KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Batch: **2022-2026**
School: **Computer Science and Engineering**
Program: **B.E- Computer Science and Engineering**

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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
PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
Program Specific Objectives -PSO's
PSO1: Software System Construction: Apply design and development principles in the construction of software systems of varying complexity.
PSO 2: Domain-specific knowledge: An ability to develop AI based solutions in the domain of data, system and network engineering.

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Curriculum Structure-Overall

CSE						Total Program Credit: 178(44+134)		Year: 2022-26	
Course with course code	I	II	III	IV	V	VI	VII	VIII	
	Single Variable Calculus 18EMAB101 (4-1-0)	Multivariable Calculus 18EMAB102 (4-1-0)	Graph Theory and Linear Algebra 15EMAB204 (4-0-0)	Applied Statistics with R 20EMAB209 (3-1-0)	Software Engineering 22ECSC301 (3-0-0)	Computer Networks-2 23ECSC303 (3-0-0)	Big Data & Analytics 24ECSC404 (2-0-1)	PE-6 XXECSE4XX (3-0-0)	Internship Training 25ECSI495 (0-0-6)
	Engineering Physics 22EPHB101 (3-0-0)	Engineering Chemistry 22ECHB102 (3-0-0)	Discrete Mathematical Structures 19ECSC202 (3-1-0)	Microcontroller: Programming & Interfacing 21ECSC206 (1-0-3)	Computer Networks-1 19ECSC302(3-1-0)	Cloud Computing 24ECSC305 (2-0-1)	Cryptography & Network Security (24ECSC403)(2-0-1)	OE XXECSO4XX (3-0-0)	
	Engineering Mechanics 15ECVF101 (4-0-0)	Problem Solving with Data Structures 18ECSP102 (0-0-3)	Computer Organization and Architecture 21ECSC201 (3-0-1)	Object Oriented programming 23ECSC204(3-0-0)	System Software 24ECSC302 (3-0-1)	Natural Language Processing and Gen AI 24ECSC307 (2-0-2)	PE-4 XXECSE4XX (3-0-0)	Capstone Project 20ECSW402 / Internship Project 25ECSW496 (0-0-11)	
	C Programming for Problem Solving 18ECSP101 (0-0-3)	Engineering Exploration 22ECRP101 (0-0-3)	Data Structures and Algorithms 23ECSC205(4-0-2)	Principles of Compiler Design 19ECSC203 (3-1-0)	Web Technologies Lab 24ESCP304 (0-0-2)	Computer Networks Lab 24ECSP305 (0-0-1)	PE-5 XXECSE4XX (3-0-0)		
	Basic Electrical Engineering 18EEEF101 (3-0-0)	Basic Electronics 18EECF101 (4-0-0)	Database Management System 15ECSC208 (4-0-0)	Operating System Principles and Programming 22ECSC202 (4-1-0)	Machine Learning and Deep Learning 24ECSC306 (2-0-2)	PE -2 XXECSE3XX (3-0-0)	Senior Design Project 20ECSW401 (0-0-6)		
	Design Thinking for Social Innovation 20EHSP101 (0-1-1)	Basic Mechanical Engineering 22EMEF101 (2-1-0)	Database Applications Lab 15ECSP204 (0-0-1.5)	Exploratory Data Analysis 21ECSC210 (2-0-2)	Mini Project 15ECSW301 (0-0-3)	PE -3 XXECSE3XX (3-0-0)	CIPE & EVS 15EHSA401 (Audit)		
	Applied Physics Lab (0-0-1) 21EPHP101	Professional Communication 15EHSH101 (1-1-0)		Object Oriented Programming Lab 20ECSP203(0-0-1.5)	PE-1 XXECSE3XX (3-0-0)	Minor Project 24ECSW302 (0-0-6)			
						Professional Aptitude & Logical Reasoning 16EHSC301 (3-0-0)			
			Corporate Communication 22EHSH201 (0.5-0-0)	Problem Solving & Analysis (22EHSH202) (0.5-0-0)	Arithmetical Thinking & Analytical Reasoning (23EHSA303) (Audit)	Industry Readiness & Leadership Skills (23EHSA304) (Audit)			
Credits	21	23	24	26	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**	

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

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	15EMAB204/* 15EMAB233	Graph Theory and Linear Algebra/ Graph Theory and Calculus	BS	4-0-0	4	4	50	50	100	3 hours
2	19ECSC202	Discrete Mathematical Structures	PC	3-1-0	4	5	50	50	100	3 hours
3	21ECSC201	Computer Organization and Architecture	PC	3-0-1	4	5	50	50	100	3 hours
4	23ECSC205	Data Structures and Algorithms	PC	4-0-2	6	8	100	0	100	3 hours
5	15ECSC208	Database Management System	PC	4-0-0	4	4	50	50	100	3 hours
6	15ECSP204	Database Applications Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
7	22EHSH201	Corporate Communication	HSS	0.5-0-0	0.5	1	100	0	100	3 hours
TOTAL				**18.5-1-4.5**	**24**	**30**	**480**	**220**	**700**	

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

*Note Graph Theory and Calculus (15EMAB233) offered only for diploma students

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	20EMAB209/ 15EMAB243	Applied Statistics with R/ Vectors Calculus and Linear Algebra	BS	3-1-0 /4-0-0	4	5/4	50	50	100	3 hours
2	21ECSC206	Microcontroller: Programming and Interfacing	PC	1-0-3	4	7	100	00	100	3 hours
3	23ECSC204	Object-Oriented Programming	PC	3-0-0	3	3	50	50	100	3 hours
4	19ECSC203	Principles of Compiler Design	PC	3-1-0	4	5	50	50	100	3 hours
5	22ECSC202	Operating System Principles and Programming	PC	4-1-0	5	6	50	50	100	3 hours
6	21ECSC210	Exploratory Data Analysis	PC	2-0-2	4	6	80	20	100	3 hours
7	20ECSP203	Object Oriented Programming Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
8	22EHSH202	Problem Solving & Analysis	HSS	0.5-0-0	0.5	1	100	0	100	3 hours
TOTAL				**16.5-3-6.5/ 17.5-2-6.5**	**26**	**36/35**	**560**	**240**	**800**	

