
3. Gilbert M Masters, Renewable and efficient Electrical Power systems, Published by John Wiley & Sons 2004 edition
4. Frank D. Petruzella, Electric Motors and Control Systems, McGraw Hill Education Private Limited 2009 Edition

Reference Books:

1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications
2. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals, 2nd edition Prentice Hall India

BACK

Program: Bachelor of Engineering		Semester - I
Course Title: Design Thinking for Social Innovation		Course Code: 20EHSP101
L-T-P: 0-1-1	Credits: 2	Contact Hrs: 4hrs/week
ESA Marks: 80	ISA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 56 hrs	Exam Duration: 3 hrs

Module		Topics	Assignments	Support activities / Tools
KNOWLEDGE, TOOLS & DEVELOPMENT	Course sensitization	1. Introduction to Social Innovation: • Awakening social consciousness **(www.yourstory.com)** • Social Innovation and Leadership • Engineering& Social innovation (EPICS) **(Connecting SI Course to Mini Project, Capstone Project, Campus Placements)** • Course Overview • **Students' Self Introduction Activity** • Group formation **Activity**	**Reading assignments** • Read the handout on "The Process of Social Innovation" by Geoff Mulgan • Design thinking for Social Innovation **Written Assignments** • **Writing about Akshaya Patra in class. (Background information about Akshaya patra and the Social Cuase it is addressing)** • **Brainstorming Session on Social Innovators in Class**	• Class activity on Behavioral Blocks to Innovation **Discussion on the behavioural blocks.** • **Introducing oneself with three Adjectives- Appreciating diversity and discovering self** • **Group Formation Activity (Forming square) (Making four equilateral triangles out of popsicle sticks to enhance group cohesiveness amongst the group mates)**
	Create Mindsets	**Seven Mindsets:** 1. Empathy **(Example of The Boy and the Puppies)** 2. Optimism	**Reading assignments** • Handout on " Create Mindsets"	• **(How to train the Dragon? Common Video for all the mindsets)** • **Watching in Class TED Talk on "How**

		(Person Paralyzed waist down / Glass Halh full Half Empty) 3. Iteration **(Thomas Alva Edison)** 4. Creative Confidence **(Origamy – Josef Albers)** 5. Making it 6. Embracing Ambiguity **(Confusion is the Welcome doormat at the door of Creativity)** 7. Learning from Failure **(Designing Website first and then asking the stakeholders about the website)** **(Spending one lakh for the business which is never launched)**		**to build youir Creative Confidence by David Kelley – IDEO Founder)**
	Process of Social Innovation	**Engage** Community study and Issue Identification	**<u>Reading assignments</u>** • Handout on Community Study and Issue Identification • Case Study on "EGramSeva" • Case Study on "Janani Agri Serve" **<u>Class Presentations</u>** • Initial observations being made by the group **(Literature Survey of Places of Hubli-Dharwad)** **www.readwhere.com**	• Activity on Observation skills To know how to use one's observation skills in understanding the social conditions • Experience sharing by senior students • Brainstorming Deliberations on the initial observations and arrive at the "Social Issue" • Familiarization of the respective

			• Detailed interaction / engagements with the society and finalize the social issue for intervention **Use template 1: Frame your Design Challenge**	templates with the help of sample case study
		PEER REVIEW		
		2. Inspiration • Plan for the Research • Development of Interview guide • Capture your Learnings	**<u>Reading assignments</u>** • Handout on Overview of Inspiration **<u>Class Presentations</u>** • Entirety of the Social Issue • Identification of the Stake Holders **(Examples on Fluoroscent Curtain and Students' Punctuality for Class)** • Interview Questions **(Role Play on Interview with Stakeholders)** • Category wise Learnings capture **Use template 2: Plan your Research** **Template 3. Development of Interview Guide** **Template 4. Capture your Learning**	• Familiarization of the respective templates with the help of sample case study
		3. Ideation **3.1 Synthesis** • Search for meaning	**<u>Reading assignments</u>** • Handout on Overview of Ideation-Synthesis	• Familiarization of the respective templates with

		• Create "How might we" question	**Class Presentations** • Create insights • "How might we" questions **Use template 5: Create Insights** **Template 6: Create "How Might We' Questions**	the help of sample case study
		3.0 Ideation **3.2 Prototyping** • Generate Ideas • Select Promising Ideas • Determine what to prototype • Make your prototype • Test and get feedback	**Reading assignments** • Handout on Overview of Ideation-Prototyping **Class Presentations** • Story board-demonstrating the possible solutions **Use template 7: Select your best ideas** **Template 8 : Determine what to prototype**	• Brain storming • Familiarization of the respective templates with the help of sample case study • Activity on Risk management • Activity on Resource management Structure building games
		PEER REVIEW		
		4.0 Implementation • Create an action plan • Community Partners (if any) • Budgeting & Fundraising 1. **Peer to Peer** 2. **Crowd Funding** 3. **Giving Kiosks** 4. **Donation** 5. **Envelop Funding** 6. **Marathons/ Walkathons**	**Reading assignments** • Handout on Overview of Implementation **Class Presentations** • Pilot implementation plan with required resources and Budget indicating stake holders & their engagement	• Familiarization of the respective templates with the help of sample case study

		7. Conducting Yoga Classes **(www.causevox.com / www.blog.fundly.com)** • Duration • Ethical concerns • Launch your solution • Feedback (Impact**)**		
		5.0 Reflect Reflection of the overall learning by the students	**<u>Reading assignments</u>** • Handout on Overview of students Reflection **Use template 9: Reflection on the Process** **<u>Class Presentations</u>** Final Presentation- After Implementation	• Familiarization of the respective templates with the help of sample case study

BACK

Program: Bachelor of Engineering		Semester - I
Course Title: Applied Physics Lab		Course Code: 21EPHP101
L-T-P: 0-0-1	Credits : 1	Contact Hrs.: 02 Hrs/Week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 28hrs	Exam Duration: 3 Hrs.

Experiments	
1.	Four probe method
2.	V-I characteristics of p-n junction diode
3.	Zener diode characteristics
4.	Hysteresis loss
5.	Transistor characteristics
6.	Measurement of dielectric constant
7.	Resonance frequency of LCR circuits
8.	Study of frequency response of passive components
9.	Calibration of thermocouple
10.	Calibration of electrical meters

BACK

II Semester

Program: Bachelor of Engineering			**Semester - II**
Course Title: Multivariable calculus			**Course Code: 18EMAB102**
L-T-P: 4-1-0	**Credits: 05**		**Contact Hours: 6hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**Total Marks: 100**
Teaching Hours: 50	**Tutorial/Practical: 28hrs**		**Exam Duration: 3hrs**
Unit-I			
1	**Partial differentiation:** Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers.		**12 hrs**
2	**Double integrals:** Double integrals- Rectangular and polar coordinates, Change the order of integration. Change of variables, Jacobian. Application of double integrals **Matlab:** optimization problems, application of double integrals		**08 hrs**
Unit-II			
3	**Triple integrals**: Triple integrals, Cartesian, change to Cylindrical and Spherical coordinates Application of Triple integrals		**07 hrs**
4	**Calculus of Vector Fields:** Vector fields, Gradient and directional derivatives. Line and Surface integrals. Independence of path and potential functions. Green's theorem, Divergence of vector field, Divergence theorem, Curl of vector field. Stokes theorem. **Matlab:** application of Triple integrals, Vector calculus problems		**13 hrs**
Unit III			
5	**Differential equations of higher orders:** (a) Linear differential equations of second and higher order with constant coefficients The method of Variation of parameters. Initial and boundary value problems. (b) Applications of second order differential equations-Newton's 2^{nd} law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations. **Matlab:** application of differential equations		**(5+5) hrs**
Text Books : 1. Early Transcendental Calculus- James Stewart, Thomson Books, 7ed 2010			
Reference Books: 1. Hughues- Hallett Gleason, Calculus Single and Multivariable, 4ed, Wiley India, 2009. 2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010			

BACK

Program: Bachelor of Engineering		Semester - II
Course Title: Engineering Chemistry		Course Code: 22ECHB102
L-T-P: 3-0-0	Credits: 03	Contact Hours: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Tutorial/Practical: --	Exam Duration: 3hrs

	Unit-I	
1	**Chemical Bonding:** Introduction, Ionic bond, factors influencing the formation of Ionic bond: Ionization energy. Electron affinity & electro negativity and properties of Ionic compounds. Covalent bond: Valence Bond theory & Molecular Orbital theory – formation of hydrogen molecule, factors influencing the formation of covalent bond, polar and non-polar covalent bond, dipole moment, problems on calculation of percentage of Ionic character and properties of covalent compounds, Co-ordinate bond: formation of hydronium ion and ammonium ion.	**04 hrs**
2	**Electrochemical Energy Systems:** Electrode potential, Nernst equation, formation of a cell; Reference electrodes – Calomel electrode, Determination of electrode potential, numerical problems on E, E_{cell} & E^0_{cell}. Batteries: Classification, Characteristics, Lead - acid, Lithium ion battery. Fuel cells - Methonol-O_2 fuel cell.	**06 hrs**
3	**Polymers:** Introduction, polymerization; mechanism of polymerization taking ethylene as an example. Determination of molecular weight of a polymer – numerical problems. Commercial polymers - Plexi glass, PS, polyurethane. Polymer composites: Carbon fiber and Epoxy resin – synthesis, properties and applications. Introduction to conducting polymers, mechanism of conduction in poly acetylene and applications.	**06 hrs**
	Unit-II	
4	**Plating Techniques:** Introduction, technological importance. Electroplating, Principles of electroplating. Factors affecting nature of electrodeposit, throwing power, Numerical problems on throwing power, Electroplating process of gold by acid cyanide bath. Electro less plating, advantages of electro less plating over electroplating. Electro less plating of Cu and its application in the manufacture of PCB.	**04 hrs**
5	**Wafer Technology:** Introduction, physical and chemical properties of silicon. Purification of silicon; chemical vapor deposition (CVD) process, zone refining process. Crystal growth; preparation of single crystal silicon by Czhochralski crystal pulling technique – numerical problems. Crystal slicing and wafer preparation.	**09 hrs**

	Fabrication process: thermal oxidation, diffusion, ion implantation – numerical problems, epitaxial growth, masking and photolithography, wet etching, dry etching.	
6	**Material Chemistry:** Liquid Crystals – Types of liquid crystals, applications of Liquid Crystal in Display system. Fluorescence and Phosphorescence – Jablonski diagram, Thermoelectric and Piezoelectric materials – meaning, properties and applications	**03 hrs**
	Unit-III	
7	**Instrumental methods of measurement:** Advantages over conventional methods. Electro analytical methods: Potentiometer - principle, methodology and applications. Optoanalytical methods: Colorimeter - Principle, methodology and applications. Spectral methods of analysis : UV – Spectrophotometer - Instrumentation and applications	**04 hrs**
8	**Environmental Chemistry:** Water: Sources and ill effects of water pollutants – fluoride and nitrate; determination of total hardness of water by EDTA method – numerical problems. , Sewage: Determination of Biological Oxygen Demand by Winkler's method – numerical problems and determination of Chemical Oxygen Demand – numerical problems.	**04 hrs**

Text Books :

1. A text Book of Engineering Chemistry, 1st edition, Dara. S. S, S. Chand & Co. Ltd., 2009, New Delhi.
2. A text Book of Engineering Chemistry, 16th edition, Jain P.C and Jain M, Dhanpat Rai Publications, 2006, New Delhi

Reference Books:

1. Text book of Inorganic Chemistry, P.L.Soni, Sultan Chand, 1999, New Delhi.
2. Hand book of batteries, David Linden, Thomas B Reddy, 3rd edition Mc Graw Hill publications, 2001, New York.
3. Polymer Science, 6th Edition, Gowariker V.R., Viswanathan N.V., Sreedhar J., New Age International (P) Ltd, 2007, New Delhi.
4. Solid State Devices& Technology, 4thEdition, V.Suresh Babu, sanguine Technical Publishers, 2005, Bangalore.
5. Material Science & Engineering: An Introduction, 9th Edition, Calister William D, John Wiley and sons, 2007, New York.
6. Instrumental methods of Chemical nalysis, 5th Edition, Gurudeep R Chatwal, Shan K Anand, Himalaya Publishing House Pvt. Ltd, 2010, Mumbai.
7. VLSI Technology, 2nd Edition, S.M.Sze, McGraw Hill Series in electrical and computer engineering, 1998, New York.

BACK

Program: Bachelor of Engineering		Semester - II
Course Title: Problem Solving with Data Structures		Course Code: 18ECSP102
L-T-P: 0-0-3	Credits: 3	Contact: 6 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs : --	Tutorial/Practical: 84hrs	Exam Duration: 3 Hrs

1	**Pointers, Structures and Files** Recap of basics: Pointers ,Structures; Self-referential structures, dynamic memory management Files – File manipulation programs	**12 hrs**
2	**Stacks and Recursion** Stack: Definition, Operations, Stack ADT Implementation of stack operations. Applications of stack. Recursion- Need for Recursion and problems on Recursion.	**16 hrs**
3	**Queues** Queue: Definitions of Linear, Circular queues, Queue ADT Linear and circular queue operations Definition and working of Priority queue, Double ended queue; Applications of queues.	**16 hrs**
4	**Lists** Concept of lists and dynamic memory management lists, definitions and representations: singly, doubly, circular lists. Dynamic Implementation of lists and its operations, Applications of linked lists	**18 hrs**
5	**Binary trees** Binary Tree: Definition, Terminology and representation, Tree Traversals both recursive and iterative. Binary Search Tree and its applications.	**16 hrs**

Text Books

1. Data Structures with C -- Seymour Lipschutz, Schaum's Outline Series
2. Data Structures Using C and C++ -- Langsam and Tanenbaum, PHI Publication
3. Data Structures Through C -- Yashavant P Kanetkar, BPB Publication

Reference Books:

1. Data Structures, Algorithms and Applications In C++ -- Satraj Sahani
2. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk

BACK

Program: Bachelor of Engineering		Semester - II
Course Title: Engineering Exploration		Course Code: 22ECRP101
L-T-P: 0-0-3	Credits: 3	Contact Hrs.: 6hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 84hrs	ESA Exam Duration: 3 hrs

No	Content	Sessions
1	Introduction to Engineering and Engineering Study	1
2	Role of Analysis in Engineering, Analysis Methodology	2
3	Data Analysis Graphing	2
4	Basics of Engineering Design, Multidisciplinary Nature of Engineering Design	5
5	Project Management	1
6	Sustainability in Engineering	2
7	Ethics	1
8	Modeling, Simulation and Data Acquisition using Software Tool	1
9	Platform based development : Arduino	3
9	Course Project	3

Reference Books:

1. Engineering Fundamentals & Problem Solving by Arvid Eide, Roland Jenison, Larry Northup, Steven, Mc GrawHill Higher Education, 6th Edition (2011)
2. Engineering Exploration (Edited Book, 2008) by Pearson Publication

Evaluation Scheme

Chapter No	Name	Weightage in percentage
1	Introduction to Engineering and Engineering Study	-
2	Role of Analysis in Engineering	10
3	Analysis Methodology	
4	Data Analysis Graphing	10
5	Basics of Engineering Design	20
	Multidisciplinary Nature of Engineering Design	
6	Project Management	5
7	Sustainability in Engineering	10
8	Ethics	5
9	Modelling, Simulation and Data Acquisition using Software Tool	-
10	Platform Based Development: Arduino	-
10	Course Project	40

BACK

Program: Bachelor of Engineering		**Semester - II**
Course Title: Basic Electronics		**Course Code: 18EECF101**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 50	**Tutorial/Practical: --**	**Exam Duration: 3 Hrs.**

	Unit-I	
1	**Trends in Electronic Industries:** Introduction, Roadmap of electronic sector, scope and opportunities in various segments of electronics (i.e., Consumer, Telecom, IT, Defense, Industrial, Medical and Automobiles), Government and private sectors, Growth profile of Electronic industries, Standards and PoliISAs, Electronic System Components.	**03 hrs**
2	**Basic Components, Devices and Applications:** Diode: PN junction characteristics; modeling as a circuit element, ideal and practical diode. AC to DC converter: Half wave and full wave rectifier (centre tap and bridge), capacitor filter and its analysis, numerical examples. Zener diode and its applications (Voltage reference and voltage regulator). Realization of simple logic gates like AND and OR gates.	**10 hrs**
3	**Transistor:** BJT, transistor voltages and currents, Signal amplifier (Fixed bias, Collector base bias, Voltage divider bias, CE configuration). DC load line. Voltage, current and power gains. Transistor as a switch: NOT Gate, Basic (DTL) NAND gate. Transistor as a Small Signal Amplifier (Single Stage and Two Stage RC-coupled Amplifier).	**07 hrs**
	Unit-II	
4	**Digital Logic:** Number systems: Decimal, Binary, Octal and Hexadecimal number systems, Conversions, Binary Operations-Addition and subtraction in binary number systems. Logic gates: Realization of simple logic functions using basic gates (AND, OR, NOT), Realization using universal gates (NAND, NOR). Boolean algebra: Theorems and postulates, DeMorgan's Theorems, simplification of logical expressions, Karnaugh Maps, Use of Karnaugh Maps to Minimize Boolean Expressions (2 Variables, 3 Variables and 4 Variables), Design of Half Adder and Full Adder, Parallel Adder using full adders.	**14 hrs**
5	**Operational Amplifier:** OPAMP characteristics (ideal and practical), Linear and non-linear applications: Inverting amplifier, Non inverting amplifier, Voltage follower, Integration, Differentiation, Adder, Subtractor, ZCD and Comparator.	**06 hrs**
	Unit-III	
6	**Communication Systems:** Basic block diagram of communication system, types of modulation. Amplitude modulation: Time-Domain	**07 hrs**

	description, Frequency-Domain description. Generation of AM wave: square law modulator. Detection of AM waves: envelope detector. Double side band suppressed carrier modulation (DSBSC), Generation of DSBSC wave : balanced modulator, Super heterodyne principle.	
7	**Linear Power Supply, UPS & CRO:** Working principle of linear power supply, UPS and CRO. Measurement of amplitude, frequency and phase of a given signal.	**03 hrs**

Text Book:

1. David A Bell, Electronic devices and Circuits, PHI New Delhi, 2004
2. K.A Krishnamurthy and M.R.Raghuveer, Electrical, Electronics and Computer Engineering for SISAntist and Engineers, 2, New Age International Publishers, 2001
3. A.P. Malvino, Electronic Principles, Tata McGraw Hill, 1999

References:

1. George Kennedy, Electronic Communication Systems, Tata McGraw Hill, 2000
2. Morris Mano, Digital logic and Computer design , 21st Indian print Prentice Hall India, 2000
3. Floyd, Digital fundamentals, 3, Prentice Hall India, 2001
4. BoylesteadNashelsky, Electronic devices & Circuit theory, Prentice Hall India, 2000
5. RamakantGaikawad , Operational Amplifiers & applications, PHI, 2000

BACK

Program: Bachelor of Engineering			Semester - II	
Course Title: Basic Mechanical Engineering			Course code: 22EMEF101	
L-T-P: 2-1-0	Credits: 3		Contact Hrs: 4hrs/week	
ISA Marks: 50	ESA Marks: 50		Total Marks: 100	
Teaching Hrs: 30	Tutorial/Practical: 28hrs		Exam Duration: 3 hrs	
Chapter	**Contents**	**Hours**	**Tutorial**	**Sessions**
	UNIT I			
1	**Introduction to Mechanical Engineering:** Definition of engineering, Mechanical Engineering, Branches of Mechanical Engineering, Who are Mechanical Engineers?, Mechanical Engineers' top ten achievements.	**2**	Visit to Workshop and Machine Shop, Tools, Safety Precautions Video presentations	**1**
2	**Manufacturing Engineering: Basics of Manufacturing** What is manufacturing?, The main manufacturing sectors, The importance of the main manufacturing sectors to the Indian economy, Scales of production Classification of manufacturing Processes. Advances in Manufacturing: CNC machines, Mechatronics and applications	**8**	Demonstration on working of Lathe, milling, drilling, grinding machines Demonstration on Welding (Electric Arc Welding, Gas Welding, Soldering) Demonstration and Exercises on Sheet metal work. Visit to Learning Factory	**5**
	UNIT II			
3	**Design Engineering: Power Transmission Elements** Overview Design Application: • Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems.	**6**	Design Problems like a moving experience, aluminium can crusher Video presentations	**5**

	• Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems. • Ball and Roller Bearings, Types, Applications.			
4	**Thermal Engineering 1: Prime Movers.** Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Future trends in IC engines.	**4**	Case study on power requirement of a bike, car or any machine Video presentations	**1**
	UNIT III			
5	**Thermal Engineering 2: Thermal Systems' Applications** Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors, Turbines, and their working principle and specifications.	**5**	Case study on selection of various thermal systems Video presentations	**1**

Text Books:

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, 2013- Cengage Learning.4
2. K.R. Gopalkrishna, Sudhir Gopalkrishna, S.C. Sharma. A Text Book of Elements of Mechanical Engineering, 30th Edition, Oct 2010,–Subhash Publishers, Bangalore.

Reference Books:

1. Course Material developed by the Department of Mechanical Engineering.
2. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology - Vol I & II, 11th edition 2001, Media Promoters and Publishers.
3. Basic Manufacturing, Roger Timings, Third edition, Newnes, An imprint of Elsevier

BACK

Program: Bachelor of Engineering		Semester - II
Course Title: Professional Communication		Course Code: 15EHSH101
L-T-P: 1-1-0	Credits: 2	Contact Hrs.: 3hrs/week
ESA Marks: 50	ISA Marks: 50	Total Marks: 100
Teaching Hrs: 20	Tutorial/Practical: 28hrs	Exam Duration: 3 hrs

	Content	Hrs
1	**Basics- English Communication:** Course Introduction, Explanation of template mix-ups with correct usages & necessity of grammar in error detection, Usage of tenses	9 hrs
2	**Vocabulary and grammar:** Vocabulary, Word Formation and Active and Passive Voice	6 hrs
3	**Bouncing Practice:** Definition and types of bouncing and its practice with examples, reading skills, free style speech. Individual presentation.	6 hrs
4	**Rephrasing and Structures:** Comprehension and Rephrasing, PNQ Paradigm and Structural practice	8 hrs
5	**Dialogues:** Introduction of dialogues, Situational Role plays,	3 hrs
6	**Business Communication:** Covering letter, formal letters, Construction of paragraphs on any given general topic.	9 hrs

References:

1. Collins Cobuild Advanced Learner's English Dictionary
2. Raymond Murphy - Intermediate English Grammar, Cambridge University Press
3. Martin Hewings- Advanced English Grammar, Cambridge University Press.

BACK

Semester – III

Program: Bachelor of Engineering		**Semester - III**
Course Title: Linear Algebra		**Course Code: 24EMAB208**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: 28hrs**	**Exam Duration: 3 hrs**

	Unit – I	
1	**Matrices and Gaussian Elimination:** Introduction, The Geometry of Linear Equations, An Example of Gaussian Elimination, Matrix Notation and Matrix Multiplication, Triangular Factors and Row Exchanges, Inverses and Transposes, Special Matrices and Applications.	**08 hrs**
2	**Vector Spaces and Subspace:** Solving Ax= 0, and Ax= b, Linear Independence, Basis, and Dimension, The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations.	**08 hrs**
	Unit – II	
3	**Orthogonality:** Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections, and Least Squares.	**08 hrs**
4	**Eigenvalues and Eigenvectors:** Introduction to Determinants, Properties of the Determinant, Formulas for the Determinant, Applications of Determinants. Introduction, Diagonalization of a Matrix, Difference Equations and Powers Ak, Differential Equations and e^{At}, Similarity Transformations.	**08 hrs**
	Unit – III	
5	**Positive Definite Matrices** Positive Definite Matrices, Minima, Maxima, and Saddle Points, Tests for Positive Definiteness, Singular Value Decomposition	**08 hrs**

Text Books:

1. Linear Algebra and its Applications, Gilbert Strang , 4 Edition, Cengage India Private Limited 2005.
2. Linear Algebra and Its Applications, David C. Lay, 5th Edition - Pearson -2023.

Reference Books:

1. Boyd, Stephen, and Lieven Vandenberghe. "Introduction to applied linear algebra: vectors, matrices, and least squares", Cambridge university press, 2018.
2. Linear algebra for computer science "Essential Mathematics for Computer Scientists" M. THULASIDAS, Singapore Management University, 2021.

Evaluation Scheme ISA

Assessment	Conducted for Marks	ISA Weightage
ISA1	30	38
ISA2	30	
Lab	40	25
Total	**100**	**63**

Evaluation Scheme ESA

Assessment	Conducted for Marks	ISA Weightage
ESA Theory Exam	100	37

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Discrete Mathematical Structures		Course Code:24ECAC201
L-T-P: 3-1-0	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 28hrs	Exam Duration: 3hrs

	Unit –I	
1	**Logic and Proofs:** Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers: Nested Quantifiers, Rules of Inference, Introduction to Proofs.	**8 hrs**
2	**Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized Permutations and Combinations, Generating Permutations and Combinations	**8 hrs**
	Unit –II	
3	**Recurrence Relations:** Applications of Recurrence Relations, Formulating Recurrence relations, Solving Linear and nonlinear Recurrence Relations, Generating Functions: recurrence relation, Inclusion–Exclusion, Applications of Inclusion–Exclusion	**8 hrs**
4	**Number Theory**: Divisibility and Modular Arithmetic, Primes and Greatest Common Divisors: Primes, Trial Division, The Sieve of Eratosthenes, Testing for primality, the Euclidean Algorithm and gcds as Linear Combinations; Solving Congruences : Linear Congruences Chinese Remainder Theorem ; Applications of Congruences : Hashing Functions, Pseudorandom Numbers and Check Digits.	**8 hrs**
	Unit –III	
5	**Groups:** Binary Operations, Semi groups, Monoid, Group, Abelian group cyclic groups, rings and Products & Quotients of Semi Groups.	**4 hrs**
6	**Finite fields:** Fields, Finite fields of the form GF(p), Polynomial Arithmetic and Finite fields of the form GF(2n)	**4 hrs**

Text Books

1. Kenneth H. Rosen, Kamala Krithivasan, Discrete Mathematics and its Applications, 8th Edition, Tata Mc-GrawHill Publication, July 30, 2021.
2. Kolman, Busby and Ross, Discrete Mathematical Structures, 6th Edition., Pearson Publication Mar 8, 2023.

Reference Books:

1. Grimaldi R.P. and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, 5th Edition, Pearson Publication, May 8, 2019.
2. Basavaraj S Anami and Venakanna S Madalli, Discrete Mathematics – A Concept based approach, Universities Press, 2016

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any 2
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any 2
III	Q.No.-7	5	Solve Any 1
	Q.No.-8	6	

Tutorial Plan

Sl. No	Topic	Number of slots
1.	Logic and Proofs	3
2.	Functions and Relations	2
3.	Counting	2
4.	Recurrence Relations	2
5.	Groups	2
6.	Number theory	1
7.	Programming : With C	2

Assessment Rubrics for Activities

Sl No	Activity	Marks	PI	CO	BL
1	Assignment on Discrete Structures (Group activity, Programming: C) Evaluations: 1. Proofs and Logic 2. Counting 3. Recurrence Relations 4. Programming 5. Groups	20	2.3.1	05	L3

Note:

- Activities are based on discrete structures and programming assignment.
- Each evaluation will carry 10 marks. Best 04 evaluations will be considered.

Rubrics for Activity			
Parameter	**Outstanding (8-10 Marks)**	**Effective (5-7 Marks)**	**Adequate (1-4 Marks)**
Understanding the problem	Specified clearly all assumptions, variables, entities and discrete structures	Specified clearly most of the assumptions, variables, entities and discrete structures	Specified few assumptions, variables, entities and discrete structures
Logic/ Model Design	Establish relationship between possible inputs, outputs and outcomes	Establish relationship between most of the inputs, outputs and not specified outcomes	Establish relationship between few inputs, outputs and not specified outcomes
Problem solving/Implementation	• Apply discrete mathematical operations / implement all functions to solve the problem. • Provide solution/ output for all legitimate inputs	• Apply discrete mathematical operations / implement most of the functions to solve the problem. • Provide solution/ output for most of the legitimate inputs	• Apply discrete mathematical operations / implement few functions to solve the problem. • Provide solution/ output for few of the legitimate inputs

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Computer Organization and Architecture		CourseCode:24ECAC202
L-T-P:3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 28hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Computer Fundamentals:** Basic Concepts and Computer Evolution: Organization and Architecture, Structure and Function, A Brief History of Computers, The Evolution of the Intel x86 Architecture, Embedded Systems Performance Issues: Two Laws that Provide Insight: Ahmdahl's Law and Little's Law, Basic Measures of Computer Performance, Calculating the Mean, Benchmarks and Spec. A Top-Level View of Computer Function and Interconnection: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect	**04 hrs**
2	**Computer System:** Memory: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Semiconductor Main Memory, DDR DRAM Input/Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access	**06 hrs**
3	**The Central Processing Unit:** Instruction Sets: Characteristics and Functions: Machine Instruction Characteristics, Types of Operands, Types of Operations Instruction Sets: Addressing Modes and Formats: Addressing Modes, Instruction Formats, Assembly Language	**06 hrs**
	Unit –II	
4	**The Processor:** Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining Instruction-Level Parallelism and Superscalar Processors: Overview, Design Issues, Intel Core Microarchitecture	**08 hrs**
5	**Parallel Organization:** Parallel Processing: Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors Multicore Computers: Hardware Performance Issues, Software Performance Issues, Multicore Organization, Heterogeneous Multicore Organization.	**08 hrs**

Unit –III		
6	**General-Purpose Graphic Processing Units:** Cuda Basics, GPU versus CPU, GPU Architecture Overview	**04 hrs**
7	**Control Unit Operation:** Micro-Operations , Control of the Processor , Case studies and Projects	**04 hrs**

Text Books:

1. William Stallings, Computer Organization and Architecture Designing for Performance, 10th Ed, Pearson Education, 2016.

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach 5th Edition, Elsevier publication, 2017.
2. Kai Hwang, Advanced Computer Architecture Parallelism Scalability Programmability, Tata McGraw Hill 2008

Laboratory Plan

Sl. No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Logisim Tool Demo	01
2.	Combinational Circuits (Half Adder, Full Adder, Decoder, Multiplexer)	01
3.	Building ALU	01
4.	Building ALU(contd..)	01
5.	1-bit RAM Cell and building bigger RAM	01
6.	1-bit RAM Cell and building bigger RAM(contd..)	02
7.	Design and simulation of main memory organization	01
8.	Design and simulation of main memory organization(contd..)	01
9.	Design and simulation of register organization	02
10.	Design and simulation of datapath for processor design.	01
11.	Design and simulation of datapath for processor design (contd..)	01
12.	Comparative study of contemporary processors	01

Evaluation Scheme ISA

Assessment	Conducted for Marks	ISA Weightage
ISA1	30	38
ISA2	30	
Lab	40	25
Total	**100**	**63**

Evaluation Scheme ESA

Assessment	Conducted for Marks	ISA Weightage
ESA Theory Exam	100	37

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Design and Analysis of Algorithms		Course Code: 24ECAC203
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50	Tutorial/Practical: --	Exam Duration: 3 hrs

Clusters		
1	**Foundations:** Design Philosophy and Intuitions, Space and Time Complexities, Order of an Algorithm, Problem patterns: Recursion, Iteration, Backtracking	06 hrs
2	**Computing Principles and Tools:** Pruning, Edge Relaxation, Sets, Traversals, Prefix and Suffix, Union-Find, Hashing and Other Principles	04 hrs
3	**Structured Data Management:** Graphs and Trees, Binary Search Trees, Tries, AVL Trees, 2-3 Trees, Red-Black Trees, DFS, BFS, Heap, Array Query, Spare Table, Segment Trees, Fenwick Trees, Skip Lists	15 hrs
4	**Sorting and Searching:** Sorting and Searching Devices	06 hrs
5	**Graph Algorithms:** Shortest Path and Spanning Trees	15 hrs
6	**Problem Assortments:** Problem types, Undecidability, Limitations of Algorithm Power	04 hrs

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Fourth Edition, The MIT Press, 2022.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India; 3rd edition, 2007.
2. Antti Laaksonen, Competitive Programmers Handbook, 2018
3. Bjarne Stroustrup, C++ Programming Language, Addison-Wesley Educational Publishers Inc; 4th edition.

Scheme for End Semester Assessment (ESA)

Clusters	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	6	

Program: Bachelor of Engineering		Semester - III
Course Title: Database Management System		Course Code: 22ECAC204
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50	Tutorial/Practical: --	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction and ER Model:** Introduction to DBMS; Data Models, Schemas and Instances; Three-Schema Architecture; Database Languages; Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets. Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues.	**06 hrs**
2	**Relational Data Model and Relational Algebra:** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Binary Relational Operations: CARTESIAN PRODUCT, JOIN: Additional Relational Operations; Relational Database Design Using ER- to-Relational Mapping.	**08 hrs**
3	**SQL:** SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN operations; Complex SQL Queries, PL/SQL.	**08 hrs**
	Unit –II	
4	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	**09 hrs**
5	**Introduction to Transaction Processing:** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializibilty.	**09 hrs**

Unit –III		
6	**Concurrency Control Techniques:** Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering.	**05 hrs**
7	**Database Security:** Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks	**05 hrs**

Text Books:

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 6th Ed, Pearson Education, 2011.
2. Shashank Tiwari , Professional NOSQL, 1st Ed,Wrox, 2011.

References:

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd Ed, McGraw Hill, 2007.
2. Silberschatz A., Korth H.F. and Sudharshan S., Database System Concepts, 5th Ed, Mc- GrawHill, 2006.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	7	

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Database Applications Lab		Course Code: 22ECAP201
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks:20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 42hrs	Exam Duration: 3 hrs

List of experiments/jobs planned to meet the requirements of the course.

4- Demonstration	• Introduction to RDBMS/Case study/ basic SQL commands. • Set theory, logical operators and aggregate functions. • Group by, Having clause, Views and index • Basics of PL/SQL.
5-Exercises	• SQL queries on set theory, logical operators and join operations. • SQL queries queries on aggregate functions, group by and having clause. • SQL queries on Views and nested query operations. • PL/SQL queries using triggers and cursors. • PL/SQL queries using procedures and functions.
3-Structured Enquiry	• Database Design
1-Open Ended Experiment	• Database design & implementation

Text Book:

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 7th edition, Pearson Education, 2012.
2. Steven Feuerstein, Bill Pribyl Oracle PL/SQL Programming, 6th Edition , O'Reilly Media,2014.

References:

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd edition, McGraw Hill, 2007.
2. PL/SQL User's Guide and Reference 10g Release 1 (10.1) December 2003.

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

Internal Semester Assessment (80%)	**Assessment**	**Weightage in Marks**
	Exercises	50
	Structured Enquiry	20
	Open Ended Experiment	10
End Semester Assessment (20%)	ESA	**20**
	Total	**100**

BACK

Program: **Bachelor of Engineering**		**Semester - III**
Course Title: Algorithms Lab		**Course Code: 24ECAP202**
L-T-P: 0-0-2	**Credits: 2**	**Contact Hrs: 4 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical: 56hrs**	**Exam Duration: 03**

Sl. No.	Experiment	No. of Slots
1	Objected Oriented Programming Using C++ Basics	2
2	Introduction and Efficiency Analysis	1
3	Trees	1
4	Structured Data Management	1
5	Searching and Sorting	1
6	Graph Algorithms	2
7	Project Work	6

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Fourth Edition, The MIT Press, 2022.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India; 3rd edition, 2007.
2. Antti Laaksonen, Competitive Programmers Handbook, 2018
3. Bjarne Stroustrup, C++ Programming Language, Addison-Wesley Educational Publishers Inc; 4th edition.

Evaluation Scheme

Sl. No.	Experiment	Marks
1	Exercise	20
2	Structured Inquiry	30
2	Project Work (ISA – 30, ESA - 20)	50
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Corporate Communications (AUDIT)		Course Code: 24EHSA201
L-T-P: 0-0-0	Credits: 0	Contact Hrs: 1 hr/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 16	Tutorial/Practical: --	Exam Duration: NA

Unit –I		
1	**Communication Skills:** Tools of Communication, Listening, Body Language, Common Postures and Gestures, Open and Closed Body Language, Body Language to be used in Corporate Scenarios, Voice: Pitch, Pace, and Pause, Verbal Language: Positive & Negative Vocabulary, Corporate Conversations	**4 hrs**
2	**Presentation Skills:** Zero Presentation, Individual Presentations, and feedback, Making Presentations Interactive, Types of Questions, Taking off and Signing off differently, Captivating your Audience, Corporate Presentations	**4 hrs**
3	**Spoken English:** Phonetic and Non-Phonetic Languages, Introduction to IPA, Sounds in English, Syllables, Word Stress, Rhythm, Pausing, and Intonation	**4 hrs**
4	**Written English:**Vocabulary Enhancement Strategies, Root Words in English, Grammar Improvement Techniques, Dictionary Usage, Similar and Contradictory Words	**4 hrs**

Text Books:

NA

Reference Books:

1. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers
2. Norman Lewis – Word Power Made Easy, Goyal Publishers
3. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.

BACK

Semester - IV

Program: Bachelor of Engineering			**Semester - IV**
Course Title: Probability & Statistics			**Course Code: 24EMAB209**
L-T-P: 3-1-0	**Credits: 4**		**Contact Hrs: 5 hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**Total Marks: 100**
Teaching Hrs:50 hrs	**Tutorial/Practical: --**		**Exam Duration: 3 hrs**
Unit –I			
1	**Description of data:** Introduction: Data, Type of Variables, mean, weighted mean, median, mode, Quartiles, Variance, Coefficient of variation, skewness, Histogram, Box plots, Normal Quantile-Quantile plots		**10 hrs**
2	**Probability:** Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Bayes' rule. Bayesian Classification.		**06 hrs**
3	Lab: Introduction to Data handling and Data visualization (Histogram, Skewness, Boxplot, QQ-norm, Measures of central tendency and dispersion)		**08 hrs**
Unit –II			
4	**Random variables and Probability Distribution:** Random variables, simple Examples, Discrete and continuous random variables; Theoretical distributions: Binomial, Poisson, Normal Introduction to bivariate distribution, joint probability distribution, marginal distribution, and covariance.		**07 hrs**
5	**Statistical Inference I:** Introduction: Sampling, SRSWR, SRSWOR, Cluster Sampling, Stratified Sampling, Basic terminologies of testing hypothesis, Confidence interval, Sample size determination, Hypothesis test for proportions, means (single and differences), using P-value approach		**09 hrs**
	Lab: Probability distribution, Testing of Hypothesis for proportions, means(single and differences)		**08 hrs**
Unit –III			
6	**Correlation and Regression:** Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression, Logistic Regression.		**04 hrs**
7	**Statistical Inference II:** Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure (Goodness of fit)		**04 hrs**
	Lab: Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach		**04 hrs**

Text Books

1. Douglas C Montgomery, George C Runger, Applied Statistics for Engineers, 5th Edition, John Wiley and Sons
2. Probability and Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye, 9th edition, Prentice Hall
3. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Ed, TATA McGraw-Hill Edition 2007.

Reference Books:

1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2005
2. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 1ed, Sultan Chand & Sons, New Delhi, 2000.
3. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Microcontroller Programming and Interfacing		Course Code: 24ECAC206
L-T-P : 1-0-2	Credits: 3	Tutorial/Practical: 5 hrs/week
ISA Marks: 66	ESA Marks: 34	Total Marks: 100
Teaching Hrs: 14	Tutorial/Practical: 56hrs	Exam Duration: --

Unit –I		
1	**Introduction to Microcontroller:** Microcontrollers and General Purpose Microprocessors, choosing a microcontroller, Introduction to AVR Microcontroller and Arduino Family. Simplified View of an AVR Microcontroller, Internal Architecture Introduction to AVR Assembly Programming, Instruction Types and Instruction Set of AVR.	**4 hrs**
2	**I/O AVR Time Delay:** I/O Port Pins and their functions, Role of DDR/DDRx Registers in Input and output operations, Programming for I/O Ports, I/O Bit Manipulations, Delay Calculation of AVR,Timers/Counters, C Data Types.	**5 hrs**
3	**AVR Interrupt Programming:** AVR Interrupts, Interrupts vs Polling, Interrupt Service Routine, Steps in executing an interrupt, Sources of Interrupts, Interrupt Priority, Concept of Context Saving in task switching, Enabling and Disabling Interrupts, Programming Timer Interrupts.	**5hrs**

Text Books:

1. Mazidi, Muhammad Ali, Sepehr Naimi, and Sarmad Naimi. *The AVR microcontroller and embedded systems: using Assembly and C*. 2nd Ed., 2017.

Reference Books:

1. Hughes, John M. Arduino: a technical reference: a handbook for technicians, engineers, and makers. " O'Reilly Media, Inc.", 2016

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	ISA Weightage
Lab Assessment -1 Assembly	10	33
Lab Assessment -2 Embedded C	20	
Course project	40	
ISA	30	33
Total	**100**	**66**

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End-Semester Assessment Scheme

Assessment	Conducted for marks	ESA Weightage
Course Project	40	34
Total	40	**34**

Lab Plan

S.No	Chapter and Topics	Activity	Lab slots
1	Chapter 1: Introduction to AVR assembly programming	Demonstration of Microchip AVR studio	1
2	AVR assembly programming	ALP on Data transfer Instructions	1
3	AVR assembly programming	ALP on Logical Instructions	1
4	AVR assembly programming	ALP on branch instructions	1
5	**Assessment-1 Assembly Programming**	**Assessment on ALP programming**	**1**
6	Chapter 2: AVR Embedded C programming for timers/counters **Course Project Problem Discussion**	Embedded C programming for timers	1
7	AVR Embedded C programming for timers/counters	Embedded C programming for counters	1
8	Interfacing Atmega32 with peripherals.	Interfacing LCD/KEYPAD/motors	1
10	**Assessment 2 Interfacing with microcontroller**		**1**
11	Course Project Review 2- Design		1
12	Course Project Intermediate demo	Assessment on Embedded C programming and Interfacing	1
13	Course Project	Implementation	1
14	**Review on Course Project**	Model demonstration by each team	1

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Object Oriented Programming		Course Code: 24ECAC207
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: --	Exam Duration: 3hrs

	Unit –I	
1	**Object Oriented Programming (OOP) Concepts and JAVA Language Fundamentals**: Introduction to OOP, Object Oriented Paradigm, Applications of OOP. Features of JAVA, JVM, JDK, Source File Structure. Programming constructs and String Handling. Class Diagrams-UML notations. Types of relations between classes.	**4 hrs**
2	**Classes and Objects:** Class Fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, this key word, Garbage collection: The finalize method. A closer Look at Methods and Classes: Overloading: Methods, Constructors. Using objects as Parameters, Returning objects, Access control. Understanding static and final keywords. Introducing nested and inner classes.	**6 hrs**
3	**Inheritance and Polymorphism: Inheritance:** Basics, Usage of super key word, Method overriding, Dynamic method dispatch, Abstract classes, Object class.	**6 hrs**
	Unit –II	
4	**Packages, Interfaces &Exception handling:** Packages and Interfaces**:** Packages, Access protection, Importing packages. Interfaces. Exception Handling: Fundamentals, Exception Types, Using try, catch, throw, throws and finally, Multiple catch, Nested try statements, user defined exceptions.	**6 hrs**
5	**Collections Framework**: Introduction, List Interface, List Implementation Classes, Set Interface, Set Implementation Classes, The Map Interface, Map Implementation Classes.	**4 hrs**
6	**Lambda Expressions & Streams API:** Functional programming, Functional interface, Bulk operations on collections. Basics of Streams, Reduction operations, Iterators and Streams	**6 hrs**
	Unit –III	
7	**Spring Boot:** Overview, key features, architecture, setting-up a Spring Boot, RESTful API, spring data JPA, CRUD Operations.	**4 hrs**
8	**Design Patterns:** Creational, Structural and Behavioral design patterns.	**4 hrs**

Textbooks
1. Herbert Schildt, "The Complete Reference", 9th Edition, McGraw-Hill.
Reference Books
1. Kathy Sierra and Bert Bates, Head First JAVA, 2, O'Reilly Media. 2. Introduction to Java Programming, Liang Y D, Pearson, 7th Edition.

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA-1	20
ISA-2	20
Activity (Design)	10
Total	50

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2& 3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	45&6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Operating System Principles and Programming		Course Code: 24ECAC208
L-T-P: 4-0-1	Credits: 5	Contact Hrs: 6 hrs/week
ISA Marks: 60	ESA Marks: 40	Total Marks: 100
Teaching Hrs: 50	Tutorial/Practical: 28hrs	Exam Duration: 3 Hrs

	Unit –I	
1	**Fundamentals of Process:** Operating System Functions and Characteristics, Process Concept, Process Control and Operations, System Call, Inter Process Communication.	**07 hrs**
2	**CPU Scheduling:** Basic Concepts, Schedulers, Scheduling Criteria, Scheduling Algorithms, Multithreading models and Thread API, Thread library.	**07 hrs**
3	**Process Synchronization:** Synchronization, Producer Consumer problem, The critical section problem, Semaphores, Classical problems of synchronization.	**06 hrs**
	Unit –II	
4	**Deadlocks:** Deadlock System Model and Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	**06 hrs**
5	**File Management:** UNIX File Types, File systems and File Attributes, I-nodes in UNIX, UNIX Kernel Support for Files, Directory Files, Hard and symbolic filenames, General File APIs. File and Record Locking.	**07 hrs**
6	**Memory Management:** Memory management strategies, Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.	**07 hrs**
	Unit –III	
7	**Virtual Memory Management:** Virtual Memory Management, Background, Demand paging, Page replacement.	**05 hrs**
8	**Case study:** Windows 10, Design Principles, System Components Influential Operating Systems: Macintosh Operating System and IBM OS/360	**05 hrs**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 10 ed., Wiley-India, 2018.
2. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in the UNIX Environment”, 3 ed. Addison Wesley Professional, 2013

Reference Books:

1. William Stallings, "Operating System Internals and Design Principles", 1 ed., Pearson Education, Asia, 2015
2. Gary Nutt," Operating System", 3 ed., Pearson Education,2009
3. Terrence Chan, "Unix System Programming Using C++", 1 ed., Prentice Hall India, 2014
4. Marc J. Rochkind, "Advanced Unix Programming", 2 ed., Pearson Education, 2005.