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

*Note Vectors Calculus and Linear Algebra (15EMAB243) offered only for diploma students

Date: Program Head

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Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22ECSC301	Software Engineering	PC	3-0-0	3	3	50	50	100	3 hours
2	19ECSC302	Computer Networks-1	PC	3-1-0	4	5	50	50	100	3 hours
3	24ECSC302	System Software	PC	3-0-1	4	5	50	50	100	3 hours
4	24ECSP304	Web Technologies Lab	PC	0-0-2	2	4	80	20	100	3 hours
5	24ECSC306	Machine Learning and Deep Learning	PC	2-0-2	4	6	50	50	100	2 hours
6	15ECSW301	Mini Project	PW	0-0-3	3	6	50	50	100	3 hours
7	XXECSE3XX	Professional Elective-1	PE	3-0-0	3	3	50	50	100	3 hours
8	23EHSA303	Arithmetical Thinking & Analytical Reasoning	HSS	0-0-0	0	1	100	0	100	3 hours
9	*15EMAB303	Statistics and probability	BS	3-0-0	03	3	50	50	100	3 hours
TOTAL				**14-1-8/ 17-1-8**	**23/ 26**	**33/ 36**	**510/ 560**	**290/ 340**	**800/ 900**	

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

Note * Statistics and probability (15EMAB303) only for diploma students

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	23ECSC303	Computer Networks-2	PC	3-0-0	3	3	50	50	100	3 hours
2	24ECSC305	Cloud Computing	PC	2-0-1	3	4	67	33	100	2 hours
3	24ECSC307	Natural Language Processing and Gen AI	PC	2-0-2	4	6	50	50	100	2 hours
4	24ECSP305	Computer Networks Lab	PC	0-0-1	1	2	80	20	100	2 hours
5	XXECSE3XX	Professional Elective-2	PE	3-0-0	3	3	50	50	100	3 hours
6	XXECSE3XX	Professional Elective-3	PE	3-0-0	3	3	50	50	100	3 hours
7	24ECSW302	Minor Project	PW	0-0-6	6	12	50	50	100	3 hours
8	23EHSA304	Industry Readiness & Leadership Skills	HSS	0-0-0	0	1	100	0	100	2 hours
9	16EHSC301	Professional Aptitude & Logical Reasoning	HSS	3-0-0	3	3	50	50	100	3 hours
				16-0-10	**26**	**37**	**530**	**370**	**900**	

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

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	24ECSC404	Big Data & Analytics	PC	2-0-1	3	4	67	33	100	2 hours
2	24ECSC403	Cryptography & Network Security	PC	2-0-1	3	4	67	33	100	2 hours
3	XXECSE4XX	Professional Elective-4	PE	3-0-0	3	3	50	50	100	3 hours
4	XXECSE4XX	Professional Elective-5	PE	3-0-0	3	3	50	50	100	3 hours
5	20ECSW401	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**	**28**	**332**	**268**	**600**	

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

Date: Program Head

Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	XXECSE4XX	Professional Elective-6	PE	3-0-0	3	3	50	50	100	3 hours
2	XXECSO4XX	Open Elective	OE	3-0-0	3	3	50	50	100	3 hours
3*	25ECSI495	Internship Training	PW	0-0-6	6	12	50	50	100	3 hours
4	25ECSW496	Internship Project	PW	0-0-11	11	22	50	50	100	3 hours
	20ECSW402	Capstone Project								
TOTAL				**6-0-17**	**17**	**34**	**100**	**100**	**200**	

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

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

Date: Program Head

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	23	24	26	23	26	18	17	178

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List of Open Electives

Sr. No	Name of the Course	Course Code
1	Distributed and Cloud Computing (2-0-1)	15ECSO401
2	Database Management System (2-0-1)	15ECSO402
3	Software Engineering (3-0-0)	15ECSO403
4	High Performance Computing for Engineering Applications (3-0-0)	15ECSO404
5	Essential of IT (3-0-0)	15ECSO405
6	Big Data Analytics (3-0-0)	18ECSO401

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List of Program Electives

Sr. No	Name of the Course	Course Code
3rd Year (Professional Electives- 1, 2 & 3)		
Data Engineering		
1.	Signals & Systems (3-0-0)	21ECSE313
2.	Fundamentals of Image & Video Processing (2-0-1)	24ECSE312
3.	Computer Vision (2-0-1)	24ECSE317
4.	Neural Networks & Deep Learning (2-0-1)	24ECSE314
5.	Natural Language processing with Neural Network models(2-0-1)	24ECSE315
Networking		
1.	Multimedia Networks (3-0-0)	21ECSE311
2.	Informatica - Intelligent Data Management Cloud (1-0-2)	24ECSE322
3.	Cyber security (2-0-1) (old)	24ECSE318
4.	Cyber security (2-0-1)	24ECSE325
5.	Internet of Things(2-0-1)	24ECSE303
6.	Block chain and Distributed Ledgers (2-0-1) (old)	24ECSE316
7.	Block chain and Distributed Ledgers (2-0-1)	24ECSE324
8.	Security Operations (2-0-1)	24ECSE321
9.	Edge Computing (2-0-1)	24ECSE323
Systems Engineering		
1.	Computational Medicine (2-0-1)	24ECSE319
2.	The ARM Architecture (2-1-0)	19ECSE302
3.	Embedded Intelligent Systems (1-0-2)	24ECSE302
4.	Robotic Process Automation Design & Development (2-0-1)	24ECSE301
5.	Parallel Computing (3-0-0)	17ECSE307
6.	Quantum Computing (3-0-0)	17ECSE306
7.	Applied Computational Medicine (2-0-1)	24ECSE320
Electives for Skill Enhancement		
1.	Algorithmic Problem Solving (2-0-4)	24ECSE309
2.	Semantic Web(3-0-0)	19ECSE303
3.	DevOps (1-0-2)	24ECSE310
4th Year (Professional Elective – 4, 5 & 6)		
Data Engineering		
1.	Advanced computer vision (2-0-1)	25ECSE434
2.	Responsible AI (2-0-1)	25ECSE459
3.	Agentic AI (2-0-1)	25ECSE466
4.	Social Network Analysis (2-0-1)	25ECSE402

5.	Multimodal AI (2-0-1)	25ECSE460
6.	Business Intelligence (1-0-2)	25ECSE461
7.	Advanced computer graphics (0-0-3)	22ECSE433
Networking		
1.	Wireless and Mobile Networks (2-0-1)	25ECSE462
2.	Wireless Communication Networks (3-0-0)	22ECSE415
3.	Software Defined Networks (2-0-1)	25ECSE405
4.	Cloud Security (2-0-1)	25ECSE463
5.	Web Security (2-0-1)	25ECSE464
Systems Engineering		
1.	Software Architecture and Design Thinking (3-0-0)	18ECSE410
2.	Advanced Parallel Computing (3-0-0)	18ECSE408
3.	Compiler Optimization for HPC (3-0-0)	22ECSE431
4.	Quantum Computing fundamental (3-0-0)	22ECSE416
5.	Multicore Architecture and Programming (2-0-1)	25ECSE465
Electives for Skill Enhancement		
1.	C# Programming & .Net (3-0-0)	18ECSE409
2.	Model Thinking (3-0-0)	18ECSE411
3.	Software Testing (3-0-0)	18ECSE407
4.	Fuzzy Set Theory (3-0-0)	19ECSE402
5.	Unix Network Programming (1-0-2)	24ECSE404
	SWAYAM MOOC Courses	
1.	Social Network Analysis (3-0-0)	24ECSE405
2.	Software Testing (3-0-0)	24ECSE402
3.	Cyber Security and Privacy (3-0-0)	24ECSE401
4.	Advanced Computer Architecture	
5.	High Performance Scientific Computing	
6.	Human Computer Interaction	
7.	Introduction To Industry 4.0 And Industrial Internet Of Things	
8.	Privacy and Security in Online Social Media	
9.	Blockchain and its Applications	

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**	**Examination 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). **Mat Lab**: 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 **Mat Lab:** 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 **Mat Lab:** 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 **Mat Lab**: problems on arc length, area, volume and surface area.	**14 hrs**

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. **Mat Lab:** 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: 40
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs:40		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	**10 Hrs**

BACK

	Diode testing: Ohmmeter tests, use of digital meter, plotting diode characteristics. **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 (Text 2 Page No 868-969)	**10 Hrs**

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

Program: Bachelor of Engineering		**Semester - I**
Course Title: Engineering Mechanics		**Course Code: 15ECVF101**
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		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**

BACK

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.

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 : 6 Hrs./week**
ISA Marks: 80	**ESA Marks: 20**		**Total Marks: 100**
Teaching Hours : --	**Practical hrs : 84 hrs**		**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: 3 Hrs.**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40		**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 **(Person Paralyzed waist down / Glass Halh full Half Empty)** 3. Iteration	**Reading assignments** • Handout on " Create Mindsets"	• **(How to train the Dragon? Common Video for all the mindsets)** • **Watching in Class TED Talk on "How to build youir Creative**

		(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)**		**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** • Detailed interaction / engagements with the society and finalize the social issue for intervention	• 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 templates with the help of sample case study

			Use template 1: Frame your Design Challenge	
		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 • Create "How might we" question	**<u>Reading assignments</u>** • Handout on Overview of Ideation-Synthesis **<u>Class Presentations</u>** • Create insights • "How might we" questions	• Familiarization of the respective templates with the help of sample case study

			Use template 5: Create Insights **Template 6: Create "How Might We' Questions**	
		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** 7. **Conducting Yoga Classes** **(www.causevox.com / www.blog.fundly.com)** • Duration • Ethical concerns • Launch your solution	**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

		• Feedback (Impact)		
		5.0 Reflect Reflection of the overall learning by the students	**Reading assignments** • Handout on Overview of students Reflection **Use template 9: Reflection on the Process** **Class Presentations** 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:	Practical hrs: 28 hrs	Examination 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: 6 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Tutorial: 28 hrs**	**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 2nd law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations. **Mat lab:** application of differential equations	**(5+5) hrs**

Text Book :

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		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. Fabrication process: thermal oxidation, diffusion, ion implantation – numerical problems, epitaxial growth, masking and photolithography, wet etching, dry etching.	**09 hrs**

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.

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 :	**Practical: 84 hrs**	**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:	Practical hrs: 84 hrs.	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 Hours: 50		Examination 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 description, Frequency-Domain description. Generation of AM wave: square law modulator. Detection of AM waves: envelope detector. Double side band	**07 hrs**

	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: 4 hrs./week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs.: 30	Tutorial: 28 hrs.	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. • Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and	6	Design Problems like, aluminium can crusher Video presentations	5

	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.: 3 hrs./week**
ESA Marks: 50	**ISA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 20	**Tutorial: 28 hrs.**	**Exam Duration: 3 hrs.**

1	**Chapter No. 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	**Chapter No. 2. Vocabulary and grammar** Vocabulary, Word Formation and Active and Passive Voice	**6 hrs**
3	**Chapter No. 3. Bouncing Practice** Definition and types of bouncing and its practice with examples, reading skills, free style speech. Individual presentation.	**6 hrs**
4	**Chapter No. 4. Rephrasing and Structures** Comprehension and Rephrasing, PNQ Paradigm and Structural practice	**8 hrs**
5	**Chapter No. 5. Dialogues** Introduction of dialogues, Situational Role plays,	**3 hrs**
6	**Chapter No. 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: Graph Theory and Linear Algebra		**Course Code: 15EMAB204**
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		**Exam Duration: 3hrs**