List of Experiments

Expt./Job No.	Experiment/job Details	No. of Labs. Session/s per batch
1.	Demonstrate the usage of process management API's viz fork, vfork, exec, exit.	1
2.	Demonstrate Inter Process Communication (IPC) using PIPE / FIFO.	1
3.	Implementation Critical Section Problem using Semaphore.	1
	REVIEW -1	
4.	Demonstrate file related system calls OPENDIR, READDIR, and CLOSEDIR.	1
5.	Implement cp commands of an operating system.	1
6.	Demonstrate file locking using 'fcntl' system call.	1
	REVIEW -2	
	Practice Programs	
7.	Implement FCFS/SJF scheduling algorithms	1
8.	Implement the conversion of a virtual address to a physical address.	1
9.	Implement paging algorithms	1

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage	Weightage in Marks
ISA-1 (Theory)	40	80%	40
ISA-2 (Theory)	40		
Flipped Classroom	20		
Laboratory Assessment-1	40	20%	10
Laboratory Assessment-2	40		
		Total	**50**

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End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	100	50
	Total	**50**

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2**
III	Q.No.-7	7	Solve Any **1**
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Principles of Compiler Design		Course Code:22ECAC209
L-T-P:3-1-0	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 28hrs	Exam Duration: 03 hrs

	Unit –I	
1	**Introduction to compilers:** Brief History Of Compilers, Translation Process, Major Data Structures In Compilers, Chomsky Hierarchy, Lexical Analysis: Scanning Process, Regular Expressions For Tokens, Lexical Errors, Applications Of Regular Expressions.	**06 hrs**
2	**Finite Automata:** Introduction: Language, Automata, From Regular Expressions To Deterministic Finite Automata (DFA): Є-Nondeterministic Finite Automata (Є-NFA), NFA, DFA, DFA Optimization, Finite Automata As Recognizer, Implementation Of Finite Automata	**06 hrs**
3	**Introduction to Syntax Analysis:** Introduction To Grammars, Context-Free Grammars (CFGs), Ambiguity In Grammars And Languages, Role Of Parsing.	**04 hrs**
	Unit –II	
4	**Top Down Parsing:** Introduction, Left Recursion, Left Factoring, LL (1) Parsing, FIRST And FOLLOW Sets, Error Recovery In Top Down Parsing.	**08 hrs**
5	**Bottom up Parsing:** Introduction, SLR (1) Parsing, General LR (1) And LALR (1) Parsing, Error Recovery In Bottom Up Parsing.	**08 hrs**
	Unit –III	
6	**Semantic Analysis:** Attributes And Attributes Grammars, Algorithm For Attribute Computation, Symbol Table, Data Types And Data Checking.	**04 hrs**
7	**Intermediate Code Generation:** Intermediate Code And Data Structure For Code Generation, Code Generation Of Data Structure References, Code Generation Of Control Statements.	**04 hrs**

Text Book:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson, 2011.
2. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997.

References:

1. Andrew W Apple, Modern Compiler Implementation in C, Cambridge University Press, 1999.
2. Charles N. Fischer, Richard J. leBlanc, Jr, Crafting a Compiler with C, Pearson, 2011.

3. Peter Linz, An Introduction to formal languages and Automata, IV edition, Narosa, 2016.
4. Basavaraj S Anami, Karibasappa K.G, Formal Languages and Automata Theory, First, Wiley India, 2011.

Tutorial tentative plan

Expt/Job No	Brief description of experiments	No of slots 1 slot = 2hrs
1	Regular expressions.	01
2	NFA, DFA and DFA optimization.	02
3	Regular and Context free grammars.	01
4	Implementation of lexical analyser using LEX tool.	02
5	Implementation of syntax analyser using YACC tool.	02
6	Top down parsing	01
7	Bottom up parsing	01
8	Implementation of parsing algorithms using C language	02

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2 ,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4 ,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	7	

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Exploratory Data Analysis		Course Code: 24ECAC210
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Tutorial/Practical: 56hrs	Exam Duration: 2 Hrs

	Unit –I	
1	**Data Description and Preprocessing:** Ecosystem for data science, Types of data, statistical descriptions of data, data visualization. Data cleaning, data integration, data reduction, data transformation.	**10 hrs**
2	**Supervised Learning: Regression:** Basic Concepts, Regression: Linear and Logistic, Evaluation metrics: R2score, MSE, RMSE, MAE	**5 hrs**
	Unit –II	
3	**Supervised Learning: Classification:** Naive Bayes, K-Nearest Neighbors (KNN), Model evaluation and selection: Accuracy, Precision, Recall, Sensitivity, Specificity, F-Score, Techniques to improve classification Accuracy-Ensemble methods: Bagging, Boosting, AdaBoost.	**8 hrs**
4	**Clustering:** Partitioning-based: K-Means, K-Medoids, Hierarchical clustering: Agglomerative, Density-based clustering:DBSCAN.	**7 hrs**

Reference Books:

1. Wes McKinney, Python for Data Analysis, 3rd Edition, O'Reilly Media, 2022 (Early Release).
2. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data, Packet Publishing Limited, 27 March 2020.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012.

Scheme of Evaluation

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	25
ISA-2 (Theory)	30	
Lab assessments	75	25
	Total	**50**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	25
Lab	25	25
	Total	**50**

Lab Schedule

S.No	Chapter and Topics	Activity	Lab slots
1	Revisit of Python basics, Numerical and vectorized computing data manipulation Watch: Home Assignment From Couch to Jupyter: A Beginner's Guide to Data Science Tools & Concepts | WiDS Worldwide	Demonstration on python basics. Demonstration on scientific libraries	1
2	Chapter 1: Data Preprocessing	Demonstration on Data Description: - Count, Pie plot, Histogram, Scatter, plot, line plot, Box plot	1
3	Chapter 1:Data Preprocessing	Data Pre-Processing: • Filling missing values(binning) • min_max & z score normalization, • linear regression, feature selection	1
4	Assessment 1	Assessment on Data description and Data Preprocessing	1
5	**Course Project/WiDSDatathon Review – 01**	Demonstration and presentation of course project	1
6	Chapter 3: Supervised Learning: Regression	• Demonstration and Practice ofbuilding Regression models • Model's evaluation using metrics	1
7	Chapter 4: Supervised Learning: Classification Watch: Home Assignment https://youtu.be/J2iqDVpbpeo	Demonstration and Practice on Classification modelsModel's evaluation using metrics	1
8	Course Project /WiDSDatathon Review – 02	Demonstration and presentation of course project	1
9	Assessment 2	Assessment on Classification/Regression	1
10	Chapter 4: Clustering	Practice on Clustering Algorithms (K means, DBSCAN)	1
11	Assessment 3	Assessment on Clustering	1
12	Course Project /WiDSDatathon Review – 03	Demonstration of complete working project	1
13	Review of portfolio/term paper		1
14	Submission of portfolio and term paper		1

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Object Oriented Programming Lab		Course Code: 24ECAP206
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 42hrs	Exam Duration: 3hrs

Experiments Number	Lab assignments/experiment	No. of Slots
1	Demonstration: Introduction to Eclipse/Any other tool IDE (Integrated Development Environment), java programming basics.	5
2	Exercise: Classes and objects, Inheritance, Polymorphism, Exceptions Handling and Collection framework/lambda expressions	4
3	Structured Enquiry: Classes and objects, Inheritance, Polymorphism, Exceptions Handling, Lambda expressions	2
4	Open Ended: Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns	3

Text Book:

1. Herbert JAVA The Complete Reference, Herbert Schildt, 10th Ed, 2017, McGraw-Hill.

Reference Books:

1. Kathy Sierra and Bert Bates, Head First Java: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media.
2. Introduction to Java Programming, Liang Y D, Pearson, 11th Edition.

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

	Assessment	Weightage in Marks
Internal Semester Assessment (80%)	Exercises	40
	Structured Enquiry	20
	Open Ended Experiment	20
End Semester Assessment (20%)	Structured Enquiry	**20**
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Problem Solving and Analysis (AUDIT)		Course Code: 24EHSA202
L-T-P: 0-0-0	Credits: 0	Contact Hrs: 1hr/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 16	Tutorial/Practical: --	Exam Duration: NA

Unit –I

1	**Analytical Thinking:** Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars	4 hrs
2	**Mathematical Thinking:** Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation	4 hrs
3	**Verbal Ability:** Problem Solving using Analogies, Sentence Completion	4 hrs
4	**Discussions & Debates:** Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion	4 hrs

Text Books: NA

Reference Books:

1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Diana Booher - Communicate With Confidence, Mc Graw Hill Publishers
6. Norman Lewis – Word Power Made Easy, Goyal Publishers
7. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
8. Kaplan’s GRE guide

BACK

Semester – V

Semester – V

Program: Bachelor of Engineering		**Semester - V**
Course Title: Software Engineering		**Course Code: 22ECAC301**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 3hrs**

	Unit - I	
1	**Software Engineering process:** Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities and Coping with change.	**05 hrs**
2	**Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management.	**05 hrs**
3	**Requirement Engineering:** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirements elicitation and analysis; Requirements validation; Requirements management, Source Control Management, Collaboration tools.	**06 hrs**
	Unit - II	
4	**System Modeling:** Context models, Interaction Models, Structural models, Behavioral models. Design Tools.	**05 hrs**
5	**Architectural Design:** Architectural Design Decision, Architectural views, Architectural patterns, Application Architectures.	**05 hrs**
6	**Software Testing:** Development Testing, Test Driven Development, Release Testing, User Testing and Testing Tools.	**06 hrs**
	Unit - III	
7	**Introduction to DevOps:** DevOps Principles, Benefits of working in a DevOps environment, Lifecycle, stages, Delivery pipeline, Technical challenges and DevOps Tools	**04 hrs**
8	**Continuous integration and continuous delivery (CI/CD):** Essentials of continuous integration, Jenkins architecture, Jenkins security management, Jekins master-slave architecture, Jenkins delivery pipeline and authentication.	**04 hrs**

Evaluation Scheme (ISA)

Assessment	Conducted for Marks	Weightage in Marks
ISA1	40	20
ISA2	40	20
Activity	10	10
	Total	**50**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
Theory	100	50
	Total	**50**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Computer Networks		Course Code: 24ECAC302
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 45	Tutorial/Practical: --	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction and Application layer:** Introduction to Internet; The Network Edge and Core; Delay, Loss, and Throughput in Packet-Switched Networks; Protocol Layer and Service Models: OSI and TCP/IP; Principles of Network Applications; The Web and HTTP; Electronic Mail in the Internet – SMTP, POP, and IMAP; The Internet's Directory Service – DNS; Dynamically configuring a host – DHCP; Peer-to-peer applications	**9 Hrs**
2	**Transport-Layer Services:** Introduction and Transport Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Pipelined protocols, stop and wait, go-back-N and selective repeat protocols; Connection-Oriented Transport: TCP; Principles of Congestion Control; TCP Congestion Control.	**9 Hrs**
	Unit –II	
3	**Network Layer: Data plane:** Introduction to Data and Control Plane of Network Layer; Virtual Circuit and Datagram Networks; The Internet Protocol: Datagram format, Fragmentation, IPv4 addressing, NAT, ICMP, and IPv6. **Network Layer: Control plane** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP. Broadcast and Multicast Routing, Broadcast Routing Algorithms.	**12 Hrs**
4	**Data Link Layer:** Introduction to the Link Layer, Error-Detection and -Correction Techniques: Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) binary and polynomial, Hamming Code	**7 hrs**
	Unit –III	
5	**Data Link Layer: Channel access protocols:** Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols: Aloha, Slotted Aloha, CSMA, CSMA/CD, CSMA/CA, Taking-Turns Protocols, The Link-Layer Protocol for Cable Internet Access.	**4 hrs**
6	**Switched Local Area Networks:** Link-Layer Addressing and ARP, Ethernet 802.3, Token ring 802.5, FDDI and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANs), Multiprotocol Label Switching (MPLS)	**4 hrs**

Text Books

1. J. F. Kurose, K. W. Ross, "Computer Networking, A Top-Down Approach", 8th Edition, Pearson Education, 2021.

Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking with TCPIP Protocol Suite", 6thEdition , McGraw Hill, 2021
2. Larry Peterson, Bruce Davie "Computer networks: a systems approach", 6th Edition, 2021.

Evaluation Scheme (ISA)

Assessment	Conducted for Marks	Weightage in Marks
ISA1 (Theory)	40	20
ISA2	40	20
Activity	10	10
	Total	**50**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
Theory	100	50
	Total	**50**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Machine Learning		Course Code: 22ECAC303
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Tutorial/Practical: --	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction to machine learning:** Introduction to Machine Learning, Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset formats, Features and observations.	**8hrs**
2	**Supervised Learning: Linear Regression, Logistic Regression:** Linear Regression: Single and Multiple variables, Sum of squares error function, The Gradient descent algorithm, Application, Logistic Regression, The cost function, Classification using logistic regression, one-vs.-all classification using logistic regression, Regularization.	**8 hrs**
	Unit –II	
3	**Supervised Learning: Neural Network:** Introduction to perceptron learning, Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, and Application- classifying digits. Support vector machines.	**8 hrs**
4	**Unsupervised Learning : Dimensionality reduction and Learning Theory:** Expectation Maximization (EM), Factor Analysis, The dimensionality reduction, PCA : PCA for compression, Incremental PCA, Randomized PCA, Kernel PCA , ICA (Independent Component Analysis). Bias/variance tradeoff, Union and Chernoff Hoeffding bounds VC dimension.	**8 hrs**
	Unit –III	
5	**Reinforcement Learning:** Reinforcement Learning: Introduction, Applications, and Model of the environment, Policy search	**4 hrs**
6	**Learning to optimize rewards and value functions Evaluating actions:** The credit assignment problem, Policy gradients, Markov decision processes, Q-learning	**4 hrs**

Text Books (List of books as mentioned in the approved syllabus)

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Christopher Bishop., Pattern Recognition and Machine Learning, Springer, 2006.

References

1. Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelian Gerona, Publisher: O'Reilly Media, July 2016.
2. Advanced Machine Learning with Python Paperback, 28 Jul 2016 by John Hearty..

Evaluation Scheme (ISA)

Assessment	Conducted for Marks	Weightage in Marks
ISA1 (Theory)	40	20
ISA2	40	20
Activity	10	10
	Total	**50**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
Theory	100	50
	Total	**50**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Internet of Things		Course Code: 24ECAC308
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 30	Tutorial/Practical:	Exam Duration: 2 hrs

	Unit –I	
1	**Introduction** IoT overview, characteristics, protocols, functional blocks, communication models, APIs, levels; enabling technologies: sensors, Zigbee, Bluetooth, Z-Wave, IEEE protocols, LPWAN, 5G networks, IoT ecosystem.	08 hrs
2	Network protocols Routing Protocol for Low-Power and Lossy Networks (RPL), cognitive RPL (CORPL), Channel-Aware Routing Protocol (CARP), Low power Wireless Personal Area Networks (LoWPAN), IPV6, 6LoWPAN, Route-Over & Mesh-Under techniques.	04 hrs
3	Application and Security protocols Message Queue Telemetry Transport (MQTT), MQTT for Sensor Networks, Secure MQTT, Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), OPC UA, 6LoWPAN), Routing Protocol for Low-Power and Lossy Networks (RPL), TLS/DTLS.	03 hrs
	Unit –II	
4	Design Methodology and IoT Platforms IoT system design, methodology, and case studies; device building blocks; platforms and operating systems; communicating with Wi-Fi, BLE, LoRAWAN, 5G; intelligent IoT with on-device AI deployment and inference.	05 hrs
5	Edge Computing for IoT: Introduction, Architectures, Technologies, and Applications in IoT, Edge Hardware and Software, Mobile Edge Computing. Edge Intelligence, Edge cloud and networking.	04 hrs
6	IoT prototyping Business models, example applications: Case studies on Home automation, Smart Cities, Environment, Energy, Agriculture, Health, Retail with emphasis on data analytics and security, Industrial IoT (IIoT), Role of AI/ML in IoT (AIoT).	06 hrs

Text Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols" John Wiley & Sons – 2012.
2. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A Hands-on-Approach)" Universities Press- 2014
3. Drew Van Duren, Brian Russell "Practical Internet of Things Security" Second Edition, Packt Publishing – November 2018.

References

1. Subhas Chandra Mukhopadhyay "Internet of Things Challenges and Opportunities" Springer- 2014.
2. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", Wiley - 2009.

Lab Plan

Exp No.	Brief description about the experiment	Number of slots
1	Study the fundamental of IoT software's and components. Familiarization with Arduino/Raspberry Pi and perform necessary software	1
2	Exercise on basic electronics and motor control fundamentals such as 1) LED Blink Application, Relay Using Bulb 2) 12V DC Motor Using L298 Motor Driver 3) Servo Motor	1
3	Exercise on usage of different types of sensors (IR Sensor, Passive Infrared Sensor (PIR Sensor), Ultrasonic Sensor, DHT 11 (Temperature and Humidity Sensor), Pulse Rate Sensor, Soil moisture sensor)	1
4	Connecting wireless communication module (e.g., Wi-Fi, Bluetooth)	1
5	**Assessment -1** Utilizing a range of sensors in conjunction with a microcontroller such as Arduino or Raspberry Pi, develop a compact IoT application designed to gather data from these sensors and wirelessly transmit it utilizing a low-power communication protocol.	1
6	**Review – 1** • Problem Identification • Software and Hardware components • Schematic diagram	1
7	Establishing MQTT Communication in IoT / Implementing AMQP Messaging in IoT / Application Protocol (CoAP) /Web Socket Building MQTT Dashboard, Publish and Subscribe using MQTT, AMQP	1

8	**Review – 2** Methodology • Block diagram • Mobile app to remote control the things / database storage and analysis.	**2**
9	Integrating Artificial Intelligence (AI) and Machine Learning (ML) techniques with Internet of Things (IoT) systems	**2**
10	**Review – 3** Final demonstration and report submission • Integrating AI/ML technique with IoT application	**3**

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Machine Learning Lab		Course Code: 22ECAP303
L-T-P:0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 45hrs	Exam Duration: 3hrs

Experiment No.	Brief description about the experiment	Number of slots
1.	Introduction to TensorFlow Sample programs with TensorFlow	1
2.	Linear Regression Nonlinear Regression Logistic Regression Activation Functions	2
3.	Training a multi-layer perceptron using API's	1
4.	Training a neural network – construction, execution and use of neural network.	1
5.	Training Neural Networks - a sequence classifier and to predict time series.	1
6.	Classification of Human Facial Expressions using Neural Networks	1
7.	Principal Component Analysis on • simple matrix • on iris dataset	1
8.	Course Project: Students in a group of four shall implement machine learning solution to a real-world problem using ML frameworks in any of the areas listed below: • Natural Language Processing • Deep Reinforcement Learning • Image processing • Audio processing • Pattern recognition • Data visualization and analysis	4
9.	Course Project Review	2

Reference Books:

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Christopher Bishop., Pattern Recognition and Machine Learning, Springer, 2006.
3. Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelian Gerona, Publisher: O'Reilly Media, July 2016.
4. Advanced Machine Learning with Python Paperback, 28 Jul 2016 by John Hearty.

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

	Assessment	Weightage in Marks
In Semester Assessment (80%)	Exercise (Problem execution, Viva, Observation Book, etc.)	15+15+10 = **40**
	Structured Enquiry	**20**
	Course Project	**20**
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Web Technologies Lab		Course Code: 24ECAP304
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: -	Tutorial/Practical: 60hrs	Exam Duration: 3 hrs

1	**Introduction to HTML basics, JavaScript:** Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics, Bootstrap
2	**RESTful API using NodeJS and Express:** Introduction to Node.js .Building servers using the http and net modules, Node modules and events, Express, REST API client, Postman, Accessing Data, Data Security using Bcrypt. API security using JWT tokens.
3	**React:** Introduction to ReactJS, Setting up the development environment, ReactJS Ecosystem, Fundamental Concepts: JSX, Components, State and Lifecycle Handling events, Conditional Rendering. Advanced ReactJS Concepts: Hooks, Context API, Routing, Error Boundaries, Form handling, State Management Libraries, Fetching data from API's.

Reference Books:

1. Robert W. Sebesta."Programming the World Wide Web", Pearson Publications 8th Edition, 2014.
2. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
3. Robin Wieruch ,The Road to React: Your journey to master plain yet pragmatic React.js, 2024.

Lab Plan

Expt./ Job No.	Lab assignments/experiment	No. of Lab. Slots per batch (estimate)
1	Demonstration on HTML, JavaScript, CSS	03
2	Exercise on HTML, JavaScript, CSS JavaScript	01
3	Demonstration on type script	01
4	Demonstration on Node	02
5	Exercise on Node JS with type script	01
6	Structured enquiry on Node JS	01
7	Demonstration on React	03
8	Exercise on React	01
9	Open ended Experiment	02

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

	Assessment	Weightage in Marks
In Semester Assessment (80%)	Exercise (Problem execution, Viva, Observation Book, etc.)	15+15+10 = **40**
	Structured Enquiry	**20**
	Course Project	**20**
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Computer Networks Lab		Course Code: 22ECAP302
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs:	Tutorial/Practical: 45hrs	Exam Duration: 3hrs

Tentative plan of lab Implementation

Week No	Lab Assignments
1	Demonstration of n/w commands and tools in command prompt.
2	Demonstration of Cisco Packet Tracer network tool: usage of hub, switch, and a router using a simple topology
3	Application layer protocol implementation – Manual configuration and DHCP
4, 5	Application layer protocol implementation - DNS and HTTP
6	Demonstration of socket programming using a simple message board application - Connection oriented and connectionless.
7, 8	Develop a quiz application using UDP sockets
9	Implementation of HTTP server using TCP sockets.
10	Performance Analysis of TCP vs UDP
11,12,13, 14,15	Design and analyze networks using simulation tools and operating systems with AI-driven optimization

Text Books

1. J. F. Kurose, K. W. Ross, "Computer Networking, A Top-Down Approach", 8th Edition, Pearson Education, 2021.

Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking with TCPIP Protocol Suite", 6th Edition, McGraw Hill, 2021
2. Larry Peterson, Bruce Davie "Computer networks: a systems approach", 6th Edition, 2021.

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

In Semester Assessment (80%)	**Assessment**	**Weightage in Marks**
	Exercise (Problem execution, Viva, Observation Book, etc.)	15+15+10 = **40**
	Structured Enquiry	**20**
	Open ended	**20**
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Mini Project		Course Code: 22ECAW301
L-T-P: 0-0-3	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 45hrs	Exam Duration: 3 Hrs

Student Evaluation Matrix

Sl. No	Continuous Internal Evaluation	Assessment	Weightage in Marks
1	Review 1 :	Problem identification & Defining a problem statement, test plan and Construction of software system	15
2.	Review 2 :	Software Requirement Specification (SRS)	10
3.	Review 3 :	Software Design	05
4.	Review 4 :	Construction (as per design) & testing	10
5.	Review 5 & peer review:	Final Demo & exhibition Peer review will be done after review 1 & review 4)	10
		Total	**50**

Scheme for End Semester Assessment (ESA)

ESA Evaluation (50 Marks)

Sl No	Description	Marks
1	Write up – Learning from Project, Personal Contribution to project	05
2	Final demo & Presentation(Solution approach to the identified problem, testing and results)	35
4	Individual Contribution to the team	10
	Total	50

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Arithmetical Thinking and Analytical Reasoning (AUDIT)		Course Code: 23EHSA303
L-T-P: 0-0-0	Credits: 0	Contact Hrs: 1 hr/week
ISA Marks: 100	ESA Marks: 00	Total Marks: 100
Teaching Hrs: 16 hrs		Exam Duration: NA

Unit – I

1	**Analytical Thinking:** Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, Puzzles for practice: Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving	**4 hrs**
2	**Mathematical Thinking I:** Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations	**4 hrs**
3	**Mathematical Thinking II:** Distribution Problems: Permutations Combinations	**2 hrs**
4	**Verbal Ability:** Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests	**6 hrs**

Text Book: NA

References:

1. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House,1989
2. Shakuntala Devi , “Puzzles to Puzzle You”, Orient Paper Backs, New Delhi, 1976
3. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, Sultan Chand and Sons, New Delhi, 2018
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
6. Kaplan’s GRE guide

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
Minor Exam 1	50
Minor Exam 2	50
Total	**100**

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Course Unitization for Minor Exams and End Semester Assessment

Sl No	Chapter	Teaching Hours	No. of Questions in ESA
1	Analytical Thinking	4	N.A.
2	Mathematical Thinking I	4	N.A.
3	Mathematical Thinking II	4	N.A.
4	Verbal Ability	4	N.A.

Note* All questions are compulsory.

BACK

Semester - VI

Program: Bachelor of Engineering			**Semester - VI**
Course Title: Deep Learning			**Course Code: 24ECAC305**
L-T-P: 3-0-1	**Credits: 4**		**Contact Hrs: 5hrs/week**
CIA Marks: 63	**ESA Marks: 37**		**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: 28hrs**		**Exam Duration: 3 hrs**
Unit-I			
1	**Introduction to Deep Learning:** Shallow neural networks and deep neural networks, Convolution neural networks (CNN), Types of layers in convolution neural networks, CNN Example, Activation functions, Pooling Layers, Padding.		**8 hrs**
2	**Classic Networks & Optimization Algorithms:** Classic Network: Lenet-5, AlexNet, VGG-16, ResNet , Inception Net, MobileNet. Transfer Learning, Depthwise Vs Pointwise Convolution. Optimization algorithms, gradient descent with momentum, RMSprop, ADAM.		**8 hrs**
Unit-II			
3	**Deep Learning for Computer Vision:** Computer vision problems, Deep learning on large Images, Edge detection, vertical and horizontal edge detection, convolution over volumes, object detection and localization, YOLO algorithm, RCNN, CNN for semantic segmentation, UNet.		**8 hrs**
4	**Recurrent Neural Networks:** Examples of sequence data, Basics of RNN, Backpropagation through time, Vanishing gradient with RNN, Gated Recurrent Unit (GRU), Long Short-Term Memory Unit (LSTM), Bidirectional RNN and LSTM.		**8 hrs**
Unit-III			
5	**Improving Deep Neural Networks: Hyper parameter tuning, Regularization and Normalization:** Data preprocessing, Augmentation, Dropout Regularization, Hyper-parameter Tuning, Need for Normalization, Batch Normalization and Programming Frameworks		**8 hrs**

Text book:

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science ,edition 3
2. Deep Learning with Python, Second Edition,
3. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition, Sebastian Raschka, Vahid Mirjalili.

Reference book:

1. Christopher Bishop., Pattern Recognition and Machine Learning, Springer, 2006
2. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Concepts, Tools, and Techniques to Build Intelligent Systems ,By AurélienGéron , Publisher: O'Reilly Media, July 2016
3. Advanced Machine Learning with Python Paperback, 28 Jul 2016 by John Hearty.

Exp No.	Brief description about the experiment	Number of slots	Marks	BL	PI Code
1.	Introduction to Neural networks training techniques.	02	(Demo) NIL	L3	2.3.1
2.	Design the DNN model using transfer learning technique.	02	10	L4	2.3.1
3.	Implementation of Optimization algorithms: Gradient descent with momentum, RMSprop, ADAM	02	(Demo) NIL	L4	2.3.1
4.	Implementation of Object detection and Localization: YOLO	02	10	L4	2.3.1
5.	Implementation of Semantic Segmentation: UNet Architecture	02	10	L4	2.3.1
6.	Implementation of Recurrent Neural Networks: RNN & LSTM	02	10	L4	2.3.1
7.	Experiments on Hyper parameter tuning: Data Preprocessing, Augmentation	02	(Demo) NIL	L4	2.4.2
8.	More Experiments on Hyper parameter tuning: Batch Normalization, Dropout Regularization	02		L4	2.4.2

Evaluation Scheme ISA

Assessment	Conducted for Marks	ISA Weightage
ISA1	30	38
ISA2	30	
Lab	40	25
Total	**100**	**63**

Evaluation Scheme ESA

Assessment	Conducted for Marks	ISA Weightage
ESA Theory Exam	100	37

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Embedded Intelligent Systems		Course code: 24ECAC306
L-T-P: 1-0-2	Credits: 3	Contact Hrs: 5hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 14	Tutorial/Practical: 56hrs	Exam Duration: 2 hrs

1	**Basics of embedded systems:** Linux Application Programming, System V IPC, Linux Kernel Internals and Architecture, Kernel Core, Linux Device Driver Programming, Interrupts & Timers, Sample shell script, application program, driver source build and execute.	**3 hrs**
2	**Heterogeneous computing:** Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b. GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx), Basic OpenCL examples - Coding, compilation and execution	**3 hrs**
3	**ML Frameworks lab with the target device:** Caffe, TensorFlow, TF Lite machine learning frameworks & architecture, Model parsing, feature support and flexibility, supported layers, advantages and disadvantages with each of these frameworks, Android NN architecture overview, Full stack compilation and execution on embedded device	**3 hrs**
4	**Model Development and Optimization:** Significance of on device AI, Quantization, pruning, weight sharing, Distillation, Various pre-trained networks and design considerations to choose a particular pre-trained model, Federated Learning, Flexible Inferencing	**3 hrs**
5	**Android Anatomy:** Android Architecture, Linux Kernel, Binder, HAL Native Libraries, Android Runtime, Dalvik Application framework, Applications, IPC	**2 hrs**

Text Books

1. Linux System Programming, by Robert Love, Copyright © 2007 O'Reilly Media
2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster, Publisher: Morgan Kaufmann

Reference Books:

1. Deep Learning, MIT Press book ,Goodfellow, Bengio, and Courville's
2. Beginning Android , by Wei-Meng Lee , Publisher: Wrox , O'Reilly Media

Sl. No.	Experiments	Number of slots
1.	Linux Application Programming.	2
2.	Basic OpenCL examples, High level language to assembly language translation, optimization and power management.	2
3.	Deep Learning Frameworks and optimization techniques.	2
4.	Implementation of basic and DNN architecture for Android framework, Push ML/DL model on Android device and run application.	3
5.	Course project	5

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Natural language processing and Gen AI		Course Code: 24ECAC307
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 06 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30 hrs	Tutorial/Practical: 56hrs	Exam Duration: 2 hrs

	Unit –I	
1	**Introduction to NLP:** Introduction to Natural Language Processing, Applications of Natural Language Processing, Word embeddings. Parsing techniques - Dependency Grammar, Neural dependency parsing.	**04 hrs**
2	**Machine Translation, Auto encoders and decoders:** Machine Translation, Seq2Seq and Attention, Autoencoder and decoders.	**06 hrs**
3	**Generative Adversarial Networks:** Generative vs. Discriminative models, Generative Adversarial Networks and Language Models, types of GANs.	**05 hrs**
	Unit –II	
4	**Transformer Networks & Diffusion models:** Transformer Networks, transformers for text generation, Diffusion models – continuous vs discrete, deterministic vs stochastic models.	**07 hrs**
5	**Large Language Models:** Introductions to LLM's, LLM - BERT and GPT models**,** prompting techniques, Adapters and low rank adoption (LoRA).	**08 hrs**

Text Book

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing, 2022.
2. "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster.
3. "Hands-On Generative Adversarial Networks with Keras: Create Beguiling Image Generation Projects to Extend Your Generative AI Skills" by Rafael Valle.

References:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft).
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning. MIT Press.

Natural Language Processing and GenAI Lab Plan:
List of Experiments:

Experiment No.	Brief description about the experiment	Number of slots
10.	Experiments on Text Classification- word2vec, Language Modeling, Machine Translation, Text Summarization	2
11.	Experiments on Machine Translation - seq2seq model, Text Summarization	2
12.	Experiments on Part-of-Speech (POS) Tagging, Question Answering Systems, Topic Modeling	2
13.	• Implementing a Basic Diffusion Model • Training a Diffusion Model • Image Denoising Using Diffusion Models	2
14.	Data pre-processing and Tokenization, Building a Simple Language Model	1
15.	Implementing Attention Mechanisms, Exploring Transformer Architectures	1
16.	• Fine-Tuning for Specific Tasks • Ethical Considerations and Bias Detection • Real-World Application Development • Performance Optimization and Scaling	4

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	ISA -I	30	25
2.	ISA – II	30	
3.	Lab Evaluation	20	10
4.	Course Project	30	15
	Total		**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	Theory Exam (ESA)	60	25
2.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Minor Project		Course Code: 24ECAW304
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 90hrs	Exam Duration: 3 hrs

The objective of the minor project is to develop deeper understanding of the chosen area of technology vertical and develop applications with a comprehensive and systematic approach.

Project Domains:

Networking	Data Engineering	System Engineering	AI & ML	Industry/Domain
Internet of Things	Data Analytics	Parallel Computing	Supervised Learning	As per industry requirements
Software Defined Network	Data Processing (Image/Video/Audio/Text)	High Performance Computing	Unsupervised Learning	-
Cloud Computing	Natural language processing	Quantum Computing	Deep Learning	-
Block Chains	Computer Vision	-	Generative Models	-
Wireless Ad-hoc & Sensor Networks	-	-	-	-
Any other related themes				

Student Evaluation Matrix:

Project will have 3 internal reviews as follows:

Assessment Weightage in Marks		Assessment Weightage in Marks
ISA	Review-1	**10**
	Review-2	**20**
	Review-3	**20**
ESA		**50**
Total		**100**

Scheme for In-Semester Assessment (ISA)

ISA (periodic reviews)	Review Expectation	Guide Marks	Reviewer Marks	Total Marks
Review-1	Identification of problem, objectives, requirement analysis and report.	**5**	**5**	**10**
Review-2	Design and Implementation: coding as per standards, module testing.	**10**	**10**	**20**
Review-3	System testing and demo of the final project, quality of code, result analysis and project report.	**10**	**10**	**20**
Total		**25**	**25**	**50**

Scheme for End Semester Assessment (ESA)

Parameters	PI's	Max Marks	CO	BL
Demo with solution approach to the identified problem	14.3.1	30	1	4
Testing & Results	3.4.2	05	2	4
Presentation	9.3.1	05	3	3
Individual Contribution	14.3.1	05	3	3
Report	10.1.2	05	3	3
Total = 50				

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Professional Aptitude and Logical Reasoning		Course Code: 16EHSC301
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: --	Exam Duration: 3 hrs

Unit –I- Arithmetical Reasoning and Analytical Thinking		
1	Arithmetical Reasoning	**10hrs**
2	Analytical Thinking	**4 hrs**
3	Syllogistic Logic	**3hrs**
Unit –II		
4	Verbal Logic	**4 hrs**
5	Non-Verbal Logic	**4 hrs**
Unit –III- Lateral Thinking		
6	Lateral Thinking	**4 hrs**

Text Books:

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi
2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Reference Books:

1.Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India

2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi

Evaluation Scheme (ISA)

Assessment	Conducted for Marks	Weightage in Marks
ISA1 (Theory)	40	20
ISA2	40	20
Activity	10	10
	Total	**50**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
Theory	100	50
	Total	**50**

****The indicated method may be adopted for CIE after due approval from DUGC of Department of Humanities.**

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Industry Readiness & Leadership Skills (AUDIT)		Course Code: 23EHSA304
L-T-P: 0-0-0	Credits: 0	Contact Hrs: 1hr/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 16	Tutorial/Practical: --	Exam Duration: NA

Unit –I

1	**Written Communication:** Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay, and Paragraph Writing for Recruitment Tests	6 hrs
2	**Interview Handling Skills:** Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette	4 hrs
3	**Lateral & Creative Thinking:** Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities	4 hrs
4	**Team Building & Leadership Skills:** Communication in a Team, Leadership Styles, Playing a Team member, Belbin's team roles, Ethics, Effective Leadership Strategies	2 hrs

Text Books:

NA

Reference Books:

1. Diana Booher – E Writing, Laxmi Publications
2. Edward de Bono – Lateral Thinking – A Textbook of Creativity, Penguin UK
3. William Strunk, E B White – The Elements of Style, Pearson
4. John Maxwell – The 17 Essential Qualities of a Team Player, HarperCollins Leadership
5. Robin Ryan – 60 Seconds and You're Hired! – Penguin Books

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
Minor Exam 1	50
Minor Exam 2	50
Total	**100**

BACK

Professional Electives-1, 2 & 3

Data Intelligence

Program: Bachelor of Engineering		
Course Title: Digital Image and Video Processing		**Course Code: 24ECAE310**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Image and Video Processing:** Introduction, 2-dimensional (2D) and 3-dimensional (3D) signals, analog/digital dichotomy, electromagnetic spectrum, and applications.	**3hrs**
2	**Signals and Systems:** Fundamentals of 2D signals and systems. Complex exponential signals, linear space-invariant systems, 2D convolution, and filtering in the spatial domain.	**3hrs**
3	**Fourier Transform and Sampling:** 2D Fourier transform, sampling, discrete Fourier transform, and filtering in the frequency domain.	**3hrs**
4	**Motion Estimation:** Applications of motion estimation, phase correlation, block matching, spatio-temporal gradient methods, and fundamentals of color image processing.	**3hrs**
	Unit –II	
5	**Image Enhancement:** Point-wise intensity transformation, histogram processing, linear and non-linear noise smoothing, sharpening, homomorphic filtering, pseudo-coloring, and video enhancement.	**3 hrs**
6	**Lossless and Lossy Compression:** Elements of information theory, Huffman coding, run-length coding and fax, arithmetic coding, dictionary techniques, and predictive coding. Scalar and vector quantization, differential pulse-code modulation, fractal image compression, transform coding, JPEG, and sub band image compression.	**4 hrs**
7	**Video Compression:** Motion-compensated hybrid video encoding and video compression standards including H.261, H.263, H.264, H.265, MPEG-1, MPEG-2, and MPEG-4.	**3 hrs**

Unit –III		
8	**Image and Video Segmentation:** Intensity discontinuity and intensity similarity, watersheds and K-means algorithms, and other advanced methods.	**4 hrs**
9	**Sparsity:** Sparsity-promoting norms, matching pursuit algorithm, smooth reformulations, and an overview of the applications.	**4 hrs**

Text Books:

1. R. C. Gonzalez and R. E. Woods, “Digital Image Processing,” 4th edition, Pearson Education(Asia) Pte. Ltd/Prentice Hall of India, 2018.
2. M. Tekalp, “Digital Video Processing”, 2nd edition, Prentice Hall, USA, 2015.

Reference Books:

1. Anil K. Jain, “Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
2. Alan C Bovik “Essential Guide to Video Processing”, AP Elsevier publication, 2009.

Laboratory Plan

Week No	Topics for discussion	Experiments for practical session
0	Overview of the Course, Registration for the MOOC course Fundamentals of Digital and Image Processing.	Guidelines for the lab sessions.
1	Introduction to course and applications of Image and Video processing	Introduction to lab session, Introduction to Python and OpenCV. Sample basic programs.
2	Introduction to 2D signals and systems, 2D Convolution and filtering in spatial domain.	filtering in spatial domain (Averaging filter and Median filter)
3	Fourier Transform and Sampling , DFT	Compute DFT of given function, filtering in the frequency domain (LPF,HPF)
4	Motion Estimation and color image processing.	Implement Block matching method and Differential method. Illustration and conversion of color models.
5	Image Enhancement	Intensity transformations, Histogram processing (Equalization and specification), smoothing and sharpening.
6	Image Recovery - image restoration	Spatial and frequency domain filters. Selection of course project topic.
7	Lossless Compression methods	Implementation of lossless image compression methods.

8	Lossy Compression methods	Implementation of lossy image compression methods.
9	Image segmentation	Edge detection and region based segmentation.
10	Video Segmentation	Basic programs on video processing and Shot detection.
11	Review 1 of Course project	
12	Review 2 of Course project	
13	Final review of course project	
14	Submission of report on learning of MOOC course and course project.	

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Computer Vision		**Course Code: 24ECAE336**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 0hrs**	**Exam Duration: 3 hrs**

	Unit – I	
1	**Introduction:** Computer Vision Overview, Pixels and image representation, Filters: Linear systems, Convolutions and cross-correlations; Lab: Basics, Filters	**4 hrs**
2	**Features and filtering:** Edge detection: Gaussian, Sobel filters, Canny edge detector, Features and fitting: RANSAC Local features, Harris corner detection, Feature descriptors: Difference of gaussians, Scale invariant feature transform; Lab: Filters, Edges, Features	**8 hrs**
3	**Semantic segmentation part I:** Perceptual grouping, Agglomerative clustering, Super pixels and over segmentation	**3 hrs**
	Unit – II	
4	**Semantic segmentation part II:** Clustering: K-means, Mean shift; Visual Bag of Words: Texture features, Visual bag of words; Lab: Resizing, clustering, recognition.	**3 hrs**
5	**Motion:** Optical Flow, Lucas-Kanade method, Horn-Schunk Method, Pyramids for large motion, Tracking: Feature Tracking, Lucas KanadeTomasi (KLT) tracker; Lab: Object detection, optical flow.	**6 hrs**
6	**Advanced Techniques:** Image stitching, Image pyramids, Object recognition, Dimensionality reduction, Face identification, Detecting objects by parts.	**6 hrs**

Reference Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Pearson Education India, 2nd Ed, 2015.
3. R. I. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2nd Edition, 2004.

Laboratory Plan

Expt. No.	Experiments	No. of Slots
1	Introduction to Computer Vision: Basics, Filters	2
2	Features and filtering :Filters, Edges, Features	2
3	Features and filtering :Filters, Edges, Features …contd	2
4	Semantic segmentation :Resizing, clustering, recognition	2
5	Semantic segmentation :Resizing, clustering, recognition …contd	2
6	Object detection, optical flow	2
7	Motion :Object detection, optical flow	2

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Reinforcement Learning		**Course Code: 22ECAE312**
L-T-P: 3-0-0	**Credits: 3**	**Contact hrs.: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching hrs.: 40	**Tutorial/Practical: --**	**Exam Duration: 3 hrs.**

	Unit –I	
1	**Introduction:** Overview of machine learning, Supervised learning vs. unsupervised learning vs. reinforcement learning, Elements of reinforcement learning: agent, environment, reward, policy, value function, Markov decision processes (MDPs).	**5 hrs**
2	**Dynamic programming**: Policy evaluation and iteration, Value iteration, Asynchronous dynamic programming.	**5 hrs**
3	**Monte Carlo methods:** Monte Carlo policy evaluation, First-visit and every-visit MC, On-policy vs. off-policy learning.	**5 hrs**
	Unit –II	
4	**Temporal-difference learning**: TD(0) prediction, Sarsa and Q-learning, Eligibility traces.	**5 hrs**
5	**Function approximation**: Linear function approximation, Non-linear function approximation, Deep neural networks.	**6 hrs**
6	**Policy gradients:** Score function and policy gradient theorem, REINFORCE algorithm, Actor-critic methods.	**6 hrs**
	Unit –III	
7	**Exploration-exploitation trade-offs**: Epsilon-greedy, Boltzmann exploration, Upper confidence bound (UCB), Thompson sampling.	**3 hrs**
8	**Deep reinforcement learning**: Deep Q-networks (DQN), Double DQN, Dueling DQN, Policy gradient methods with function approximation, applications of Reinforcement Learning.	**5 hrs**

Text Book:

1. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto (2nd edition, MIT Press, 2018).

Reference Books:

1. Kaelbling, L. P., Littman, M. L., & Moore, A. W. (1996). Reinforcement learning: A survey. Journal of artificial intelligence research, 4, 237-285.
2. Mnih, V., Kavukcuoglu, K., Silver, D., Graves, A., Antonoglou, I., Wierstra, D., &Riedmiller, M. (2013). Playing Atari with deep reinforcement learning. arXiv preprint arXiv:1312.5602.
3. Schulman, J., Levine, S., Abbeel, P., Jordan, M., & Moritz, P. (2015). Trust region policy optimization. In Proceedings of the 32nd International Conference on Machine Learning (ICML-15) (pp. 1889-1897).

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
5.	ISA -I	30	25
6.	ISA – II	30	
7.	Lab Evaluation	20	10
8.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
3.	Theory Exam (ESA)	60	25
4.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering		
Course Title: Bioinformatics		**Course Code: 22ECAE314**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs	**Tutorial/Practical: --**	**Exam Duration: 3 hrs.**

	Unit –I	
1	**Biological Database:** Definition, components, multidisciplinary nature, and applications of bioinformatics; Databases: Introduction, meaning, types and characteristics of databases, types of databases, Biological database: Classification, Primary Database: Ligand Database, Enzyme database, human disease database, microbial and viral, genome database, structure visualization tools.	**07 hrs**
2	**Pairwise Sequence Alignment:** Definition, significance, and applications; Types of pairwise sequence alignment: Local and Global alignment; Methods of pairwise sequence alignment: Dot matrix, Dynamic programming: features of dynamic programming, Global Alignment: Needleman & Wunsch Algorithm, Local Alignment: Smith – Waterman Algorithm, and Word method: BLAST, PSI-BLAST, PHI-BLAST and FASTA; Substitution matrices: PAM and BLOSUM; gap penalties.	**8 hrs**
	Unit –II	
3	**Multiple Sequence Alignment:** Meaning, significance, and applications; Methods of MSA: Progressive Alignment methods, Iterative methods, Local Multiple sequence Alignment: Profile Analysis, BLOCK analysis, Pattern searching and Motif analysis, Statistical methods or Probabilistic models; Multiple Sequence Alignment editors.	**07 hrs**
4	**Phylogenetic analysis: Meaning** and significance; Concepts of evolutionary trees: Tree terminology, types of phylogenetic trees; fundamentals of phylogenetic models, Phylogenetic Data Analysis: Alignment: Building the data model, and extraction of phylogenetic data set; Determining substitution models: Models of Substitution Rates Between Bases, Models of Among- Site Substitution Rate Heterogeneity, Models of Substitution Rates Between Amino Acids; Tree Building methods: Distance based methods: Neighbor Joining (NJ) method, Fitch-Margoliash (FM) method; Character based methods: Maximum parsimony, Maximum Likelihood; Tree Evaluation methods, Phylogenetic Softwares.	**08 hrs**
	Unit –III	

5	**Gene Prediction:** Gene structure, Prokaryote and Eukaryote gene prediction, Prokaryote and Eukaryote promoter site prediction Gene Prediction tools, Genomic database, Next Generation Sequencing.	**05 hrs**
6	**Protein Prediction:** Protein structures: Secondary Structure: Alpha helix, beta Sheets, phi & psi angles, Ramachandran plots. Protein Structure Prediction: Use of sequence patterns and Amino acid; Protein Secondary Structure Prediction methods: Chou-Fasman, neural network, and nearest neighbor method; Tertiary Structure Predictions: Homology modeling; Protein sequence and structure analysis:	**05 hrs**

Text Books:

1. Andreas D. Baxevanis, B. F. Francis Ouellette, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd, Wiley-Inte, 2005.
2. David Mount, Bioinformatics: Sequence and Genome Analysis , 2nd, Cold Sprin, 2004.