	Unit –I	
1	**Graph theory:** Definitions and examples of graph, Subgraphs, Components, Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Colouring and Chromatic Polynomials.	**10 hrs**
2	**Trees:** Definitions, Properties, examples, Rooted trees and Binary rooted trees, preorder and post order traversals, sorting, spanning trees, prefix codes and weighted trees, Optimization and Matching- Dijkstra's shortest path algorithm, Minimum spanning trees, Kruskal and prim's algorithms.	**10 hrs**
	Unit –II	
3	**Matrices and System of linear equations:** Introduction to system of linear equations and its solutions, elementary row operations-echelon form, Rank of a matrix. Consistency of system of linear equation, solution of system of equations by (i) Direct methods-Gauss elimination, Gauss Jordon method (ii) Iterative methods- Guass-Seidal method. Eigen values and Eigen vectors of a matrix. Largest Eigen value and the corresponding Eigen vector by power method, Application case study.	**12 hrs**
4	**Vector space:** Vector spaces and sub spaces- examples, Linear combinations Spanning sets, subspaces, Linear spans Row space of a matrix, Linear dependence and linear independence. Basis and dimensions, application to matrices, Rank of a matrix. Sums and direct sums, Coordinates, Application case study.	**08 hrs**
	Unit –III	
5	**Fourier Series:** Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Coefficients of Exponential Fourier Series and Examples. Convergence of Fourier Series. Amplitude and phase spectra of a periodic signal Properties of Fourier Series(with proof): Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.	**10 hrs**

Text Books

1. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education, 2005.
2. Discrete Mathematics and its applications., Kenneth H Rosen, Mcgrawhill, 7ed, 2011
3. Discrete and Combinanatorial Mathematics by Ralph P.Grimaldi, Pearson Education, Asia, Fourth edition-2002.
4. Grewal B. S., Higher Engineering Mathematics, 39th Ed., Tata McGRAW Hill, New Delhi, 2005.

Reference Books:

1. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaums outline.
2. Theory and Problems of Combinatorics including concept of Graph Theory by V. K. Balakrishnan (Schaum's outline series), Mcgraw Hill, 1995
3. Graph Theory with Applications to Engineering and Computer SISAnce by NarsinghDeo, PHI publications (1986).
4. Simon Haykin, Barry Van Veen, Signals and Systems, John Wiley, 2002.

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	5	

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Discrete Mathematical Structures		Course Code: 19ECSC202
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: 28 hrs	Exam Duration: 3hrs

	Unit –I	
1	**Logic and Proofs:** Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates & Quantifiers, Nested Quantifiers, Rules of Inference and Introduction to Proofs.	**10 hrs**
2	**Functions and Relations:** Functions, Relations & their Properties , Representing Relations, Closures of Relations, Equivalence relations and Partial orderings.	**6 hrs**
	Unit –II	
3	**Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized Permutations & Combination, and Generating Permutations & Combinations.	**10 hrs**
4	**Recurrence Relations:** Applications of Recurrence Relations, Solving linear Recurrence Relations and Solving recurrence relation using Generating Functions.	**6 hrs**
	Unit –III	
5	**Groups:** Binary Operations, Semi groups, Products & Quotients of Semi Groups, Groups, and Product & Quotients of Groups.	**4 hrs**
6	**Number Theory :** Divisibility & Modular Arithmetic, Primes and Greatest Common Divisors, Solving Congruences and Applications of Congruences	**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

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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 Content:

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

BACK

Program: Bachelor of Engineering		Semester-III
Course Title: Computer Organization and Architecture		Course Code: 21ECSC201
L-T-P:3-0-1	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical: 28 hrs	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

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	4,5	Solve Any **2**
III	Q.No.-6	6	Solve Any **1**
	Q.No.-7	7	

Expt/ Job 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.	1-bit RAM Cell and building bigger RAM	01
5.	Design and simulation of main memory organization	01
6.	Design and simulation of main memory organization (contd...)	01
7.	Design and simulation of register organization	01
8.	Design and simulation of data path for processor design.	01
9.	Design and simulation of data path for processor design (contd...)	01
10.	Comparative study of contemporary processors	01

BACK

Program: Bachelor of Engineering		Semester - III
Course Title: Data Structures and Algorithms		Course Code: 23ECSC205
L-T-P: 4-0-2	Credits: 6	Contact Hrs: 8 hrs/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 50	Practical: 56 hrs	Exam Duration: NA

Unit –I		
1	**Foundations:** Design Philosophy and Intuitions, Space and time complexities, order of an algorithm, Problem patterns: recursion, iteration, backtracking	12 hrs
2	**Computing Principles and Tools:** Pruning, Edge relaxation, sets, Traversals, Prefix and Suffix, Union-Find, Hashing	12 hrs
3	**Structured Data Management:** Graphs and Trees, Tries, AVL Trees, 2-3 Trees, Red-Black Trees, DFS, BFS, Heap, Array Query, Spare table, Segment trees, Fenwick trees, Skip Lists	26 hrs
4	**Sorting and Searching:** Sorting and searching devices	16 hrs
5	**Graph Algorithms:** Shortest path and spanning trees	16 hrs
6	**Problem Assortments:** Problem types, Undecidability, Limitations of algorithm power	4 hrs

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Third Edition, the MIT Press, 2009.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

Reference Books:

1. Hemant Jain, Problem Solving Using Data and Algorithms Using C, Taran Technologies Private Limited, 2016.
2. HackerRank / CodeChef / SPOJ

BACK

Program: Bachelor of Engineering		Semester- III
Course Title: Database Management System		Course Code:15ECSC208
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		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. ShashankTiwari , 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: 15ECSP204
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:	Practical: 42 hrs	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%)

	Assessment	Weightage in Marks
Internal Semester Assessment (80%)	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: Corporate Communications		Course Code: 22EHSH201
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hrs: 1 hr/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 16		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

Program: Bachelor of Engineering		Semester- III
Course Title: Graph Theory And Calculus		Course Code: 15EMAB233
L-T-P: 4-0-0	Credits: 4	Contact hours:4hr/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching hours: 50		Exam Duration: NA

	Unit - 1	
1	**Graph theory:** Definitions and examples of graph, Sub-graphs, Components, Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Coloring and Chromatic Polynomials.	**10 hrs**
2	**Trees:** Definitions, Properties, examples, Rooted trees and Binary rooted trees, preorder and post order traversals, sorting, spanning trees, prefix codes and weighted trees, Optimization and Matching- Dijkstra's shortest path algorithm, Minimum spanning trees, Kruskal and prim's algorithms.	**10 hrs**
	Unit - 2	
3	**Differential Calculus:** Differentiation of standard functions of first and higher orders, Taylor's and Maclaurin's series expansion of simple functions for single variable	**9 hrs**
4	**Partial differential:** Function of several variables, Partial derivatives, Chain rule, Errors and approximations	**6 hrs**
5	**Integral Calculus:** Evaluation of integrals, properties, Beta and Gamma functions, relation between Beta and Gamma functions Approximate integration- Trapezoidal rule, Simpson's 1/3 rule, Multiple integrals, simple problems.	**5hrs**
	Unit - 3	
6	**Chapter No. 6. Differential equations** • Introduction, order and degree of equation, Solution of first order first-degree differential equations, variable separable methods, Linear differential equations, Bernoulli's equations, Initial value problems, Runge -kutta method for initial value problem • Differential equations of second and higher orders with constant coefficients	**10hrs**

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

1. Kenneth H Rosen, Discrete Mathematics and its applications, 7, Mcgrawhill.
2. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, 7, Pearson Education, 2011
3. Grewal B. S, Higher Engineering Mathematics, 39, Tata McGRAW Hill, 2002

References

1. Early Transcendental Calculus James Stewart, Thomson Book's 5E 2007
2. V. K.Balakrishnan, 2. Theory and Problems of Combinatorics including concept of Graph Theory, 4e, Mcgraw Hill, 1995
3. Narsingh Deo, 3. Graph Theory with Applications to Engineering and Computer Science, 4e, PHI publications, 1986.

BACK

Semester-IV

Program: Bachelor of Engineering		**Semester- IV**
Course Title: Applied Statistics with R		**Course Code: 20EMAB209**
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: 28 hrs**	**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 QuantitleQunatile plots	**08hrs**
2	**Probability:** Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Baye's rule, Applications: Data Classification Methods - Decision Tree Induction, Bayesian Classification.	**06hrs**
	R-tutorial: Introduction to Data handling ,Description of data graphically, Histogram, Skewness, Boxplot, QQ-norm, Decision tree	**08 hrs**
	Unit –II	
3	**Random variables and Probability Distribution** Random variables, simple Examples, Discrete and continuous random variables; Introduction to bivariate distribution, joint probability distribution, marginal distribution, covariance. Theoretical distributions: Binomial, Poisson, Normal.	**08 hrs**
4	**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	**08 hrs**
	R-tutorial: Probability distribution, Testing of Hypothesis for proportions, means(single and differences)	**08 hrs**
	Unit –III	
5	**Correlation and Regression5 hours:** Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression, Logistic Regression.	**05 hrs**
6	**Statistical Inference II:** Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure(Goodness of fit)	**05 hrs**
	R-tutorial: Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach	**04 hrs**

Text Books

1. 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.
2. Kishor S Trivedi, probability and statistics with reliability queuing and computer science applications, 1ed, PHI, 2000.

Reference Books:

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

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

Program: Bachelor of Engineering		**Semester- IV**
Course Title : Microcontroller Programming and Interfacing		**Course Code: 21ECSC206**
L-T-P:1-0-3	**Credits: 4**	**Contact Hrs: 7 hrs/week**
ISA Marks: 100	**ESA Marks: 0**	**Total Marks: 100**
Teaching Hrs: 20	**Practical: 84 hrs**	**Exam Duration: 3 hrs**

Module - I		
Lecture /Reading	**Introduction to Microcontroller and Embedded System:** Microcontrollers and General Purpose Microprocessors, Embedded System Features, Choosing a microcontroller, Criteria for choosing a microcontroller, Harvard and Von Neumann Architecture, Introduction to AVR Microcontroller and Arduino Family.	**01 hrs**
Hands on	Introduction to the hardware, setup, familiarizations with the working of the hardware	**03 hrs**
Lecture /Reading	**AVR Architecture and Assembly Language Programming on AVR Microcontrollers:** Simplified View of an AVR Microcontroller, Internal Architecture (Harvard) of AVR, Registers and Data Memory in AVR, Instruction format and size in AVR, Using Instructions with Registers and Data Memory, Watch Dog Timer, Flags and Special Function Registers, Data Formats and Assembler directive. Introduction to AVR Assembly Programming, Instruction Types and Instruction Set of AVR (Data Transfer Instructions, Branch Instructions, Bit and Bit test Instructions, Arithmetic and Logic Instructions, MCU Control Instructions, Jump and RET Instruction), Structure of Assembly Program in AVR, asm, lst, map and object files, Executing a program instruction by instruction, RISC Architecture features of AVR Microcontrollers, Viewing registers and memory with AVR Studio IDE.	**03 hrs**
Hand on	• Assembly programming on the hardware using appropriate SDK Set of programs to be given on various instruction types/ instruction set • HLL Python programming on the hardware	**21 hrs**
Review	Review I	**03 hrs**
Module –II		
Lecture /Reading	**AVR Time Delay:** Delay Calculation of AVR, AVR Multistage execution Pipeline, Timers/Counters, C Data Types	**02 hrs**
Hands on	AVR Timer/Counter Programming	**06 hrs**
Lecture /Reading	**AVR I/O Port Programming:** 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,	**02 hrs**

Hands on	I/O Port programming	**06 hrs**
Review	Review II	**03 hrs**
Module –III		
Lecture /Reading	**Interrupts in AVR and 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, Programming external interrupts,	**02 hrs**
Hands on	Interrupt Programming	**09 hrs**
Lecture /Reading	**AVR Serial Port Programming:** Basics of Serial Communication, RS232 standards, RS232 Pins, RS232 Handshaking Signals, ATMEGA32 connections to RS232, Baud Rate and UBRR Register, UDR register and USART, UCSR Registers and USART Configuration, Programming AVR for Serial Communication.	**01 hrs**
Hands on	Serial Communication programming	**06 hrs**
Review	Review III	**03 hrs**
Module –IV		
Lecture /Reading	**LCD and Keyboard Interfacing:** LCD Interfacing, Sending Commands and Data to LCD (4 Bits and/or 8 Bits at a time).	**02 hrs**
Hands on	Keyboard Interfacing, Matrix Keyboard connection to AVR Ports, Key Identification,	**06 hrs**
Lecture /Reading	**ADC, DAC and Sensor Interfacing:** Need for ADC and DAC in Interfacing, ADC Characteristics, ADC devices, and ATmega32 ADC features, Programming A/D Converter	**02 hrs**
Hands on	DAC Interfacing, Sensor Interfacing	**03 hrs**
Review	Review IV	**03 hrs**
Module –V		
Hands on	**Integration of the work done in various modules according to the problem statement**	**12 hrs**
Review	Review V	**03 hrs**

Text Books:

1. Mazidi M. A, NaimiSarmad, NaimiSepehr, ""The AVR Microcontroller and Embedded System using Assembly and C", Prentice Hall.