Reference Books:

1. P. Rastogi, N. Mendiritta, S. C. Rastogi, Bioinformatics: Methods and Applications: Genomics,
2. Anand Solomon K, Molecular Modelling and Drug Design , 1st, MJP Publis, 2015

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
9.	ISA -I	30	25
10.	ISA – II	30	
11.	Lab Evaluation	20	10
12.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
5.	Theory Exam (ESA)	60	25
6.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering		
Course Title: Computer Graphics		**Course Code: 22ECAE315**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 3 Hrs**

	Unit –I	
1	**Introduction:** Image Processing as Picture Analysis, The Advantages of Interactive Graphics. Representative Uses of Computer Graphics, Classification of Applications. Development of Hardware and Software for Computer Graphics, Conceptual Framework for Interactive Graphics	**06 hrs**
2	**Basic Raster Graphics Algorithms for Drawing 2d Primitives:** Overview, Scan Converting Lines, Scan Converting Circles, Filling Rectangles. Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primiives, Line Style and Pen Style.	**08 hrs**
3	**Clipping in a Raster World:** Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons. Antialiasing	**06 hrs**
	Unit –II	
4	**Geometric Objects and Transformations:** Scalars, Points, and Vectors, Three-Dimensional Primitives Coordinate Systems and Frames, Frames in OpenGL. Modeling a Colored Cube, Affine Transformations, Translation, Rotation, and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, OpenGL Transformation Matrices	**07 hrs**
5	**Viewing:** Classical and Computer Viewing, Viewing with a Computer, Positioning of the Camera Simple Projections, Projections in OpenGL, Hidden-Surface Removal, Interactive Mesh Displays, Parallel- Projection Matrices, Perspective-Projection Matrices, Projections and Shadows	**07 hrs**
6	**Representing Curves:** Polygon Meshes, Parametric Cubic Curves: Hermit curves, Bezier curves, B-Splines	**06 hrs**
	Unit –III	
7	**Lighting:** Light and Matter, Light Sources, The Phong Reflection Model, Computation of Vectors , Light Sources in OpenGL	**05 hrs**
8	**Shading:** Polygonal Shading, Approximation of a Sphere by Recursive Subdivision Specification of Materials in OpenGL, Shading of the Sphere Model Global Illumination	**05 hrs**

Text Books:

1. Computer Graphics: Principles and Practice, James D. *Foley*, Andries *van Dam*, Steven K. Feiner, John F. Hughes ,2nd Edition, Pearson Education, 2008
2. Interactive Computer Graphics - A Top-Down Approach Using OpenGL (5/e),

Edward Angel, 5th Edition, Pearson Education, 2009
Reference Books: 1. Computer Graphics using OpenGL, F. S. Hill Jr. and S. M. Kelley, 3rd Edition ,Pearson Education, 2009 2. Computer Graphics with OpenGL, D. D. Hearn and M. P. Baker, 3rd Edition Computer Graphics, Peter Shirley, Steve Marschner, Cengage Learning, 2009

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
13.	ISA -I	30	25
14.	ISA – II	30	
15.	Lab Evaluation	20	10
16.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
7.	Theory Exam (ESA)	60	25
8.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering			
Course Title: Multimedia Computing		**Course Code: 22ECAE316**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 3 Hrs**	
Unit –I			
1	**Introduction to multimedia:** Global structure of Multimedia, Multimedia Application, Medium, Multimedia system and properties, Characteristics of a Multimedia System, Challenges for Multimedia Systems, Components of a Multimedia System		**04 hrs**
2	**Sound / Audio System:** Concepts of sound system, Music and speech, Speech Generation, Speech Analysis, Speech Transmission		**06 hrs**
3	**Images and Graphics:** Digital Image Representation, Image and graphics Format, Image Synthesis, analysis and Transmission.		**06 hrs**
Unit –II			
4	**Video and Animation:** Video signal representation, Computer Video Format, Computer- Based animation, Animation Language, Methods of controlling Animation, Display of Animation, and Transmission of Animation.		**08hrs**
5	**Content Analysis:** Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications**.**		**08hrs**
Unit –III			
7	**User Interfaces:** Basic Design Issues, Video and Audio at the User Interface, User-friendliness as the Primary Goal.		**04 hrs**
8	**Multimedia Application:** Media preparation and composition, Media integration and communication, Media Entertainment, Telemedicine, E-learning, Digital video editing and production systems, Video conferencing, Video-on-demand		**04 hrs**

Text Books:

1. Multimedia: Computing, Communications and Applications, Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia.

Reference Books:

1. Multimedia Communications, Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Education Asia
2. Multimedia Systems, John F. Koegel Buford, Pearson Education Asia

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	ISA -I	30	25
2.	ISA – II	30	
3.	Lab Evaluation	20	10
4.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	Theory Exam (ESA)	60	25
2.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering		
Course Title: Ethics in AI		**Course Code: 23ECAE325**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction to Ethical AI: Cause and Effect:** Algorithms, AI and Model Outcomes, Rules for AI: training and constraints, Ethical AI: Cause and Effect.	**6 hrs**
2	**Artificial Intelligence Data Fairness and Bias**: Fairness and protections in machine learning, Fairness and protections in machine learning, building fair models, minimizing bias in data.	**7 hrs**
	Unit –II	
3	**Artificial Intelligence Privacy and Convenience:** Privacy and convenience vs big data, Protecting Privacy: Theories and Methods, Building Transparent Models	**6 hrs**
4	**AI Fairness:** Individual fairness, Group fairness, Counterfactual fairness, Fairness in natural language processing, Fairness in computer vision, Deepfakes, Federated learning	**6 hrs**
	Unit –III	
5	**Artificial Intelligence Ethics in Action:** Case Study: AI for Healthcare Domain, AI for Edge Device, AI for Agriculture, AI for NLP	**5 hrs**

Text Books:

1. Coeckelbergh, Mark. AI ethics. MIT Press, 2020.

Reference Books:

1. Boddington, Paula. Towards a code of ethics for artificial intelligence. Cham: Springer, 2017.

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	ISA -I	30	25
2.	ISA – II	30	
3.	Lab Evaluation	20	10
4.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	Theory Exam (ESA)	60	25
2.	Lab Exam (ESA)	20	25
		20	
		10	

BACK

Program: Bachelor of Engineering		
Course Title: Augmented and Virtual Reality		**Course Code: 25ECAE303**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

1	Working VR in Unity: Unity XR, headset and controller tracking, loss of tracking, Unity core APIs related to XR functionality	**6 hrs**
2	Interaction and Locomotion: interact with objects in VR, scene exploration, teleportation, and grab and throw interactions, how to avoid causing nausea and dizziness for your user.	**6 hrs**
3	VR UX with the Unity API: Text Issues in VR, Optimizing Text Readability, Attaching Displays to a Controller, Interacting with Canvas Elements	**8 hrs**
4	Moving Constrained Objects with Tracking, Hitting Objects, UX That Moves With You, Triggering Canvas Events from Raycasts, Creating Virtual Controls That Mimic Real World Controls.	**8 hrs**

References

1. Virtual Reality Technology, Gregory C. Burdea & Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc., ISBN: 978-0-471-36089-6
2. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, 2nd Edition, 2006. ISBN: 978-0-471-36089-6
3. Greengard, Samuel. Virtual reality. Mit Press, 2019.

Lab Experiments

Sl. No	Experiments	No of Slots (2 hrs/per week)
1	(AR) app development in Unity entailsthat overlay digital elements onto the real world.	1
2	Create a 3D object and apply different geometric Transformations using Mouse/Keyboard	1
3	Create animation for a 3D object (transformation, color, texture, etc.)	1
4	Bouncing ball on multiple 2D/3D platforms	1
5	Develop First Person Controller to a Scene	1
6	Create a 3D Character movement	1

7	Create a menu driven interface for adding and removing objects from a Scene	1
8	Build a cubic room, whose sides are made out of six planes. The room should be 15x15x15 Unity units. At the center of the roof of the room, place a point source of light. This light should change color by pressing the Tab key.	1
9	Course Project	4

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering			
Course Title: Parallel Computing		**Course Code: 22ECAE320**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 03 hrs**	
Unit –I			
1	**Introduction to Parallel Computing & Parallel Programming Platforms:** Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines.		**8 hrs**
2	**Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.		**8 hrs**
Unit –II			
3	**Analytical Modeling of Parallel Programs:** Sources of Overhead in Parallel Programs, Performance metrics for parallel systems, The effect of Granularity on performance, Scalability of Parallel Systems, Minimum execution time and minimum cost optimal execution time, Asymptotic analysis of Parallel programs, Other Scalability Metrics.		**8 hrs**
4	**Programming Using the Message Passing Paradigm:** Principles of Message – Passing Programming, The Building Blocks, and MPI: The Message passing Interface, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups & Communicators.		**8 hrs**
Unit –III			
5	**Pthreads and Synchronization:** Thread Basics, POSIX Thread API, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs.		**4 hrs**
6	**OpenMP**: Open MP programming model, Specifying tasks in openMP, Synchronization constructs in opn MP, Data handling in OpenMP, Open MP library functions, Environment variables in OpenMP, Explicit Thread versus OpenMP based programming.		**4 hrs**

Text Books:

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, Introduction to Parallel Computing, Second Edition, Pearson India, 2013

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	ISA -I	30	25
2.	ISA – II	30	
3.	Lab Evaluation	20	10
4.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
1.	Theory Exam (ESA)	60	25
2.	Lab Exam (ESA)	20	25
		20	
		10	
		Total	**50**

BACK

Program: Bachelor of Engineering		
Course Title: Computational Medicine		**Course Code: 24ECSE340**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 30 hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Cell Organization:** Cell Theory, Prokaryotic and Eukaryotic Cells, Organelles, Cell Membrane, Cell Cycle, Tissue, Organs, Organ Systems, Homeostasis	**5 hrs**
2	**Systems Biology:** Systems Biology, Modelling Biological Systems, Network Biology, Omics Technologies, Systems Biology Applications.	**5 hrs**
3	**Biological Networks:** Protein-Protein Interaction Networks (PPINs), Gene Regulatory Networks (GRNs), Metabolic Networks, Metabolic Networks	**5 hrs**
	Unit –II	
4	**Molecular Interactions:** Protein-Protein Interactions, Protein-DNA Interactions, Protein-Ligand Interactions, Molecular Dynamics Simulations.	**5 hrs**
5	**Introduction to modelling health and disease:** Principles of Computational Physiology, Integrating Molecular Networks into Physiological Models, Animal Models and Human Translation	**5 hrs**
6	**Introduction to Computational Anatomy:** Case Studies : Computational Anatomy of the Brain and Computational Anatomy of the Heart	**5 hrs**

Text Books: NA

Reference:

1. Lecture Notes and Handouts
2. Some reference papers / Slides/ Videos

Hands-On - Probable Lab Work

- Lab sessions on cell observation (microscopy) and tissue analysis.
- Group projects on modelling biological systems.
- Case studies on diseases related to cellular dysfunction.
- Bioinformatics exercises using publicly available datasets.
- Computational exercises in network analysis using available software tools.
- Case studies of network-based drug discovery and development.
- Data mining and analysis of biological network datasets.
- Integration of network analysis with experimental validation.
- Hands-on experience with computational modelling software.
- Development of simplified models to understand core concepts.
- Analysis of real-world data to parameterize and validate models.
- Collaboration with experimental biologists and clinicians.
- Hands-on experience with medical image processing software.
- Development of image analysis pipelines for specific clinical problems.
- Application of machine learning techniques for image analysis.
- Collaboration with clinicians for data interpretation and clinical validation.

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Networking and Security

Program: Bachelor of Engineering		
Course Title: Cloud Computing		**Course Code: 24ECAE338**
L-T-P:2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction:** Motivation for cloud computing, elastic computing and its advantages: Business models for cloud providers, Types of clouds: multi-cloud, cloud platforms. Data center infrastructure: Network equipment and multi-port server interfaces, Leaf spine network topology.	**4 hrs**
2	**Virtualization and containerization:** Virtual Machines: approaches to virtualization, levels of trust, live migration of virtual machines. Advantages and disadvantages of virtual machines, isolation facilities in an operating system, Linux namespaces used for isolation, container approach for isolated apps, Docker containers, Docker software components, items in a Dockerfile. Monolithic applications in a data center.	**4 hrs**
3	**Automation and Orchestration:** Automation in data centers, levels of automation, zero touch provisioning and Infrastructure as code, automation tools, Orchestration: Automation with a larger scope, Kubernetes: An example container orchestration system, Kubernetes cluster model, Kubernetes pods: creation, templates, and binding time, Kubernetes nodes and control plane, worker node software components.	**4 hrs**
	Unit –II	
4	**Microservices:** The Microservices approach, advantages and disadvantages of Microservices, Microservices Granularity, Communication protocols used for Microservices, communication among Microservices, creating a Microservices, server mesh proxy.	**4 hrs**
5	**Serverless computing and event processing:** Traditional client-server architecture, scaling a server in a cloud environment, Serverless computing approach, stateless servers and containers, Architecture of a Serverless infrastructure, An example of Serverless processing, advantages and disadvantages of Serverless computing.	**3 hrs**
6	**DevOps for cloud:** Introduction to DevOps, DevOps tools: Puppet, Chef and Ansible. Configuration management using Ansible, Ansible- Modules, Ad Hoc, Playbooks, Ansible for IT automation.	**3 hrs**

Text Books:

1. Douglas Comer, "The Cloud Computing: The Future of Computing", 1st ed, Chapman and Hall/CRC 1 July 2021.
2. Dan C. Marinescu, Cloud Computing Theory and Practice, 3rd Edition, Elsevier - February 15, 2022.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, Mastering Cloud Computing, McGraw Hill, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010.

Laboratory Plan

Expt./Job No.	Brief description about the experiment/job	No. of tutorial Slots per batch
1	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization	03
2	Implementation of cloud service models (IaaS,PaaS,SaaS)	03
3	Live Migration of VM's and containerization using dockers	02
4	Building Kubernetes cluster	02
5	Create Microservice based web service	02
6	Ansible for IT automation.	02

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Data Integration and Cloud Services		**Course code: 24ECAE319**
L-T-P: 1-0-2	**Credits: 3**	**Contact hrs: 5hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 15	**Tutorial/Practical: 56hrs**	**Exam Duration: 2 hrs**

1	**Data Integration for Developers:** Introduction to PowerCenter, Folders, Sources, and Targets, Design Objects, File Lookups, Relational Lookups, Database Joins in PowerCenter, Workflow Logic, Merging, Routing, and Sorting Data, Command Tasks, Debugging, Parameterization, Updating Database Tables, Mapplets, Mapping Design Workshop, Addendum.	**3 hrs**
2	**PowerCenter Architecture and Transformations:** PowerCenter 10 Architecture, Parameter Files, User-Defined and Advanced Functions, Pivoting Data, Dynamic Lookups, Stored Procedure and SQL Transformations, Troubleshooting Methodology and Error Handling, Transaction Processing, Transaction Control Transformation, Recovery, Command Line Programs, Performance Tuning Methodology, Performance Tuning Mapping Design, Memory Optimization, Performance Tuning: Pipeline Partitioning.	**4 hrs**
3	**Cloud Application Integration Services:** Overview of Cloud Application Integration, Understand the Basics: Process Designer, Working with Assets, Adding Web Services to a Process, Fault Handling, Introduction to Guides Designer, API Management, CAI and CDI Integration, Troubleshooting, Tips & Tricks, Best Practices.	**4 hrs**
4	**Cloud Data Integration Services:** Informatica Cloud Overview, Runtime Environments and Connections, Synchronization Task, Cloud Mapping Designer, Cloud Mapping Designer – Transformations, Mapping Parameters, Expression Macro and Dynamic Linking, Replication Task, Masking Task, Mass Ingestion Task, Task flows, Hierarchical Connectivity, Intelligent Structure Model.	**4 hrs**

Text book:

1. Learning Informatica PowerCenter 10.X, Second Edition, Rahul Malewar, Publisher: Packt, 2017.

Reference book:

1. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Publisher: Elsevier, 2012.

Sl. No.	Experiments	Number of slots
1.	Demonstration on *PowerCenter tool*	2
2.	Exercise on *workflow creation and perform transformations.*	3
3.	Structured Enquiry on given case Study to deploy workflow for a real-world scenario	5
4.	Written exam on theoretical concepts	1
5.	Course project	3

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Cyber Security		**Course Code: 24ECAE337**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical:** 0hrs	**Exam Duration: 3 hrs**

	Unit –I	
1	**Chapter 1** **Introduction to Cyber Security:** Overview of Cybersecurity, Importance and Goals of Cybersecurity, Cybersecurity Threat Landscape, Cybersecurity Fundamentals, Overview of Domain-specific Security, Threat Intelligence and Incident Response.	8hrs
2	**Chapter 2** **Cyber-crimes and Cyber Laws**: Classification of cyber-crimes, Common cyber-crimes – targeting computers, mobiles, crimes against women and children, financial frauds, social engineering, malware and ransomware, zero-day and zero-click attacks, cybercriminals' modus operandi, reporting, remedial measures, legal perspective, IT Act 2000 and amendments, cyber offences, organizations dealing with cybercrime and cybersecurity in India, case studies.	7hrs
	Unit –II	
3	**Chapter 3** **Network and Web Security**: Identifying and protecting critical web assets, cookies, wireless network vulnerabilities, Application software and data integrity issues, OWASP top 10 threats, Mitigating web risks, Overview of network security, Multilevel Security Models, Firewalls and Intrusion Detection Systems	8hrs
4	**Chapter 4** **Security Operations**: Security Operations Centre (SOC) Fundamentals, Key SOC Roles and Responsibilities, SOC Components (People, Processes, Technology), Cyberthreats and the impact of a Breach, Investing in Security and Establishing a Baseline, Fundamental Security Capabilities and Industry Threat Models, Standards, Guidelines, and Frameworks, Vulnerabilities, Risk & Business Challenges	7hrs
	Unit – 3	

5	**Chapter 5** **Development of SOC:** SOC Maturity Model, Key SOC Functions: Threat Detection, Incident Response, Forensics, Planning and Designing a SOC Facility, Network Considerations for SOC, Disaster Recovery & Business Continuity in SOC.	5hrs
6	**Chapter 6** .**Security Information and Event Management (SIEM**): Key SIEM Components, Introduction to SIEM solutions, Key Features, SIEM Architecture, Log collection methods, Incident Detection in SIEM: Detecting Malware, Phishing, Insider Threats, Automated Incident Response with SIEM and SOAR.	5hrs

References:

1. Cybersecurity Essentials by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short was published on October 5, 2018.
2. Principles of Information Security by Michael E. Whitman and Herbert J. Mattord (7th edition) was published on June 27, 2021.
3. Computer Security: Principles and Practice by William Stallings and Lawrie Brown (4th edition, Global Edition) was published on June 21, 2018.

Lab Experiments:

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots per batch (estimate)
1.	Demonstration of attacks like DDoS, Password Cracking	2
2.	Web Application Vulnerable to Cross-Site Scripting (XSS)	1
3.	Implementation of Multi-Factor Authentication	1
4.	Firewall Functionality and Traffic Control Demonstration	1
5.	Intrusion Detection System (IDS) Demo using Snort or Suricata	2
6.	Design and Implementation of Signature-Based IDS	1
7.	Firewall Functionality and Traffic Control Demonstration	1

8.	Configuring Identity and Access Management (IAM) in OpenStack	1
9.	Securing a Web Application Deployed on a Cloud VM	1
10.	Demonstration of SIEM, Log Analytics, and Threat Detection	2
11.	Threat Detection and Automated Response using SIEM and SOAR	1

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Web Security		**Course Code: 24ECAE302**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction:** Security Vulnerabilities, Threats and Risk, protecting assets, Cookies, Wireless network vulnerabilities, Identification and authentication failures, Application software and data integrity issues, Website security, online business risks	**7 hrs**
2	**Mitigating website risks, Threats and Vulnerabilities:** Accepting user input on your website, OWASP top 10 threats, Additional web threats not in top 10, Mitigating web risks, Threats and Vulnerabilities	**8 hrs**
	Unit –II	
3	**Web Application Security :** Web services, Common website attacks, Common website weaknesses, Best practices for mitigating web attacks and weaknesses, Security regulations, standards and guidelines, Types of information security, Mitigating risk in web applications, Security actions to protect websites	**7 hrs**
4	**Developing Secure websites and web applications:** Accepting user input into your website, Functional websites, Development processes, Layered security strategies, Incorporating security requirements within SDLC, Using secure and unsecure protocols, Best practices for securing web applications, Website Vulnerability and Security Assessment	**8 hrs**
	Unit –III	

Text Books:

1. Mike Harwood, Ron Price, “Internet and Web Application Security”, 3rd ed, Jones and Bartlett Publishers, Inc, 2022.

Reference Books:

1. Hoffman, A. Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O'Reilly Media, 2020.
2. OWASP Foundation, OWASP Top 10: Web Application Security Risks, 2021

Lab experiments:

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots per batch (estimate)
1.	Develop a webpage with XSS vulnerability, show script injection, and suggest prevention methods.	1
2.	Create an online store and explain security measures for protecting sensitive data.	1
3.	Build a login system to show risks of weak passwords and implement MFA.	1
4.	Develop a web app with OWASP Top 10 flaws and apply mitigation strategies.	2
5.	Design an app exposing insecure storage and poor error handling, then apply fixes.	1
6.	Create an app demonstrating confidentiality, integrity, and availability in information security.	1
7.	Build a secure app using input validation, authentication, access control, and encryption.	1
8.	Show the difference between using HTTPS and HTTP in a web application.	1
9.	Exploit back-end and SQL flaws in a web app and discuss mitigation.	1
10.	Create a web app complying with WCAG, GDPR, and consumer protection laws.	2

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Security Operations		**Course Code: 25ECAE330**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction:** Security Operations Center (SOC) Fundamentals, Key SOC Roles and Responsibilities, SOC Components (People, Processes, Technology), Cyberthreats and the impact of a Breach, Investing in Security and Establishing a Baseline, Fundamental Security Capabilities and Industry Threat Models, Standards, Guidelines, and Frameworks, Vulnerabilities, Risk & Business Challenges,	**7 hrs**
2	**Development of SOC:** SOC Maturity Model, Key SOC Functions: Threat Detection, Incident Response, Forensics, Planning and Designing a SOC Facility, Network Considerations for SOC, Disaster Recovery & Business Continuity in SOC, Security Considerations, Guidelines and Recommendations for Securing SOC	**8 hrs**
	Unit –II	
3	**SIEM:** Key SIEM Components, Introduction to SIEM solutions, Overview and Key Features, SIEM Architecture, Log collection methods, Security Event Correlation and Rule Writing	7 hrs
5	**Incident Detection and Response:** Incident Detection in SIEM: Detecting Malware, Phishing, Insider Threats, Detecting Lateral Movement (MITRE ATT&CK Framework), Incident Response: Automated Incident Response with SIEM and SOAR, Generating and Managing SIEM Alerts	8 hrs

Text Books:

1. J. Muniz, A. Lakhani, O. Santos, and M. Frost, The Modern Security Operations Center: The People, Process, and Technology for Operating SOC Services, 1st ed. O'Reilly Media, 2021.

Reference Books:

1. R. MacDougall and R. Lain, The Security Operations Handbook: Managing a SOC and Detecting Threats, Packt Publishing, 2021.
2. E. Al-Shaer, Automated Security Operations: Threat Hunting, Detection, and Response at Scale, Pearson, 2020.

Laboratory Plan

Expt No.	Name of the Experiment	No. of tutorial Slots per batch (estimate)
1	Installing and configuring WAZUH.	01
2	Configure log sources and forwarding logs to SIEM component.	01
3	Log collection methods and analysis.	01
4	Malware detection.	01
5	Intrusion detection.	01
6	Phishing attack analysis.	01
7	Insider threat monitoring.	01
8	Network attack detection.	01
9	SIEM alert management.	03
10	SIEM reports.	04

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Software Defined Networks		**Course Code: 25ECAE331**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction:** Evolving network requirements, Types of Network and Internet Traffic, The SDN approach, Data Center Networking: Big Data over SDN, Cloud Networking over SDN.	**8 hrs**
2	**SDN Data Plane and OpenFlow:** Data plane functions and protocols, OpenFlow logical network device, OpenFlow protocol, OpenFlow messages, OpenFlow events: Responding to switches.	**8 hrs**
	Unit –II	
3	**Control Plane:** SDN Control plane architecture, POX architecture, OpenDaylight architecture, REST, Mininet based examples	**8 hrs**
4	**Programming SDNs:** Components in POX, POX APIs, Registering Components, The Event System: Handling Events, Creating Your Own Event Types, Raising Events, Binding to Components' Events, Working with packets, Working with sockets: ioworker, OpenFlow in POX.	**8 hrs**
	Unit –III	
5	**Software Application plane:** SDN Application Plane Architecture, Traffic Engineering, Measurement and Monitoring. Security Requirements, SDN Security.	**4 hrs**
6	**Network Functions Virtualization (NFV):** OpenFlow VLAN Support, Virtual Private Networks, Network Virtualization: A Simplified Example, Network Virtualization Architecture, Benefits of Network Virtualization.	**4 hrs**

Text Books:

1. William Stallings, "Foundations of modern networking: SDN, NFV, QoE, IoT and Cloud", Addison Wesley; 1 edition, 2015.
2. Thomas D. Nadeau & Ken Gray, "SDN - Software Defined Networks", O'Reilly, 2013.

Reference Books:

1. Sreenivas Voruganti, Sriram Subramanian, "Software-Defined Networking (SDN) with OpenStack", Packt Publishing, 2016.
2. POX manual current documentation, https://openflow.stanford.edu/display/ONL/POX+Wiki.html

BACK

Program: Bachelor of Engineering		
Course Title: Edge Computing		**Course Code: 25ECAE332**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30		**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction:** Definition and key concepts, Difference between edge, fog and edge computing Importance and benefits of edge computing, Case studies and real-world applications, Edge computing architecture.	**8 hrs**
2	**Edge Computing Technologies:** Edge hardware and devices: IoT devices, gateways, edge servers, Sensors and actuators, edge hardware platforms, Software for Edge Computing: operating systems and middleware, edge computing platforms and frameworks, development tools and SDKs. Wireless technologies for edge: for Wi-Fi, Zigbee, LoRa, 5G, mmWave, LiFi. Communication protocols: MQTT, CoAP, AMQP, BLE	**8 hrs**
	Unit –II	
3	**Edge Cloud:** Introduction to Edge Data Center, use cases and applications, Lightweight edge edges and its services, Edge architectures using Kubernetes, Edge Networking: 5G Architecture, SDN, NFV, SFC and AI.	**8 hrs**
4	**Mobile Edge Computing (MEC):** Architecture, computational model, offloading policy, Integration of MEC into 5G/6G, Case study, Applications and Challenges, simulation tools, MEC for industrial IoT, Edge intelligence at device, edge and core layers using ML/FL.	**8 hrs**

Text Books:

1. Yan Zhang, "Mobile Edge Computing", 1st Edition, Springer, 2021.
2. Buyya R., Srirama S.N., “Fog and Edge Computing”, Wiley, 2019.

Reference Books:

1. Sabella D., Reznik A., Frazao R., “Multi-access Edge Computing in Action”, 1st edition, 2019
2. Al-Turjman F. (ed.): “Edge Computing: from hype to reality”, Springer, 2019.

Lab Experiments:

Expt No.	Name of the Experiment	No. of tutorial Slots per batch (estimate)	Marks
1.	Kubernetes Setup – Single node	01	--
2.	EdgeXFoundry for IoT Data Analysis	01	---
3.	LF Edge Demo	01	
4.	KubeEdge Evaluations	01	5

5.	Edge Application Deployment on KubeEdge-IoT	01	---
6.	Edge Application Deployment on KubeEdge-Video Streaming	01	5
7.	MEC- Edge device, Edge node and private 5G integration	03	--
8.	Open Ended Activity	04	10

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

System and Software Development

Program: Bachelor of Engineering		
Course Title: Advanced Java Programming		**Course Code: 24ECAE329**
L-T-P:2-0-1	**Credits: 4**	**Contact Hrs: 5hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Java Database Connectivity (JDBC)** – Introduction to JDBC,JDBC Architecture and Types of Drivers, Steps to Connect with a Database, Statement vs Prepared Statement, Executing SQL Queries (CRUD operations), ResultSet and its Methods, Exception Handling in JDBC, Simple Java Database Application	**04 hrs**
2	**Java Servlets** – Introduction to Web Applications, Servlet Life Cycle ,Developing a Simple Servlet, Handling Request and Response (GET, POST),Session Tracking Techniques: Cookies, URL Rewriting, Http Session, Servlet Config and Servlet Context, Deployment using Apache Tomcat	**06 hrs**
3	**JavaServer Pages (JSP)** – Introduction to JSP,JSP Life Cycle, JSP Tags: Directives, Scriptlets, Expressions, Implicit Objects, JSP vs Servlets, Using JSP with JDBC, Introduction to JSTL and EL (Expression Language)	**06 hrs**
	Unit –II	
4	**MVCArchitecture** – Understanding Model-View-Controller Pattern, Integrating Servlet and JSP using MVC, Form Handling in MVC, Simple MVC-based Web Application	**04 hrs**
5	**Spring Boot Essentials** – Introduction to Spring and Spring Boot, Features and Architecture of Spring Boot, Setting Up a Spring Boot Project, Creating REST APIs with Spring Boot, CRUD Operations using Spring Data JPA, Connecting to MySQL/PostgreSQL using Spring Boot	**06 hrs**
6	**RESTful Web Services and Security Basics** – Introduction to REST API,HTTP Methods (GET, POST, PUT, DELETE),Creating RESTful Services with Spring Boot, Exception Handling in REST, Introduction to Spring Security, Basic Authentication & Securing REST APIs, Role-Based Access Control (RBAC),Using Postman with Secured APIs	**04 hrs**

Text Books:

1. **Kathy Sierra, Bert Bates**, *Head First Java*, 2nd Edition, O'Reilly Media, 2005.
2. **Budi Kurniawan**, *Servlets and JSP: A Tutorial*, 2nd Edition, Brainy Software, 2005.
3. **Craig Walls**, *Spring in Action*, 5th Edition, Manning Publications, 2018.

Reference Books:

1. **Herbert Schildt**, *Java: The Complete Reference*, 11th Edition, McGraw-Hill Education, 2018.
2. **Y. Daniel Liang**, *Introduction to Java Programming and Data Structures*, 11th Edition, Pearson, 2017.
3. **Rod Johnson**, *Expert One-on-One J2EE Development without EJB*, Wrox Press, 2004.

4. **Paul Deck**, *Spring Boot: Up & Running*, O'Reilly Media, 2021.
5. **Leonard Richardson, Mike Amundsen, Sam Ruby**, *RESTful Web APIs*, O'Reilly Media, 2013.

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Introduction to JDBC: Architecture, Database Connectivity, Executing Basic Queries	01
2.	JDBC CRUD Operations using Statement and Prepared Statement, Handling ResultSet	01
3.	Exception Handling in JDBC and Mini Java Database Application	01
4.	Creating a Simple Servlet, Handling HTTP GET and POST Requests	01
5.	Session Management in Servlets: Cookies, URL Rewriting, Http Session	01
6.	JSP Fundamentals: Directives, Scriptlets, Expressions, and Implicit Objects	02
7.	Using JSP with JDBC: Mini Dynamic Web App with JSTL and EL	01
8.	MVC Architecture: Form Handling and Integration of Servlet and JSP	02
9.	Introduction to Spring Boot: REST API Development with CRUD using Spring Data JPA	02
10.	Securing REST APIs with Spring Security: Basic Authentication and Role-Based Access	02

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Blockchain and Distributed Ledgers		**Course Code: 24ECAE339**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction:** Overview of block chain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Types of block chain, block chain platforms, Block chain Architecture, Block chain Use Cases: Finance, E-Governance, Supply chain management, Healthcare management and cyber security.	**06 hrs**
2	**Cryptography Basics:** Introduction to cryptography, Public key crypto: Introduction, RSA, Public key infrastructure, Hash Functions: Properties of Hash Functions, SHA, Digital signature Schemes, Merkle trees.	**06 hrs**
3	**Consensus Mechanisms and Mining:** Consensus in Distributed Systems, Consensus mechanisms in Permission less blockchain: Proof of Work, Proof of Stake (POS), Proof of Activity, Delegated POS, Proof of Elapsed Time. Consensus mechanisms in Permissioned Blockchain: RAFT, Practical Byzantine Fault Tolerance (PBFT), Scalability of consensus algorithms.	**06 hrs**
	Unit –II	
4	**Ethereum and Smart Contracts:** Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling, Applications of Ethereum Smart contracts: Tokens and Token Standards, Fungible and Non-Fungible Tokens, crowd funding	**06 hrs**
5	**Enterprise Blockchain Platforms:** Hyperledger Fabric: Introduction, Architecture, Identity, Membership and Peer Management, Chain codes. Corda: Principal Features, Architecture, CorDapp. Consensus Mechanisms in Hyperledger Fabric and Corda.	**06 hrs**

Reference Books:

1. Imran Bashir "Mastering Blockchain ", 3st Edition, Packt Media, 2020.
2. Melanie Swan, “Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014.
3. Arshdeep Bhaga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", 1st Edition, VPT, January 31, 2017.

List of Exercises

Expt./ No.	Brief description about the experiment/job	No. of Lab. Slots
1.	Overview and Demonstration of Ethereum smart contracts	1
2.	Solidity programming- Data types, control structures and functions	1
3.	Deploying contract using external blockchain using Metamask/Myetherwallet	1
4.	Creating custom Ethereum blockchain using Geth	1
5.	Connecting to Geth node using Web3	1
6.	Create distributed storage using IPFS.	1
7.	Connect IPFS to Ethereum and Hyperledger Fabric	1
8.	**Course Project**	**7**

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Algorithmic Problem Solving		**Course Code: 24ECSE309**
L-T-P: 2-0-4	**Credits: 6**	**Contact Hrs: 10 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 112**	**Exam Duration: NA**

	Unit –I	
1	**Design Philosophy and Reflections:** Algorithm Design Techniques and Principles, Case Studies and Reflections	**5 hrs**
2	**Advanced Data Structures:** Tricks and Techniques, Matrix, Grids, Trees and Variants, Lists, Skip lists, Hash, Trie, Union-Find and Variants	**5 hrs**
3	**Dynamic Programming:** Common and Typical Problem Sets, Idea and Intuition, Design of DP Problems	**5 hrs**
4	**Array Query:** Need, Types and Variants, Design and Philosophy, The Pathway From Lookup Table Fenwick Trees.	**5 hrs**
5	**Search Space Analysis:** Search Space, Graph Algorithms, Heuristic Space Analysis	**5 hrs**
6	**Problem Solving:** Assortment of Problems, CSES Problem Set	**5 hrs**

Text Books

1. Levitin A., “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2017.
2. Levitin A, Levitin M, “Algorithmic Puzzles”, First Edition, Oxford University Press, 2011.
3. Online Coding Platforms

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, MIT Press, 2010.

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
5.	ISA -I	30	25
6.	ISA – II	30	
7.	Lab Evaluation	20	10
8.	Course Project	30	15
		Total	**50**

Evaluation Scheme (ESA)

SL. No.	Section	Conducted for marks	Weightage in Marks
3.	Theory Exam (ESA)	60	25
4.	Lab Exam (ESA)	20	25
		20	
		10	
		Total	**50**

Lab Experiments:

Experiment No.	Concept	Hours
1	Design Techniques and Reflections	16
2	Mathematics in Competitive Programming	16
3	Dynamic Programming	16
4	Array Query and Case Studies	16
5	Search Space Analysis	16
6	Problem Assortments	16
7	CSES Problem Set	16

BACK

Program: Bachelor of Engineering			
Course Title: DevOps and MLOps		**Course Code: 23ECAE335**	
L-T-P: 0-0-2	**Credits: 3**	**Contact Hrs: 4 hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hrs:	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**	
1	**Introduction to DevOps and Version Control:** Overview of DevOps culture and tools Git basics – clone, commit, push, pull, branching, merging Using GitHub/GitLab for collaboration		**6 hrs**
2	**CI/CD and Build Automation:** Concepts of Git-based workflows, docker, Jenkins, Git Hub Actions, Building pipelines for applications, **Network Automation:** Automating infrastructure using Ansible, Terraform, Netmiko ,basics of IaC and zero touch provisioning.		**8 hrs**
3	**MLOps Foundations – Model Training and Versioning:** ML model training using tools like MLflow, DVC, TFX, Kubeflow pipelines.		**4hrs**
4	**ML Experiment Tracking and Model Deployment:** Tracking runs with MLflow – parameters, metrics, artifacts Model serving using Flask/FastAPI Testing endpoints with Postman		**6hrs**
5	**CI/CD for ML and Model Monitoring:** Automating ML workflows with Jenkins or GitHub Actions Model performance monitoring Logging and detecting data drift		**8 hrs**

Text Books:

1. G. Kim, J. Humble, P. Debois, and J. Willis, The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations, Portland, OR, USA: IT Revolution Press, 2016.
2. N. Forsgren, J. Humble, and G. Kim, accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations, Portland, OR, USA: IT Revolution Press, 2018.
3. M. Krief, Learning DevOps: Continuously Deliver Better Software, Birmingham, UK: Packt Publishing, 2019.

Reference Books:

1. N. Gift, Python for DevOps: Learn Ruthlessly Effective Automation, Sebastopol, CA, USA: O'Reilly Media, 2020.
2. B. Beyer, C. Jones, J. Petoff, and N. R. Murphy, Site Reliability Engineering: How Google Runs Production Systems, Sebastopol, CA, USA: O'Reilly Media, 2016.

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

In Semester Assessment (80%)	**Assessment**	**Weightage in Marks**
	Exercise (Problem execution, Viva, Observation Book, etc.)	15+15+10 = **40**
	Structured Enquiry	**20**
	Course Project	**20**
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

Lab Experiments:

Sl.no	Details of Experiment	No. of Lab. Slots per batch
1.	Git workflow (clone, commit, push, pull, branch) Set up a Jenkins pipeline / GitHub Actions workflow	1
2.	Containerization with docker: Build, tag, and run containers; DockerHub push/pull	1
3.	Infrastructure as Code: tools like terraform/ansible: Create simple IaC scripts for deploying web apps	2
4.	MLOps with tools like Jupyter, scikit-learn Train and evaluate a basic ML model	2
5.	Tools like DVC: Track data and models with DVC; version control setup	2
6.	ML Flow: Track and compare multiple training runs	2
7.	CI/CD for ML Models, Jenkins/GitHub Actions, Automate model testing and deployment	2
8.	Open Ended Activity	4

BACK

Program: Bachelor of Engineering		
Course Title: Microservice Architecture using Java		**Course Code: 24ECAE304**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Fundamentals of Microservices:** Introduction to microservice architecture, benefits and challenges, comparison with monolithic architecture, principles of microservice design, domain-driven design, service decomposition strategies, synchronous vs. asynchronous communication, RESTful APIs and HTTP, messaging systems and event-driven architecture	**6 hrs**
2	**Building Microservices with Java:** Introduction to Spring Boot, creating a simple microservice, dependency management with maven and gradle, database per service pattern, managing transactions across microservices, event sourcing, service registry and discovery, centralized configuration with spring cloud config	**6 hrs**
	Unit –II	
3	**API Gateway and Security:** Introduction to API gateway, implementing API gateway with spring cloud gateway, securing microservices with OAuth2, JWT authentication and authorization, importance of monitoring microservices, Implementing logging, distributed tracing.	**6 hrs**
4	**Testing and Deployment:** Unit testing and integration testing, contract testing, end-to-end testing strategies, containerization with Docker, orchestration with Kubernetes, auto-scaling in cloud environments.	**6 hrs**
	Unit –III	
5	**Case Studies and Best Practices:** Case studies, analysis of architecture choices, best practices in microservice development, common anti-patterns and how to avoid them, emerging trends and technologies, future of microservice architecture	**6 hrs**

Reference Books:

1. Irakli N, Ronnie M, “Microservice Architecture Aligning Principles, Practices, and Culture”, O'Reilly Media, Inc..
2. Shahir Daya, Nguyen Van Duy, “Microservices from Theory to Practice”, IBM Redbooks.
3. Binildas Christudas, “Practical Microservices Architectural Patterns: Event-Based Java Microservices with Spring Boot and Spring Cloud”, Apress.
4. Christian Posta, “Microservices for Java Developers”, O'Reilly Media, Inc.

Lab experiments:

Expt./ Job No.	Brief description about the experiment/job	No. of Lab. Slots per batch (estimate)	Marks	Bloom's level
12.	Setting Up Development Environment	1	-	3
13.	Basics of Java	2	-	3
14.	Building Your First Microservice	1	-	3
15.	Service Communication	1	-	3
16.	Service Discovery	1	-	3
17.	Configuration Management	1	-	3
18.	Securing Microservices	1	-	3
19.	Monitoring and Logging	1	-	3
20.	Exercise	3	20	3

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		
Course Title: Multicore architecture and Programming		**Course Code: 25ECAE334**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Multi-core Architecture:** Parallel Computing Platforms, Parallel Computing in Microprocessors, Multi-threading on Single-Core versus Multi-Core Platforms, Understanding Performance, Amdahl‟s Law, Growing Returns: Gustafson‟s Law, System Overview of Threading, Application Programming Models and Threading, Virtual Environment	**5 hrs**
2	**Fundamental Concepts of Parallel Programming:** Designing of Threads, Parallel Programming Patterns, Error Diffusion and Analysis, Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages,Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.	**5 hrs**
3	**Shared Memory programming: OpenMP:** A Portable Solution for Threading, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.	**5 hrs**
	Unit –II	
4	**Distributed memory programming:** MPI, Program Architecture, point to point communication, collective communications. Communicating objects, Node management, one sided communications, I/O considerations, combining MPI processes with threads, Timing and performance measurements, MPI Library, Debugging and profiling MPI Programs.	**5 hrs**
5	**GPU Programming:** CUDA programming model, Execution model, CUDA compilation process, memory hierarchy, optimization techniques, dynamic parallelism, profiling CUDA programs. Case study: Fractal set calculation, Block cipher encryption.	**5 hrs**
6	**GPU Programming:** OpenACC,HIP,OpenCL basics, OpenCL for Heterogeneous Computing, GPU Profiling and tools.	**5 hrs**

Text Books:

1. Shameem Akhter and Jason Roberts, Multicore Programming , Increased Performance through Software Multi-threading, Intel Press , 2010
2. GerassimosBarlas, "Multicore and GPU Programming: An Integrated Approach Paperback", 1st Edition, Morgan Kaufmann, 2015.
3. Robert(Bob) Robey,and Yuliana(Yulie) Zamora, Parallel and High performance computing, Manning publications, 2021.

Lab Experiments:

Expt./Job No.	Brief description about the experiment/job	No. of tutorial Slots per batch (estimate)	Marks
1	Explore OpenMP features, such as task parallelism, loop scheduling, and nested parallelism.	02	NA (Demo)
2	Apply OpenMP to parallelize image processing tasks like blurring, sharpening, or color conversion.	04	20
3	Real word application development using MPI	03	10
4	GPU-based word count, text search using CUDA programming	02	10
5	Add two large vectors in parallel using OpenCL.	01	10

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	34
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Semester – VII

Program: Bachelor of Engineering		Semester - VII
Course Title: Big Data and Analytics		Course Code: 24ECAC404
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/Week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 30	Tutorial/Practical: 28hrs	Exam Duration: 2 hrs

	Unit –I	
1	**Introduction:** Overview of Big data, Big Data Characteristics, Different Types of Data. Data Analytics, Data Analytics Life Cycle.	**4 hrs**
2	**Big Data Storage**: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices	**4 hrs**
3	**No SQL Database**: Document-oriented, Column-oriented, Graph-based, MongoDB.	**4 hrs**
	Unit – II	
4	**Big Data Processing**: Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce, Examples on MapReduce, Spark.	**6 hrs**
5	**Stream Processing:** Introduction to Stream Processing-Batch Versus Stream Processing; Examples of Stream Processing ; Scaling Up Data Processing; Distributed Stream Processing; Stream-Processing Model-Sources and Sinks, Immutable Streams Defined from One Another, Transformations and Aggregations, Window Aggregations, Stateless and Stateful Processing.	**6 hrs**
	Unit – III	
6	Big Data Analysis: Pig- Introduction, Pig Primitive Data Types - Running Pig - Execution Modes of Pig – HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive	**3 hrs**
7	**Big Data Visualization:** Hive – Introduction, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF). Serialization and Deserialization.	**3 hrs**

Text Books:

1. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques, Prentice Hall, 2015.
2. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley India Pvt Ltd 2014.
3. Gerard Maas and François Garillot, Stream Processing with Apache Spark Mastering Structured Streaming and Spark Streaming, O'REILLY,2019

Reference Books:

1. Frank J Ohlhorst, Big Data and Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012.
2. Colleen Mccue, Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis, Elsevier, 2007.

Credit: 1	***Big Data and Analytics Lab***
	Preamble: Data is created constantly, and at an ever-increasing rate. Mobile phones, social media, imaging technologies to determine a medical diagnosis—all these and more create new data, and that must be stored somewhere for some purpose. Devices and sensors automatically generate diagnostic information that needs to be stored and processed in real-time. Merely keeping up with this huge influx of data is difficult, but substantially more challenging is analyzing vast amounts of it, especially when it does not conform to traditional notions of data structure, to identify meaningful patterns and extract useful information. These challenges of the data deluge present the opportunity to transform business, government, science, and everyday life.
	Objective: The student should be able to use Big Data and Analytics Frameworks and tools for handling, processing, and analyzing huge datasets.
	Team size: Group of 3- 4
	Type: Each batch will work for one distinct application area

Sl. No.	Experiments	CO	Blooms level	Timeline w.r.t COE	PI code	Hrs	Marks
1.	Hadoop Installation Assignment of the following application areas to each batch: 1) Financial Data Analysis 2) Market-Basket Analysis 3) Telecommunication Industry 4) Health Care 5) Agriculture 6) Public Security 7) Bio-informatics Others	CO1	L3	1st &2nd week	1.4.1	4	Nil
2.	Problem Identification (10 M) a) Learning the domain (2M) b) Assessment of resources available(2M): i) Data ii) People iii) Technology iv) Time c) Framing the Problem (Identifying Issue to be addressed) (2M) d) Developing Initial Hypothesis (2M) Identifying potential Data sources (2M)	CO1	L3	3rd Week	2.3.1	2	10
3.	Data/File handling on DFS through NoSQL, Sharding, and Replication	CO2	L3	4th Week	2.3.1	4	Nil
4.	Data Preparation: (10M) a) Preparing the Analytic Sandbox (2M) b) Performing ETLT (2M) c) Data Conditioning (3M) Data Visualization (3M)	CO2	L3	5th & 6th Week	1.4.3	4	10

5.	Design and Model Selection	CO2	L3	7th & 8 th Week	2.3.1	4	10
6.	Implementation	CO3	L3	9th , 10th & 11th Week	5.3.1	6	10
7.	Presentation and Report	CO4	L3	12th Week	10.1.2	2	10
					Total	**28**	**50**

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	34
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**67**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		Semester - VII
Course Title: Cryptography & Network Security		Course Code: 24ECAC403
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 30	Tutorial/Practical: 28hrs	Exam Duration: 2 hrs

	Unit –I	
1	**Introduction:** Introduction, OSI Security architecture, Secure design principles, A model for network security, Classic Crypto: Substitution and Transposition ciphers, Taxonomy of Cryptography and Cryptanalysis.	**6 hrs**
2	**Cryptographic Algorithms:** Symmetric Key Crypto: Stream ciphers, Feistel Cipher, Block Ciphers-AES, DES, IDEA, Block cipher modes, Asymmetric Key Crypto: Knapsack, Diffie-Hellman, Elgamal cryptosystem, Elliptic Curve Cryptography	**6 hrs**
	Unit –II	
3	**Key management and User authentication:** Key management: Symmetric key distribution, Distribution of public keys, Kerberos, Symmetric key agreement, Public key distribution. User authentication: Overview, Passwords, Challenge response, Zero knowledge proof, Password cracking, Biometrics.	**6 hrs**
4	**Network access control and Cloud Security**: Network access control: Overview, Network access enforcement methods, Access Control Matrix, Multilevel Security Models, Multilateral Security, Firewalls, Intrusion detection system, Cloud Security: Cloud Security risks and countermeasures, data protection in cloud, cloud security as a service.	**6 hrs**
	Unit –III	
5	**Application and Transport Security Protocols:** Introduction, Pretty Good Privacy and S/MIME, Secure Socket Layer, Transport Layer Security, SSH.	**3 hrs**
6	**Network and Wireless Security Protocols:** IPSec overview, Encapsulating security payload, combining security associations, Internet key exchange, GSM Security, IEEE 802.11 Wireless LAN Security.	**3 hrs**

Text Book

1. William Stallings, Cryptography and Network Security Principles and Practices, 8th Edition, Pearson, 2020
2. Mark Stamp, “Information Security: Principles and Practices”, 3rd Edition, John Wiley and Sons, 2021.

References

1. Jonathan Katz and Yehuda Lindell, “Introduction to Modern Cryptography”, 3rd edition, CRC Press, 2020.
2. Behrouz A. Forouzan, “Cryptography and Network Security”, 6th Edition, Tata McGraw-Hill, 2015.

Laboratory Plan

Expt./Job No.	*Brief description about the experiment/job*	*No. of Lab. Slots (each lab 2 hours)*
1.	Demo and practice on Crypto Library	2
2.	Implementation of symmetric key algorithm	2
3.	Implementation of Asymmetric key algorithm and Hash functions	2
4.	Course project	8
Total number of hours		**14*2=28**

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	**Conducted for marks**	**Weightage in Marks**
ISA-1 (Theory)	30	34
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**67**

End-Semester Assessment Scheme

Assessment	**Conducted for marks**	**Weightage in Marks**
Theory	60	33
Total		**33**

BACK

Program: Bachelor of Engineering		Semester - VII
Course Title: Senior Design Project		Course Code: 22ECAW401
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs:	Tutorial/Practical: 42 hrs	Exam Duration: 3 hrs

Seventh semester senior design project theme: Usage of Design Principles in building the solution.