Reference Books:

1. J. M. Hughes, "Arduino A Technical Reference", O'Reilly

BACK

Program: Bachelor of Engineering		Semester- IV
Course Title: Object Oriented Programming		Course Code: 23ECSC204
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: 3hrs

	Unit –I	
1	**Introduction:** Introduction to object oriented programming. Characteristics of object oriented languages, Programming Basics, arrays, Functions in C++ (parameter passing techniques.)	**4 hrs**
2	**Classes and Objects:** Introduction to Classes and Objects, encapsulation visibility modifiers, constructor and its types, nested classes, String class Anonymous objects. UML diagrams to describe classes and relationships.	**6 hrs**
3	**Inheritance:** Introduction, types of Inheritance, constructors, Abstract class, Aggregation: classes within classes	**6 hrs**
	Unit –II	
4	**Virtual Functions and Polymorphism:** Pointers, Reference variables, Virtual functions, Friend functions, static functions, The 'this' pointer	**6 hrs**
5	**Exception Handling:** Introduction to exceptions, Throwing an Exception, Try Block, Exception Handler (Catching an Exception), Multiple exceptions. Exceptions with arguments, Built-in exception class hierarchy.	**6hrs**
6	**Templates :**Operator overloading, Function and class templates,Smart pointers	**4 hrs**
	Unit –III	
7	**Design Patterns:** Creational, Structural and Behavioural design patterns.	**4 hrs**
8	**Standard Template Library:** container classes**:** Sequence and Associative Containers, Lambda Expressions, Move semantics	**4 hrs**

Textbooks

1. Robert Lafore, Object oriented programming in C++, 4th Ed, Pearson education, 2001

Reference Books

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5Ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Ed, Tata McGraw Hill, 2017

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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		Semester- IV
Course Title: Principles of Compiler Design		Course Code:19ECSC203
L-T-P:3-1-0	Credits: 4	Contact Hrs: 05 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial: 28 hrs	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.	**06hrs**
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	**06hrs**
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	Top down parsing.	01
5	Bottom up parsing.	02
6	Implementation of lexical & syntax analyzer using LEX and YACC tools.	02
7	Design of CFG for validating Natural languages and implement the same.	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: Operating Systems Principles and Programming		Course Code:22ECSC202
L-T-P: 4-1-0	Credits: 5	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50 + 26	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.	**5 hrs**
8	**Case study:** Windows 10, Design Principles, System Components Influential Operating Systems: Macintosh Operating System and IBM OS/360	**5 hrs**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 9 ed., Wiley-India, 2019.
2. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3 ed. Addison Wesley Professional, 2018xv6: Programming from the Ground Up, Jonathan Bartlett Edited by Dominick Bruno, Jr 2021

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
   Marc J. Rochkind, "Advanced Unix Programming", 2 ed., Pearson Education, 2005.

List of Experiments

S. No	Experiment
1	Demonstration of UNIX commands related to processes, files and memory
2	The xv6 operating system, Processes in xv6,
3	Process Management: Implementation of System Call on xv6, Add a new system call in xv6
4	Inter Process Communication (IPC): Pipes and FIFO
5	Process synchronization

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: Exploratory Data Analysis		Course Code: 21ECSC210
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 6 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 30	Practical: 56 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction and scientific python:** Ecosystem for data science, basic python, numerical and vectorized computation, data manipulation, data visualization.	**10 hrs**
2	**Exploratory Data Analysis:** Types of data: categorical, numerical, probability distributions , Descriptive statistics, univariate and multivariate statistics, advanced data visualization, Case study	**10 hrs**
	Unit –II	
3	**Data Pre-Preprocessing:** Data cleaning, data integration, dimensionality reduction: feature selection and feature extraction, data transformation	**10 hrs**
4	**Supervised Learning:** Linear and logistic regression, naïve Bayes classifier, K-nearest neighbours	**10 hrs**
5	**Clustering:** Partitioning-based, hierarchical clustering, density-based clustering	**10 hrs**
	Unit –III	
6	**Time-series analysis**: Autocorrelation, time-series forecasting, auto regressive moving average models.	**10 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, Packt Publishing Limited, 27 March 2020.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Lab Exam on Course Project	1, 2	Demonstration of Course Project
II		3,4,5	
III		6	

BACK

Program: Bachelor of Engineering		Semester- IV
Course Title: Object Oriented Programming Lab		Course Code: 20ECSP203
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:	Practical: 42 hrs	Exam Duration: 3hrs

Experiments Number	Lab assignments/experiment	Number of Slots
1	Demonstration: Introduction to Code Blocks IDE (Integrated Development Environment), C++ programming basics.	4
2	Exercise: Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling	4
3	Structured Enquiry: Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling	2
4	Open Ended: Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns	2

Text Book:

1. Robert Lafore, "Object oriented programming in C++", 4thEd, Pearson education, 2001

Reference Books:

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5Ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Ed, Tata McGraw Hill, 2017

Evaluation:

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

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

BACK

Program: Bachelor of Engineering		Semester- IV
Course Title: Problem Solving and Analysis		Course Code: 22EHSH202
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hrs: 1hr/week
ISA Marks: 100	ESA Marks: NA	Total Marks: 100
Teaching Hrs: 16		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

Diploma Course

Program: Bachelor of Engineering		**Semester- IV**
Course Title: Vectors Calculus and Linear algebra		**Course Code:15EMAB243**
L-T-P: 4-0-0	**Credits:4**	**Contact Hours: 4hr/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50		**Exam Duration: 3hrs**