SDP aims to design and develop a solution using software design principles - design patterns (creational, behavioral & structural),
User experience (UX) design and API (application programming interface) that are generally followed in industries.

Project Domains:

Networking	Data Engineering	System Engineering
● Internet of Things ● Cloud Computing ● SDN (Software Defined Network) ● SNA(Social Network Analysis)	● Data Analytics *Data Processing:* ● Image and video processing ● Computer Vision and Graphics ● NLP(Natural Language Processing)	● Parallel Computing ● HPC (High Performance Computing) ● Parallel system design

Student Evaluation Matrix:

Project will have 3 internal reviews as follows:

Continuous internal Evaluation	Review Expectation
Review-1	Literature Survey, Problem Analysis and Problem formulation
Review-2	Requirements, Design, design principles adopted in modules/components and Algorithms.
Review-3	Implementation and Testing.

Scheme for End Semester Assessment (ESA)

Sl. No.	Expectation	Marks
1	Write up 1. Problem Statement and Objectives. 2. System design with brief description. 3. Concluding remarks.	05
2	Presentation: Prepare minimum of 15-18 slides of presentation with consultation of your respective guides.	05
3	Demo (Complete execution of the project with results) and Viva voce.	30
4.	Project Report.	10

BACK

Program: Bachelor of Engineering		Semester - VII
Course Title: CIPE & EVS		Course Code: 15EHSA401
L-T-P : Audit	Credits: Audit	Contact Hrs: 2 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 32		Exam Duration: 3 hrs

	Unit – I	
1	**Features of Indian Constitution:** Features of Indian Constitution, Preamble to the constitution of India, Fundamental rights under Part III – details of Exercise of rights, Limitations & Important cases. Berubari Union and Exchange of Enclaves, Kesavanand Bharati vs. UOI, Maneka Gandhi vs. UOI, Air India Ltd. vs. Nargees Meerza, T.M.A. Pai Foundation vs. St. of Karnataka, M.C. Mehta vs. UOI etc.,	**4 hrs**
2	**Relevance of Directive principles of State Policy:** Relevance of Directive principles of State Policy under Part IV, Fundamental duties & their significance. Sarla Mudgal v. UOI	**3 hrs**
3	**Union:** Union – President, Vice President, Union Council of Ministers, Prime Minister, Parliament & the Supreme Court of India.	**4 hrs**
4	**State:** State – Governors, State Council of Ministers, Chief Minister, State Legislature and Judiciary.	**2 hrs**
5	**Constitutional Provisions for Scheduled Castes & Tribes:** Constitutional Provisions for Scheduled Castes & Tribes, Women &Children & Backward classes, Emergency Provisions.	**2 hrs**
6	**Electoral process:** Electoral process, Amendment procedure, 42nd, 44th and 86th Constitutional amendments.	**2 hrs**
	Unit – II	
7	**Scope & Aims of Engineering Ethics:** Scope & Aims of Engineering Ethics: Meaning and purpose of Engineering Ethics, Responsibility of Engineers, Impediments to responsibility, Honesty, Integrity and reliability, risks, safety & liability in engineering. Bhopal Gas Tragedy, Titanic case.	**5 hrs**
8	**Intellectual Property Rights:** Intellectual Property Rights (IPRs)- Patents, Copyright and Designs	**3 hrs**
9	**Ethical perspectives of professional bodies:** Ethical perspectives of professional bodies- IEEE, ASME, NSPE and ABET, ASCE etc.	**3 hrs**
	Unit – III	
10	**Effects of human activities on environment:** Effects of human activities on environment - Agriculture, Housing, Industry, Mining, and Transportation activities, Environmental Impact Assessment, Sustainability and Sustainable Development.	**2 hrs**

11	**Environmental Protection:** Environmental Protection – Constitutional Provisions and Environmental Laws in India.	**2 hrs**

Text Books (List of books as mentioned in the approved syllabus)

1. Dr. J. N. Pandey, "Constitutional Law of India", Central Law Agency, 2005
2. Dr. M.K. Bhandari, "Law relating to Intellectual Property Rights", Central Law Publicaitons, Allahabad, 2010.
3. Charles E. Harris and others, "Engineering Ethics: Concepts and Cases", Thomson Wadsworth, 2003

References:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice-hall EEE, 2001
2. Mike Martin and Ronald Schinzinger, "Ethics in Engineering", Tata McGraw-Hill Publications.

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
Minor Exam-1	20
Minor Exam-2	20
Assignment	10
Total	50

BACK

Professional Electives- 4, 5 & 6

Data Intelligence

Program: Bachelor of Engineering		
Course Title: Advanced Computer Graphics		**Course Code: 22ECAE407**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6 hrs/week**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical : 84hrs**	**Exam Duration: -NA-**

***No Units**		
1	Review of Rasterization and Ray tracing	**3 hrs**
2	Rendering acceleration data structures	**3 hrs**
3	Applications of Texture mapping	**3 hrs**
4	Physically based lighting models, global illumination	**3 hrs**
5	Multi-pass shading techniques	**6 hrs**
6	Surface design and representation (Implicit and Parametric forms)	**3 hrs**
7	Mesh Parameterization	**6 hrs**
8	Mesh simplification	**3 hrs**
9	Animation	**3 hrs**
10	Virtual world design	**6 hrs**
11	Volume rendering	**3 hrs**

Reference Material:

1. Peter Shirley, Fundamentals of Computer Graphics, 2009, A. K. Peters
2. Tomas Akenine-Moller, Eric Haines, and Naty Hoffman, Real-Time Rendering, 2008, A.K. Peters.
3. Henrik Wann Jensen, Realistic Image Synthesis Using Photon Mapping, 2001, A.K. Peters.
4. Watt A. and M. Watt, Advanced Animation and Rendering Techniques Theory and Practice, 1994, Addison-Wesley.
5. Foley, J.D., A. van Dam, S. Feiner, and J. Hughes, Computer Graphics: Principles and Practice, Addison-Wesley, ISBN 0-201-12110-7. (Errata)
6. Neider, J., T. Davis, and M. Woo, OpenGL Programming Guide, Addison-Wesley, ISBN 0-201-63274-8.
7. Blinn J., A Trip Down the Graphics Pipeline. Jim Blinn's Corner, Morgan Kaufmann.
8. Luebke D., M. Reddy, J. Cohen, A. Varshney, B. Watson, R. Huebner, Level of Detail for 3D Graphics, 2003, Morgan-Kaufman.
9. Ebert D., F. Musgrave, D. Peachey, K. Perlin and S. Worley, Texturing & Modeling: A Procedural Approach 2e AP Professional.
10. Parent, R., Computer Animation: Algorithms and Techniques Morgan Kaufmann.
11. Hoffman, C. Geometric and Solide Modeling Morgan Kaufmann.
12. Graphics Gems I-V, AP Professional.
13.

14. Pharr, M., Jakob, W., and Humphreys, G. Physically Based Rendering: From Theory To Implementation.
15. Bretscher, O., Linear Algebra with Applications 2e Prentice Hall.

Scheme for End Semester Assessment (ESA): No ESA for the course

*Content and reference material as shared by IIT Delhi Professor

BACK

Program: Bachelor of Engineering		
Course Title: Social Network Analysis		**Course Code: 24ECAE405**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction:** Introduction: Motivation, different sources of network data, types of networks, tools for visualizing network data.	**6 hrs**
2	**Structural properties of networks:** Structural properties of networks: Notions of centrality, cohesiveness of subgroups, roles and positions, structural equivalence, equitable partitions, stochastic block models.	**10 hrs**
	Unit –II	
3	**Cascading properties of networks:** Cascading properties of networks: Information/influence diffusion on networks, maximizing influence spread, power law and heavy tail distributions, preferential attachment models.	**10 hrs**
4	**Small world phenomenon:** Small world phenomenon : Six Degrees of Separation, Structure and Randomness, Decentralized Search, Empirical Analysis and Generalized Models, Core-Periphery Structures and Difficulties in Decentralized Search, Advanced Material: Analysis of Decentralized Search.	**6 hrs**
	Unit –III	
5	**Mining Graphs- I:** Mining Graphs- I: Community and cluster detection: random walks.	**4 hrs**
6	**Mining Graphs- II:** Mining Graphs- II: Spectral methods; link analysis for web mining.	**4 hrs**

Text Books:

1. Stanley Wasserman, Katherine Faust, Social network analysis: methods and applications, Cambridge University Press, 1994.
2. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.

Reference Books:

1. Peter R. Monge, Noshir S, Contractor, Theories of communication networks, Oxford University Press, 2003.
2. Duncan Watts, Six degrees: the science of a connected age. Norton, 2004.

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**66**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	34
	Total	**34**

BACK

Program: Bachelor of Engineering		
Course Title: Information Retrieval		**Course Code: 24ECAE406**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 Hrs**

	Unit –I	
1	**Introduction to IR:** Nature of unstructured and semi-structured text, Inverted index and Boolean queries, Index Construction.	**4 hrs**
2	**Basic IR Models:** Vector space, Term Frequency / Inverted Document Frequency (TF-IDF), Probabilistic, Vector space scoring.	**4 hrs**
3	**Query Operations:** Relevance feedback, Query expansion.	**6 hrs**
	Unit –II	
4	**Performance Evaluation:** Unranked and ranked retrieval evaluation, test collections, evaluating search engines.	**4 hrs**
5	**Text Categorization:** Introduction to text classification, Rocchio, and Nearest Neighbor, Spam, Sentiment, and Online Advertising.	**4 hrs**
6	**Text Clustering:** Clustering Techniques, Analysis & Validation, Application Scenarios for Search Results and Database Clustering	**2 hrs**
	Unit –III	
7	**Search Engine and Link Analysis:** Web search basics, Web crawling and indexes. Search engine techniques, PageRank, Hubs and Authorities	**5 hrs**

Text Books:

1. Manning, Raghavan and Schutze, Introduction to Information Retrieval, Cambridge University Press, 2009**.**
2. B.Croft, D.Metzier and T. Strohman, "Search Engines Information Retrieval in Practice", Addison -Wesley, 2009.

Reference Books:

1. D. Grossman and O. Frieder, "Information Retrieval: Algorithms and Heuristics", Springer, 2004.
2. Ceri. S Bozzon, A; Brambilla, M ; Della Valle, E; Fraternali, ;Quarteroni, S "Web Information Retrieval", 2013.

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	**Conducted for marks**	**Weightage in Marks**
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**66**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	34
	Total	**34**

BACK

Program: Bachelor of Engineering			
Course Title: Multimodal Learning			**Course Code: 25ECAE416**
L-T-P: 2-0-1	**Credits: 3**		**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**		**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**		**Exam Duration: 3 hrs**
Unit –I			
1	**Introduction:** Introduction to modalities(Text,Audio and Image), Foundational principles in multimodal-Modalities are Heterogeneous, Modalities Interact		**3 hrs**
2	**Multimodal Representations:** Challenges in multimodality learning, Joint Multimodal Representation, Shallow multimodal representations, Deep Multimodal auto encoders, Deep Multimodal Boltzmann machines, Multimodal Joint Representation.		**6 hrs**
3	**Multi-modal alignment:** Explicit multimodal-alignment, Implicit multimodal-alignment, Temporal sequence alignment.		**6 hrs**
Unit –II			
4	**Multimodal Fusion:** Model Free-Early, late, hybrid, Model Based-Neural Networks		**6 hrs**
5	**Multimodal Generation:** Translation, Creation and Summarization		**6 hrs**
6	**Multimodal Applications:** Multimodal Image/video descriptions, Multimodal VQA, Multimodal speech synthesis, Multimodal emotion recognition, Multimodal image/video retrival.		**3 hrs**

References:

1. Jean- Philippe Thira, Ferran Marques, Hervk Bourlard, Multimodal Signal Processing Theory and Applications for Human-Computer Interaction,Academic Press, 2010.
2. M Yang, B Rosenhahn, V Murino, Multimodal Scene Understanding: Algorithms, Applications and Deep Learning, Academic Press Inc, 2019

Practical	Title	No. of Lab sessions/batch
1.	Multimodal Classification with Image + Text + Audio	02
2.	Multimodal video segmentation	02
3.	Multimodal sentiment analysis	02
4.	Multimodal alignment based application	02
5.	Multimodal generation based applications	02
6.	Course activity	02

Evaluation Scheme

Scheme of ISA Evaluation Scheme

Assessment	Weightage in Marks
ISA Theory	33
ISA Lab	33
Total	**66**

Scheme for Semester End Examination (ESA)

Assessment	Weightage in Marks
ESA Theory	34
Total	**34**

BACK

Program: Bachelor of Engineering		
Course Title: Quantum Computing		**Course Code: 25ECAE421**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Tutorial/Practical: --**	**Exam Duration: 3hrs**

	Unit –I	
1	**Introduction and Background:** Overview, Computers and the Strong Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation	**6 hrs**
2	**Linear Algebra and the Dirac Notation:** The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators, The Spectral Theorem, Functions of Operators, Tensor Products, The Schmidt Decomposition Theorem, Some Comments on the Dirac Notation	**6 hrs**
3	**Introduction to Quantum Toolbox in Python:** Installation, Basics and Quantum mechanics	**4 hrs**
	Unit –II	
4	**Qubits and the Framework of Quantum Mechanics:** The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations, Mixed States, Partial Trace, General Quantum Operations	**6 hrs**
5	**A Quantum Model of Computation:** The Quantum Circuit Model, Quantum Gates, 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits	**6 hrs**
6	**Problems and Project:** Exploring Python for Solving Problems / Projects using Quantum Computing.	**4 hrs**
	Unit –III	
7	**Introductory Quantum Algorithms:** Probabilistic Versus Quantum Algorithms, Phase Kick-back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm	**4 hrs**
8	**Case Studies and Projects done during the course**: Image processing, Data Sciences, Machine Learning, Networking	**4 hrs**

Text Books

1. Phillip Kaye, Raymond Laflamme and Michele Mosca "An Introduction to Quantum Computing ", Oxford University, Press, 2007
2. User Guide - Quantum Toolbox in Python, Release 4.2.0 – Qutip.org

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2**
III	Q.No.-7	7	Solve Any **1**
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		
Course Title: Agentic AI		**Course Code: 25ECAE426**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 hrs/Week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Agentic AI:** Concept of agency in AI: autonomy, proactivity, and goal orientation, Difference between traditional AI models and agentic systems, Components of agentic AI: perception, reasoning, learning, and action, Intelligent agent architectures (Reactive, Deliberative, Hybrid)	**7 hrs**
2	**Introduction to AI Agents and Learning and Adaptation of Agents:** What are AI Agents, Lang Graph Overview, Agent Architecture, Agent Autonomy, Reinforcement learning in agentic systems, Learning from environment and user feedback, Meta-cognition and self-adaptation in agents.	**8 hrs**
	Unit – II	
3	Agentic Planning and Decision Making : Goal modeling and reasoning, Planning under uncertainty, Integrating symbolic and sub-symbolic reasoning, Ethical and value-aligned decision making in agents.	**7 hrs**
4	Edge-Orchestrated LLM Agents: Implementing LLMs models using agentic frameworks like **LangChain, CrewAI and AutoGen**. Human-Agent Collaboration, Reinforcement Learning for Edge Adaptation, Multi-Agent Collaboration	**8 hrs**

Text Books:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig (4th Edition, 2020)
2. "An Introduction to MultiAgent Systems" by Michael Wooldridge (2nd Edition, 2009)
3. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto (2nd Edition, 2018)

Reference Books:

1 "Programming Multi-Agent Systems in AgentSpeak using Jason" by Rafael H. Bordini et al. (2007)

2"Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth (2nd Edition, 2017)

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**66**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	34
	Total	**34**

BACK

Networking and Security

Program: Bachelor of Engineering		
Course Title: AI for Cyber Security		**Course Code: 25ECAE419**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Cybersecurity:** Introduction to AI for Cybersecurity Professionals, Evolution in AI: from expert systems to data mining, Types of cyber threats: Malware, phishing, ransomware, DDoS, Case studies of major cybersecurity incidents	**5 hrs**
2	**Detecting Phishing and Spam Threats with AI:** Detecting spam with Perceptrons, Spam detection with SVMs, Phishing detection with logistic regression and decision trees, Spam detection with Naive Bayes, NLP to the rescue, Malware Detection using AI: Analysis of Malware, Hacking the PE file format, Decision tree malware detectors, Detecting metamorphic malware with HMMs, Advanced malware detection with deep learning	**10 hrs**
	Unit –II	
3	**Intrusion Detection System with AI**: Anomaly detection rationales, Turning service logs into datasets, Detecting botnet topology, Different ML algorithms for botnet detection	**10 hrs**
4	Fraud Prevention with Cloud AI Solutions : Introducing fraud detection algorithms, Predictive analytics for credit card fraud detection, IBM Watson Cloud solutions, Evaluating the quality of our predictions	**5 hrs**

Text Books:

1. Alessandro Parisi, "Hands-On Artificial Intelligence for Cybersecurity", Packt Publishing, 1st Edition, August 2019

References:

1. Emmanuel Tsukerman, "Machine Learning for Cybersecurity Cookbook", Packt Publishing, 2019
2. Clarence Chio, David Freeman, "Machine Learning and Security", O'Reilly Publishing, 2018

List of Experiments

Sl.no	Details of Experiment	No. of Lab. Slots per batch
1	Develop a spam email classifier using perceptrons and evaluate its accuracy.	1
2	Develop a phishing detection model using logistic regression and decision trees.	1
3	Analyze malware by hacking the PE file format and implementing a detection mechanism.	2
4	Create a metamorphic malware detection system using Hidden Markov Models (HMMs).	2
5	Build a dataset from service logs and perform anomaly detection using ML algorithms.	2
6	Detect botnet topology using a chosen machine learning algorithm.	2
7	Compare the performance of various machine learning algorithms for botnet detection.	2
8	Develop a neural network-based DDoS attacks system for real-time analysis.	2

Evaluation Scheme

Scheme of ISA Evaluation Scheme

Assessment	**Weightage in Marks**
ISA Theory	33
ISA Lab	33
Total	**66**

Scheme for Semester End Examination (ESA)

Assessment	**Weightage in Marks**
ESA Theory	34
Total	**34**

BACK

Program: Bachelor of Engineering			
Course Title: Mobile and Wireless Networks			**Course Code: 22ECAE412**
L-T-P:3-0-0	**Credits: 3**		**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**Total Marks: 100**
Teaching Hrs: 40			**Exam Duration: 3 hrs**
Unit –I			
1	**Introduction:** Characteristics of Cellular Systems, Fundamentals of Cellular Systems, Cellular System Infrastructure, Satellite Systems, Network Protocols, Ad Hoc Networks, Sensor Networks, Wireless LANs, MANs and PANs.		**4 hrs**
2	**Mobile Radio Propagation:** Introduction, Types of Radio Waves, Propagation, Mechanisms, Free Space Propagation, Land Propagation, Path Loss, Doppler Effect, Delay Spread, Intersymbol Interference, Coherence and width Cochannel Interference.		**6 hrs**
3	**Cellular Concept:** Introduction, Cell Area. Signal Strength and Cell Parameters, Capacity of a Cell, Frequency Reuse, How to Form a Cluster, Cochannel interference, Cell Splitting , Cell Sectoring.		**6 hrs**
Unit –II			
4	**Wireless LAN:** Infra-red vs radio transmissions; Infrastructure and ad-hoc network; IEEE 802.11 – system architecture, protocol architecture, physical layer, MAC layer, MAC management, 802.11b, 802.11a, HIPERLAN; Bluetooth		**8 hrs**
5	**4G Networks and Beyond:** Evolution from 1G to 4G and beyond; 4G, LTE; LTE OFDMA/SCFDMA; MIMO; LTE duplex; LTE frame and subframe; LTE-M; LTE-LAA/LTE-U; LTE Advanced – introduction, carrier aggregation, coordinated multipoint, D2D communication; Need for 5G; Technologies enabling 5G – mmWave, massing MIMO, beam-forming, network function virtualisation.		**8 hrs**
Unit –III			
6	**AI for Optimization of WiFi Networks**: WiFi Optimization Strategies: Dynamic Channel Assignment: Algorithms for minimizing interference. AI for Dynamic Channel Assignment, Traffic Prioritization: QoS management using WMM (Wi-Fi Multimedia), AI for Traffic Prioritization.		4 hrs
7	**AI driven 5G Optimization:** Network Slicing: Slice isolation and resource allocation. GNN for Network slicing, Beamforming: Techniques for improving directional communication, AI for beamforming.		**4 hrs**

Text Book (List of books as mentioned in the approved syllabus)

1. Dharma Prakash Agrawal, Qing –An Zeng , " Introduction to wireless and mobile systems", Cengage Learning, 2014.
2. Roy Blake, "Wireless communication technology", Cengage Learning, sixth Indian reprint 2013.
3. Singal T.L., "Wireless communication", Tata McGraw Hill Education private limited, 2011.

References

1. Wireless telecommunications systems and networks by Gray J. Mullet, Cengage Learning, Reprint 2014.
2. Upena Dalal, "Wireless communication" Oxford University press, first edition 2009.
3. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley Dreamtech India Pvt. Ltd., 2004.
4. Jochen Schiller, "Mobile Communications", Addision Wesley, 2nd Edition, 2011.
5. Radhika Ranjan Roy, "Networked Artificial Intelligence AI-Enabled 5G Networking, Auerbach Publications, 2024.

BACK

System and Software Development

Program: Bachelor of Engineering		**Semester -**
Course Title: C# and .NET		**Course Code: 25ECAE422**
L-T-P:2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction to C# & C# Basics**: .NET Framework Overview, CLR, Common Type System (CTS), Common Language Specification (CLS), Introduction to Visual Studio C# Basics – Data Types, Variables, Operators, Control Statements (if, switch, loops), Arrays, Strings, Enums, Structs	**06hrs**
2	**Object-Oriented Programming in C#**: Classes and Objects, Constructors, Inheritance, Polymorphism, Interfaces, Abstract Classes, Access Modifiers	**04hrs**
3	**Exception Handling and Collections**: try-catch-finally, Custom Exceptions, Collection Classes (List, Dictionary, Stack, Queue), Generics	**05 hrs**
	Unit –II	
4	**Windows Forms and GUI Programming**: Event Handling, Controls (TextBox, Button, Label, etc.), Dialogs, Menu Strip, Timer, List Box, Combo Box	**06 hrs**
5	**ADO.NET and Data Access**: ADO.NET Architecture, Connection, Command, DataReader, DataAdapter, DataSet, Performing CRUD with SQL Server	**04 hrs**
6	**Introduction to ASP.NET Core**: Web Applications with ASP.NET Core, Razor Pages, MVC Pattern, REST APIs with ASP.NET Core, Entity Framework Core	**05 hrs**

Text Books:

1. **Herbert Schildt**, *C# 8.0 and .NET Core 3.0*, McGraw-Hill Education, 2019.
2. **Andrew Troelsen and Philip Japikse**, *Pro C# 8 with .NET Core 3*, Apress, 2020.
3. **Adam Freeman**, *Pro ASP.NET Core MVC 2*, Apress, 2017.

Reference Books:

1. **Ben Albahari, Joseph Albahari**, *C# 9.0 in a Nutshell*, O'Reilly Media, 2021.
2. **Christian Nagel**, *Professional C# and .NET*, Wiley, 2021.
3. **Joydip Kanjilal**, *Mastering C# and .NET Framework*, Packt Publishing, 2016.
4. **Jon Skeet**, *C# in Depth*, 4th Edition, Manning Publications, 2019.
5. **Dino Esposito**, *Modern Web Development with ASP.NET Core 3*, Microsoft Press, 2020.

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Introduction to C# and Visual Studio – Setting Up the Environment, Basic Syntax, and First Console Application	01
2.	Data Types, Variables, and Operators in C# – Creating Programs that Use Arrays, Strings, and Enums	01
3.	Object-Oriented Programming in C# – Classes, Objects, Constructors, Inheritance, Polymorphism	02
4.	Exception Handling in C# – try-catch-finally, Custom Exceptions, and Debugging Techniques	01
5.	C# Collections – Using List, Dictionary, Stack, Queue, and Generics	01
6.	Windows Forms Application – Designing GUI Applications, Event Handling, Working with Controls (TextBox, Button, ListBox)	02
7.	ADO.NET – Connecting to SQL Server, CRUD Operations with DataReader and DataAdapter	01
8.	ASP.NET Core Web Application – Creating a Simple MVC Application with Razor Pages	01
9.	Building REST APIs with ASP.NET Core – Introduction to Web API, Handling GET, POST, PUT, DELETE	02
10.	Entity Framework Core – Database Integration, Creating Models, and CRUD Operations in ASP.NET Core	02

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA Theory	33
ISA Lab	33
Total	**66**

Evaluation Scheme

ESA Scheme

Assessment	Weightage in Marks
ESA Theory	34
Total	**34**

Program: Bachelor of Engineering			
Course Title: Robotic Process Automation Design & Development			**Course Code: 25ECAE423**
L-T-P:2-0-1	**Credits: 3**		**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**		**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**		**Exam Duration: 2 hrs**
Unit –I			
1	**Programming Basics & Recap:** Programming Concepts Basics - Understanding the application - Basic Web Concepts - Protocols - Email Clients -. Data Structures - Data Tables - Algorithms - Software Processes - Software Design - Scripting - .Net Framework - .Net Fundamentals - XML - Control structures and functions - XML - HTML - CSS - Variables & Arguments.		**6 hrs**
2	**Rpa Concepts:** RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.		**10 hrs**
Unit –II			
3	**Rpa Tool Introduction & Basics:** Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data		**8 hrs**
4	**Advanced Automation Concepts And Techniques**: Recording and		**8 hrs**

	Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.	
Unit –III		
5	**Email Automation & Exceptional Handling**: Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.	**8 hrs**

Text Books:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing
   Release Date: March 2018 ISBN: 9781788470940

Reference Books:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**

Program: Bachelor of Engineering			
Course Title: Software Testing		**Course Code: 25ECAE424**	
L-T-P:3-0-0	**Credits: 3**	**Contact Hrs: 03 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 40		**Exam Duration: 3 hrs**	
Unit – I			
1	**Software Testing Principles:** Need for testing, The Psychology and Economics of Program Testing Program, Inspections, Walkthroughs, and Reviews.		**4hrs**
2	**Test-Case Design:** Overview, White box testing, Error Guessing, strategies , Module (Unit) Testing-Incremental Testing, Top-down versus Bottom-up Testing, Performing the Test.		**6hrs**
3	**Higher-Order Testing**: Function testing, System testing, Acceptance testing, Installation testing, Test planning and Control, Test completion criteria, Extreme testing.		**6hrs**
Unit – II			
4	**Testing Tools and Standards:** Automated Tools for Testing - Static code analyzers - Test case generators - GUI Capture/Playback – Stress Testing - Testing Client – server applications – Testing compilers and language processors - Testing web-enabled applications.		**10hrs**
5	**CMM Model and its stages** – Introduction to PCMM, CMMI and Six Sigma concept – ISO 9000.		**6hrs**
Unit – III			
6	**Software Quality and Testing:** Introduction to software quality and quality control – Benefits of quality control - Quality assurance - quality circles and quality improvement.		**4hrs**
7	**Introduction to quality cost** – Measuring quality cost – Total Quality Management (TQM).Architecture, Process, memory and file management in Mobile OS, Network OS.		**4hrs**

Text Books:

1. Glenford J. Myers, Tom Badgett, Corey Sandler, and Todd M. Thomas, “The Art ofSoftware Testing”, John Wiley & Sons, Second edition, 2004.
2. Roger S. Pressman, “Software Engineering. A Practitioners Approach”, McGraw-HillInternational Edition, Seventh edition, 2009.

References:

1. William E. Perry, “Effective Methods for Software Testing”, John Wiley & Sons, Secondedition, 2000.
2. Boris Beizer, “Techniques for Functional Testing of Software and Systems”, John Wiley & Sons, 1995.
3. P.C. Jorgensen, “Software Testing - A Craftman's Approach”, CRC Press, 1995.
4. Boris Beizer, “Software Testing Techniques”, Van Nostrand Reinhold, Second edition,1990.

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2, 3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4, 5	Solve Any **2**
III	Q.No.-7, Q.No.-8	6, 7	Solve Any **1**

BACK

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Bachelor of Engineering		
Course Title: Software Architecture and Design Thinking		**Course Code: 25ECAE425**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 3 hrs**

	Unit – I	
1	**What Is Software Architecture?** What Software Architecture Is and What It Isn't, Architectural Structures and Views, Architectural Patterns, What Makes a "Good" Architecture?	**5 hrs**
2	**Why Is Software Architecture Important?** Inhibiting or Enabling a System's Quality Attributes, Reasoning About and Managing Change, Predicting System Qualities, Enhancing Communication among Stakeholders, Carrying Early Design Decisions, Defining Constraints on an Implementation, Influencing the Organizational Structure, Enabling Evolutionary Prototyping, Improving Cost and Schedule Estimates, Supplying a Transferable, Reusable Model, Allowing Incorporation of Independently Developed Components, Restricting the Vocabulary of Design Alternatives, Providing a Basis for Training	**6 hrs**
3	**The Many Contexts of Software Architecture:** Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?, What Do Architectures Influence?	**5 hrs**
	Unit - II	
4	**Understanding Quality Attributes:** Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions	**5 hrs**
5	**Quality Attributes:** Tactics for Availability, Tactics for Interoperability, Tactics for Modifiability, Tactics for Performance, Tactics for Security, Tactics for Testability, Tactics for Usability.	**6 hrs**
6	**Architectural Tactics and Patterns:** Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics and Patterns, Using Tactics Together	**5 hrs**

Unit – III		
7	**Architecture and Requirements:** Gathering ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding the Business Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together	**4 hrs**
8	**Designing an Architecture, Implementation, Testing and Evaluation Designing:** Design Strategy, The Attribute-Driven Design Method, The Steps of ADD, Implementation, and Testing: Architecture and Implementation, Architecture and Testing, Evaluation: Evaluation Factors, The Architecture Tradeoff Analysis Method, Lightweight Architecture Evaluation	**4 hrs**

Text Books (List of books as mentioned in the approved syllabus)

1. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice (3rd Edition), Addison-Wesley Professional; 3 edition
2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern- Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2012 (chapter 2)

References:

1. Richard N. Taylor, NenadMedvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley- India 2012
2. Mary Shawand David Garlan: Software Architecture-Perspectives on an Emerging Discipline, Prentice Hall of India, 2007.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		
Course Title: Advanced Parallel Computing		**Course Code: 22ECAE414**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 03 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction and History:** GPUs as Parallel Computers; Architecture of a Modem GPU; Parallel Programming Languages and Models; Overarching Goals; Evolution of Graphics Pipelines; The Era of Fixed- Function ; Graphics Pipelines; Evolution of Programmable Real-Time Graphics; Unified Graphics and Computing Processors; GPGPU; An Intermediate Step; GPU Computing; Scalable GPUs Recent Developments; Future Trends.	**7 hrs**
2	**Introduction to CUDA:** Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using b1ock Id x and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance.	**9 hrs**
	Unit –II	
3	**CUDA Memories:** Importance of Memory Access Efficiency; CUDA Device Memory Types; A Strategy for Reducing Global Memory Traffic; Memory as a Limiting Factor to Parallelism; Global Memory Bandwidth; Dynamic Partitioning of SM Resources; Data Prefetching; Instruction Mix; Thread Granularity; Measured Performance.	**7 hrs**
4	**Introduction to OPENCL:** Introduction to OPENCL; Background; Data Parallelism Model; Device Architecture; Kernel Functions; Device Management and Kernel Launch; Electrostatic Potential Map in OpenCL.	**9 hrs**
	Unit –III	
5	**Case Study:** Concepts of Game Design, Applications like Matrix multiplication, MRI reconstruction Molecular Visualization and Gaming.	**4 hrs**
6	**Parallel Programming and Computational Thinking:** Goals of Parallel Programming, Problem Decomposition, Algorithm Selection, Computational Thinking.	**4 hrs**

Text Books:

1. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands on Approach”, Morgan Kaufmann/Elsevier India reprint, 2010.

Reference Books:

1. Benedict R Gaster, Lee Howes, David Kaeli, Perhaad Mistry and Dana Schaa, "Heterogeneous Computing with OpenCl", Morgan Kaufmann/Elsevier reprint, 2012.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

BACK

Program: Bachelor of Engineering			
Course Title: Scalable AI		**Course Code:22ECAE415**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 40		**Exam Duration: 3 Hrs**	
Unit –I			
1	**Scaling Up Machine Learning:** Introduction, Machine Learning Basics, Reasons for Scaling Up Machine Learning, Key Concepts in Parallel and Distributed Computing, Platform Choices and Trade-Offs, Thinking about Performance		**4 hrs**
2	**MapReduce and the New Software Stack:** Distributed File Systems, MapReduce, Algorithms Using MapReduce, Algorithms Using MapReduce, Extensions to MapReduce, The Communication-Cost Model, Complexity Theory for MapReduce		**6 hrs**
3	**Finding Similar Items:** Applications of Set Similarity, Shingling of Documents, Similarity-Preserving Summaries of Sets, Locality-Sensitive Hashing for Documents, Distance Measures, The Theory of Locality-Sensitive Functions		**6 hrs**
Unit –II			
4	**Link Analysis:** PageRank, Efficient Computation of PageRank, Topic-Sensitive PageRank, Link Spam, Hubs and Authorities.		**5 hrs**
5	**Frequent Itemsets:** The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.		**6hrs**
6	**Clustering:** Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces		**5 hrs**
Unit –III			
7	**Parallel Online Learning:** Limits Due to Bandwidth and Latency, Parallelization Strategies, Delayed Update Analysis, Parallel Learning Algorithms, Global Update Rules		**4 hrs**
8	**Parallel Large-Scale Feature Selection:** Logistic Regression, Feature Selection, Parallelizing Feature Selection Algorithms, Scalable machine learning tools (Hadoop, Spark etc.)		**4 hrs**

Textbooks

1. Scaling Up Machine Learning, Bekkerman, R., Bilenko, M., Langford, J., (2011), Cambridge University Press
2. Mining of Massive Datasets. 2nd edition. - Jure Leskovec, Anand Rajaraman, Jeff Ullman. Cambridge University Press. http://www.mmds.org/

Reference Books

1. Hadoop: The definitive Guide. Tom White. Oreilly Press.
2. Tensorflow for Machine Intelligence: A hands on introduction to learning algorithms. Sam Abrahams et al. Bleeding edge press.

BACK

Semester – VIII

Industry Internship and Industry Project: Rules and Regulations

Total Duration: 5 months full time (No breaks)

1. Students of 8th semester are permitted to opt for full-time Industry Internship.
2. Internship duration is for one full semester. Student-intern is available with the Industry for full time
3. The internship has 2 mandatory components-- i) Internship- Training and
   ii) Internship - Project
   i) Internship- Training: Industry is free to decide topics for the training. E.g. topics such as learning tools/ framework/programming language /Industrial practices/ literature survey etc. or any pre- requisites required to carry out the Internship Project.
   ii) Internship Project: Industry has to assign a well-defined problem statement for the Project and shall provide an industry mentor (called as Industry Guide) to execute the project. University will also assign a University faculty as co-guide (called as University Guide). University guide in consultation with Industry Guide has to review the project progress at regular intervals using Skype/ Webex or personal visit to the industry.
4. Expectations at the end of the Internship
   a) Student has to submit 'Internship Training Report' & 'Internship Project Report' to the University. Contents of the Reports shall be decided in consultation with Industry Guide.
   b) The industry is expected to provide the student performance evaluation as follows:
      a) "Internship- Training" Marks (Out of 100)
      b) "Internship - Project" Marks (Out of 100)
      c) Industry shall issue Internship Certificate to student-intern.

Program: Bachelor of Engineering		Semester: VIII
Course Title: Internship Training		Course Code: 25ECAI493
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs:		Exam Duration: 3 hrs

Overview of the Course

Industry Training is a supervised, practical training periods for which Undergraduate, final year students earn academic credits. Industry Training provide excellent opportunities for students to put into practice much of the knowledge and skills acquired during their studies and to gain first-hand knowledge of the software industry. It is also an opportunity for employers to observe the student in the work environment and evaluate their potential for possible future employment.

The companies selected for the Industry Training can range from start-ups to large scale industries. The students who got placed in campus interviews may be offered Industry Training depending upon the need of the company. Other students who wish to do internship are responsible to find a company on their own for the Training.

Course Learning Outcomes.

CO 1. Enhance their employ ability skills and become job ready along with real corporate exposure.
CO 2. Acquire knowledge in one particular technology.
CO 3. Demonstrate leadership ability and responsibility to perform the given task.
CO 4. Offered jobs in the organizations in which they undergo their Industrial Training.
CO 5. Demonstrate common practices, employment opportunities and work ethics in their relevant

Scheme for in Semester Assessment(ISA) and End Semester Assessment (ESA)

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Training	22ECAI493	50	50	Students must secure minimum of 40% marks in both ISA and ESA.

BACK

Program: Bachelor of Engineering		Semester-VIII
Course Title: Internship Project		Course Code: 25ECAW494
L-T-P: 0-0-11	Credits: 11	Contact Hrs: 22 hrs/week
ESA Marks: 50	ISA Marks: 50	Total Marks: 100
Teaching Hrs: --		Exam Duration: 3 hrs

Overview of the Course

The purpose of providing the Industry Project is to give you the opportunity for students, to apply the knowledge, skills and competencies they have acquired, in real life practice. An Industry Project involves a stay in a relevant company or organization.

The students who got placed in campus interviews may be offered Industry Project depending upon the need of the company. Other students who wish to do Industry Project are responsible to find a company on their own.

Course Learning Outcomes.

CO 1. Identify the problem and perform requirement analysis

CO 2. Design potential solutions and evaluate to select optimal solution

CO 3. Apply professional norms of project implementation to meet specified requirements

CO 4. Apply fundamental activities of module, integration and system testing to validate the system

CO 5. Analyze results and present technical/scientific findings effectively through written and oral mode

Scheme for in Semester Assessment(ISA) and End Semester Assessment (ESA)

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Project	22ECAW494	50	50	Students must secure minimum of 40% marks in both ISA and ESA.

BACK

Program: Bachelor of Engineering		Semester - VIII
Course Title: Capstone Project		Course Code: 22ECAW402
L-T-P: 0-0-11	Credits: 11	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs: --	Tutorial/Practical: 42 hrs	Exam Duration: 3hrs

Course Content

Eighth Semester Capstone project: Design a suitable solution for the identified problem and apply professional norms of project implementation to meet specified requirements.

Project domains:

Networking	Data Engineering	System Engineering
Internet of Things • Cloud Computing • SDN (Software Defined Network) • SNA(Social Network Analysis)	Data Analytics *Data Processing:* • Image and video processing • Computer Vision and Graphics • NLP(Natural Language Processing)	Parallel Computing • HPC (High Performance Computing) • Parallel system design

Students Assessment through ISA (50%) + ESA (50%)

	Assessment	Weightage in Marks
Internal Semester Assessment* (50%)	Periodic reviews by Project Guide	25
	Periodic reviews by Committee	25
End Semester Assessment (50%)	Final Review	50
	Total	**100**

Student Evaluation Matrix:

Project will have 3 internal reviews as follows:

Continuous internal Evaluation	Review Expectation
Review-1	Motivation, Literature Survey, Problem Analysis and Problem formulation, Objectives, Oral Communication
Review-2	High Level Design/Methodology, Suitable data structures and programming paradigm, Modern tools & techniques used, Module implementation & integration, Presentation & Report
Review-3	Complete Project Demo, Report, Presentation / Paper Publication

Scheme for End Semester Assessment (ESA)

Sl. No	Expectation	Marks
1	Literature Survey/ Existing Methods	15
2	Methodology and Implementation details, Results and Discussions	20
3	Project demonstration.	10
4.	Relevance of project to ethical/ social/ legal/ economic concerns	05
	Total	**50**

BACK

Open Electives

Program: Bachelor of Engineering		
Course Title: Distributed and Cloud Computing		**Course Code: 22ECAO401**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 30	**Practical: 28 hrs**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Distributed System Models and Enabling Technologies:** Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	**4 hrs**
2	**Virtual Machines and Virtualization of Clusters:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management.	**4 hrs**
3	**Cloud Platform Architecture over Virtualized Data Centers:** Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	**4 hrs**
	Unit –II	
4	**Cloud Programming and Software Environments:** Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine.	**4 hrs**
5	**Cloud Resource Management:** Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time.	**4 hrs**
6	**Cloud Security:** Cloud security risks, Privacy; privacy impact assessment, Trust, Security of virtualization. Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	**4 hrs**
	Unit –III	
7	**Docker Containers:** Introduction, Docker swarm, Kubernetes.	**3 hrs**
8	**Building containerized applications:** Microservice architecture, building micro services and containerized applications.	**3 hrs**

Text Books:

3. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, Elsevier, 2013.
4. Dan C. Marinescu, Cloud Computing Theory and Practice, Elsevier, 2013.
5. Nigel Poulton, The Kubernetes Book, Packt Publishing, 2019.

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**66**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	34
Total		**34**

BACK

Program: Bachelor of Engineering		
Course Title: Database Management System		**Course Code: 22ECAO404**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction and ER Model:** Introduction to DBMS; Data Models, Schemas and Instances; Three-Schema Architecture; Database Languages; Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets. Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues.	**08 hrs**
2	**Relational Data Model and Relational Algebra:** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Binary Relational Operations: CARTESIAN PRODUCT, JOIN: Additional Relational Operations; Relational Database Design Using ER- to-Relational Mapping.	**08 hrs**
	Unit –II	
3	**SQL:** SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN operations; Complex SQL Queries, PL/SQL.	**08 hrs**
4	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	**08 hrs**
	Unit –III	
5	**Introduction to Transaction Processing:** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializibilty.	**04 hrs**
6	**Concurrency Control Techniques:** Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering.	**04 hrs**

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**66**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	34
Total		**34**

BACK

Program: Bachelor of Engineering			
Course Title: High Performance Computing for Engineering Applications			Course Code:22ECAO402
L-T-P: 3-0-0	Credits: 3		Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50		Total Marks: 100
Teaching Hrs: 40			Exam Duration: 3 hrs
Unit –I			
1	**Introduction to High Performance Computing:** Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies like CFD, Bioinformatics, Flow analysis etc.		**8 hrs**
2	**High Performance Computing Systems:** Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built		**8 hrs**
Unit –II			
3	**Parallel Algorithms:** Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques		**8 hrs**
4	**Parallel Programming:** Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI)		**8 hrs**
Unit –III			
5	**Achieving Performance:** Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks		**4 hrs**

6	**Case Studies and Projects done during the course:** Various case studies from various engineering discipline	**4 hrs**

Text Books

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
2. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

BACK

Program: Bachelor of Engineering		
Course Title: Essentials of Information Technology		**Course Code:22ECAO405**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical : 84hrs**	**Exam Duration: 3 hrs**

	Unit - I	
1	**Introduction to computer systems:** Components of computer systems, program execution cycle, computer networks, software and its classification, Operating System: introduction, memory management, process management, file management.	**6 hrs**
2	**Programming basics:** Introduction to problem solving, SDLC overview and need for object oriented approach, object oriented concepts, introduction to java, control structures, arrays, strings.	**6 hrs**
3	**Classes and Objects:** Class fundamentals, access specifiers, constructors and its types, method overloading, static members.	**4 hrs**
	Unit – II	
4	**Data structures:** Introduction, Linear data structures: stack, queue, linked lists, Non-Linear data structures: trees, binary search tree, illustration using java collection framework.	**5 hrs**
5	**Inheritance and Polymorphism:** Inheritance: basics, types of inheritance, method overloading and overriding, dynamic method dispatch.	**5 hrs**
6	**Packages, Interfaces and Exceptions:** Introduction to packages, access protection, interfaces, exception handling mechanism, and user defined exceptions.	**6 hrs**
	Unit - III	
7	**Database Design Process:** Characteristics of DBMS, ER model, mapping ER model to relational schema, normalization.	**4 hrs**
8	**Structured Query Language:** SQL data types, database languages, operators, aggregate functions, order by and group by clause, joins and sub queries.	**4 hrs**

Text Books:

1. Infosys Campus Connect Foundation Program Volume:1–3, Education and Research Department, Infosys Technologies Ltd, 2013.
2. Herbert Schildt, “Java The Complete Reference”, 8th Edition, McGraw-Hill, 2012.

Reference Books:

1. Elmasri. and Navathe, “Fundamentals of Database Systems”, 6th Edition, Pearson Education, 2011.
2. Silberschatz, Galvin, and Gagne, "Operating System Concepts", 8th Edition, Wiley, 2009.

Scheme for End Semester Assessment (ESA)

UNIT	Experiments to be set of 10 Marks Each	Chapter Numbers	Instructions
I	Project Examination	4 - 8	Project implementation and demonstration 20 marks

BACK

Program: Bachelor of Engineering			
Course Title: Software Engineering			**Course Code: 22ECAO403**
L-T-P: 3-0-0	**Credits: 3**		**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**Total Marks: 100**
Teaching Hrs: 40			**Exam Duration: 3 hrs**
Unit –I			
1	**Software Engineering process:** Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, The rational unified process, Continuous Integration and Continuous Deployment and Tools.		**6 hrs**
2	**Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management.		**4 hrs**
3	**Requirement Engineering:** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirement's elicitation and analysis; Requirements validation; Requirements management.		**6 hrs**
Unit –II			
4	**System Modeling:** Context models, Interaction Models, Structural models, Behavioral models.		**6 hrs**
5	**Architectural Design:** Architectural Design Decision, Architectural views, Architectural patterns, Application Architectures.		**5 hrs**
6	**Object-Oriented design and implementation:** Object oriented design using UML, design patterns, Implementation Issues, Open source development.		**5 hrs**
Unit –III			
7	**Software Testing:** Development Testing, Test Driven Development, Release Testing, User Testing.		**4 hrs**
8	**Configuration management:** Change management, Version management, System building, Release management.		**4 hrs**

Text Books:

1. Ian Somerville, Software Engineering, 9th, Pearson Ed, 2015

Reference Books:

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7th, McGraw,2007
2. Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering Theory and Practice, 3rd, Pearson Ed, 2006
3. Jalote, P, An Integrated Approach to Software Engineering, 3rd, Narosa Pub, 2005

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2, 3	Solve Any 2 out of 3
II	Q.No.-4, Q.No.-5, Q.No.-6	4, 5, 6	Solve Any 2 out of 3
III	Q.No.-7	7	Solve Any 1 out of 2
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		
Course Title: Big Data Analytics		**Course Code: 22ECAO406**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction:** Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	**4 hrs**
2	**Big Data Technologies:** Parallel Data Processing, Distributed Data Processing, Hadoop , Spark	**8 hrs**
3	**Nosql:** NoSQL Databases, Document databases, Key-value databases, Wide-column stores, Graph databases	**4 hrs**
	Unit –II	
4	**Big Data Modeling:** Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.	**8 hrs**
5	**MongoDB** – Introduction to MongoDB, RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.	**8 hrs**
	Unit –III	
6	**Big Data Visualization:** Hive - Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL).	**4 hrs**
7	**Big data applications and case study:** Stock market analysis, weather data analysis	**4 hrs**

Text Books:

1. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques, Prentice Hall, 2015.
2. Seema Acharya, Subhashini Chellappan, Big Data & Analytics, Wiley India Pvt Ltd 2014

Reference Books:

1. Frank J Ohlhorst, Big Data and Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012.
2. Colleen Mccue, Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis, Elsevier, 2007.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2, 3	Solve Any 2 out of 3
II	Q.No.-4, Q.No.-5, Q.No.-6	4, 5	Solve Any 2 out of 3
III	Q.No.-7	6	Solve Any 1 out of 2
	Q.No.-8	7	

BACK