	Unit - 1	
1	**Vector Algebra:** Vector addition, multiplication (Dot and Cross products), Triple products	**4hrs**
2	**Vector differentiation:** Vector functions, Vector differentiation, Velocity and Acceleration of a vector point function, Vector fields, Gradient and directional derivatives.	**6hrs**
3	**Vector Integration:** 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.	**10hrs**
	Unit - 2	
4	**Matrices and System of linear equations**: Introduction to system of linear equations and its solutions, elementary row operations-echelon form, Rank of a matrix. Consistency of system of linear equation, solution of system of equations by • Direct methods-Gauss elimination, Gauss Jordon method Iterative methods- Guass-Seidal method. Eigen values and Eigen vectors of a matrix. Largest Eigen value and the corresponding Eigen vector by power method, Application case study.	**12 hrs**
5	**Vector space:** Vector spaces and sub spaces- examples, Linear combinations Spanning sets, subspaces, Linear spans Row space of a matrix, Linear dependence and linear independence. Basis and dimensions, application to matrices, Rank of a matrix. Sums and direct sums, Coordinates, Application case study.	**08 hrs**
	Unit - 3	
6	**Integral Transforms:** Laplace transformation and its applications Fourier transforms, Discrete Fourier transforms and its applications	**10 hrs**

Text Book:

1. Grewal B S, Higher Engineering Mathematics, 38ed, Khans Publication, New Delhi, 2001
2. Bali and Iyengar, A text book of Engineering Mathematics, 6ed, Laxmi Publications(p) Ltd, New Delhi,200

References Books:

1.Early Transcendental Calculus- James Stewart, Thomson Books, 5e 200

BACK

Semester – V

Program: Bachelor of Engineering		Semester-V
Course Title: Software Engineering		Course Code: 22ECSC301
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: 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.	**04 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.	**07 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 ipeline , 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**

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	

BACK

Program: Bachelor of Engineering		Semester-V
Course Title: Computer Networks – I		Course Code: 19ECSC302
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 Hrs: 28	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction:** 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. Networks Attacks.	**8 hrs**
2	**Application Layer:** Principles of Network Applications; The Web and HTTP; Electronic Mail in the Internet - SMTP; The Internet's Directory Service – DNS; Dynamically configuring a host – DHCP; Peer-to-peer applications	**8 hrs**
	Unit –II	
3	**Transport-Layer Services:** Introduction, Connectionless Transport, Principles of Reliable Data Transfer Protocol, Connection-Oriented and Connectionless Transport, Principle of Congestion Control, TCP Congestion Control.	**8 hrs**
4	**Network Layer: Data plane:** Introduction to Data and Control Plane, Virtual Circuit and Datagram Networks, Internet Protocol: Datagram Format, Fragmentation, IP Addressing	**8 hrs**
	Unit –III	
5	**Network Layer: Data plane:** NAT, IPv6, Software Defined Network(SDN)	**4 hrs**
6	**Network Layer: Control Plane and Network Management:** SDN Control Plane, Network Management and SNMP	**4 hrs**

Text Books:

1. J. F. Kurose, K. W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education, 2017.

Reference Books:

1. Peterson, Larry L, Computer networks: A Systems Approach, 5th Edition, The Morgan Kaufmann series in networking, 2012
2. Behrouz A. Forouzan, TCP/IP protocol suite, 4th, McGraw Hill, 2010.

Computer Networks-I Tutorial

Sl. No	Exercise	No of Slots (2 hrs/per week)
1	Demonstration of n/w commands and tools in command prompt.	1
2	Demonstration of Cisco Packet Tracer network tool: usage of hub, switch, and a router using a simple topology	2
3	Application layer protocol implementation – Manual configuration and DHCP	1
4	Application layer protocol implementation - DNS and HTTP	1
5	Application layer protocol implementation - SMTP	1
6	Demonstration of static routing using Cisco Packet Tracer	1
7	Assessment – 1 (Demonstration of a given topology using Cisco Packet Tracer)	1
8	Demonstration of socket programming using a simple message board application - Connection oriented and connectionless.	2
9	Demonstration of simple banking application using connection oriented socket programming.	1
10	Demonstration of a simple calculator application using connectionless socket programming.	1
11	Assessment – 2 (Implementation of a given application using socket programming)	1
12	Exercise on usage of Wireshark tool to capture packets in the network.	1
		14 Slots

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**
	Q.No.-7	5	

BACK

Program: Bachelor of Engineering		Semester-V
Course Title: System Software		Course Code: 24ECSC302
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial: 28 hrs	Exam Duration: 3hrs

	Unit – I	
1	**Introduction to Machine Architecture:** Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC and SIC/XE Programming Examples.	**6 hrs**
2	**Assembler:** Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features- Instruction Formats & Addressing Modes, Program Relocation.	**10 hrs**
	Unit – II	
3	**Assembler M/c Independent Features and Design options:** Machine Independent Assembler Features: Literals, Symbol Defined Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Options: One Pass Assembler, Multi Pass Assembler, Implementation Example: Assembler (8086): MASM.	**8 hrs**
4	**Loaders and Linkers:** Basic Loader Functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Machine Dependent Loader Features: Relocation, Program Linking, Algorithm and Data Structures for a Linking. Loader M/c Independent Features: Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, and Implementation Example: 8086 Linker.	**8 hrs**
	Unit – III	
5	**Chapter 5. Macro Processor:** Basic Macro Processor Functions: Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features: Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Implementation Example: 8086 Macro Processor.	**4 hrs**
6	**Back end of Compiler**: Code generation and Machine dependent features Revisit of phases of compilers, code generation routines, machine-dependent optimization features	**4 hrs**

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

1. Leland.L.Beck and D. Manjula, System Software, 3rd edition, Pearson Education, 2011.

References

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, 2nd edition, Addison-Wesley, 2011.
2. John J. Donovan, "System Programming", 2nd Ed., Tata McGraw Hill, 2009.
3. D. M. Dhamdhere, "System Programming and Operating Systems", 2nd Ed., Tata McGraw Hill, 2011

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

	Assessment	Weightage in Marks
ISA Scheme (50 Marks)	ISA I	15
	ISA II	15
	Lab Assessment	20
	ISA Total	50
ESA Scheme (50 Marks)	**Regular end semester exam**	50
Total		**100**

Lab Schedule

S. No	Topics	Lab slots
1	Practice programs on file handling	1
2	Tokenization for SIC assembly program	1
3	Implementation of Pass 1 Assembler.	1

BACK

Program: Bachelor of Engineering		Semester-V
Course Title: Web Technologies Lab		Course Code: 24ECSP304
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs:	Practical Hrs: 56	Exam Duration: 3hrs

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	02
2	Exercise on HTML, JavaScript, CSS JavaScript	01
3	Demonstration on Node	02
4	Demonstration on React	03
5	Exercise on React	02
6	Structured enquiry – NodeJs	01
7	Course Project	03

BACK

Program: Bachelor of Engineering		Semester- V
Course Title: Machine Learning and Deep learning		Course Code: 24ECSC306
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	Practical Hrs: 56	Exam Duration: 2 hrs

	Unit –I	
1	**Introduction and Regression:** Fundamentals of ML, linear, ridge, lasso, elastic-net regression, evaluation.	**07 hrs**
2	**Classification**: Linear discriminant analysis, logistic regression, support vector machines, decision tree, extra trees, Bayesian networks, evaluation.	**07 hrs**
3	**Ensemble learning:** Bagging, boosting, stacking, random forest, resampling methods, regularization for linear and logistic regression.	**06 hrs**
	Unit –II	
4	**Neural networks:** Perceptron, gradient descent, optimization algorithms, backpropagation, hyper parameters, regularization.	**07 hrs**
5	**Deep neural networks:** convolutional neural networks, various CNN architectures, model selection and evaluation, bias-variance.	**07 hrs**
6	**Seq2Seq models:** Recurrent neural networks, long short-term memory, auto encoders.	**06 hrs**

Reference Books:

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning, MIT Press,2016.
3. Aurelian Gerona, Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Concepts, Tools, and Techniques to Build Intelligent Systems, Publisher: O'Reilly Media, July 2016.
4. Luca Pietro Giovanni Antiga, Thomas Viehmann, Eli Stevens, Deep Learning with PyTorch Manning Publications, 2020.

List of Experiments:

Expt. No.	Experiments	No. of Slots
1	Introduction to Regression, regularization	2
2	Classification algorithms	2
3	Ensemble learning models	2
4	Perceptron networks, neural network training	2
5	Convolutional Neural Networks, State-of-the-art DNN models	2
6	Sequence models	2
7	Course Project	2

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,Q. No- 4	1, 2,3	Solve Any **3**
II	Q.No.-5, Q.No.-6, Q.No.-7,Q.No-8	4,5,6	Solve Any **3**
III	Lab exam	1,2,3,4,5,6	Lab exam evaluation

BACK

Program: Bachelor of Engineering		Semester- V
Course Title: Mini Project		Course Code: 15ECSW301
L-T-P: 0-0-3	Credits: 3	Contact Hrs: 3 hrs/week
CIE Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs:	Practical Hrs: 42 hrs	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
3	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

Program: Bachelor of Engineering			
Course Title: Statistics and Probability			**Course Code: 15EMAB303**
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: 28 hrs**		**Exam Duration: 3 hrs**
Unit –I			
1	**Description of Data:** Introduction - Data, Variables, Graphical representation and interpretation of data, Measure of Skewness, Comparison of data sets using central tendency and dispersion, Choice of suitable measure for data analysis.		**05 hrs**
2	**Correlation and Regression:** Meaning, scatter diagram, Karl Pearson's coefficient of correlation, Limits of correlation coefficient. Linear regression, regression coefficients, properties, Angle between two regression lines, Examples		**05 hrs**
3	**Probability:** Introduction-Definition, Axioms, addition and multiplication rule of probability (without proof), conditional probability, Baye's rule – examples		**06 hrs**
Unit –II			
4	**Theoretical distributions:** Random variables-simple Examples, Discrete and continuous random variables; Theoretical distributions: Binomial, Poisson, Exponential, Normal, Uniform		**06 hrs**
5	**Sampling distributions:** Introduction-Sampling, Sampling distribution, Standard error, Null and alternate hypothesis, Type-I and Type-II errors, level of significance, Confidence limits for means, testing of hypothesis for means; large and small samples, Student's t-test and F-test.		**10 hrs**
Unit –III			
6	**Tests of Hypothesis – 2: 6.1** Test for coefficient of correlation, Chi-square test for goodness of fit, test for dependence of attributes **6.2** ANOVA -one way and two way.		**08 hrs**

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

1. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 11th Ed, Sultan Chand & Sons, New Delhi, 2000.
2. 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.

References

1. Murray R Spiegel et al, theory and problems of Probability and Statistics, 2ed. McGraw Hill, Schaum's Outline series, 2004.
2. Miller, Freud and Johnson, Probability and Statistics for Engineering, 5ed, PHI publications, 2000.
3. Kishor S Trivedi, probability and statistics with reliability queuing and computer science applications, 1ed, PHI, 2000.

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, Q.No-8	6	Solve Any **1** out of **2**

BACK

Semester - VI

Program: Bachelor of Engineering		**Semester: VI**
Course Title: Computer Networks - 2		**Course Code: 23ECSC303**
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	**Network Layer- Routing Algorithms:** 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.	**8 hrs**
2	**Network Layer – Queuing theory:** Router structure, Buffering strategies: Input queuing, Output queuing, Application of queuing theory for performance of queuing mechanisms: M/M/1 system, M/M/m system, M/M/1/B system.	**8 hrs**
	Unit –II	
3	**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, 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.	**8 hrs**
4	**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).	**8 hrs**
	Unit –III	
5	**Wireless and Mobile Networks:** Wireless Links and Network Characteristics, 802.11 Wireless LANs, Architecture, MAC Protocol, Frame, Mobility, Personal Area Networks: Bluetooth and Zigbee. Cellular Networks and Internet Access, Mobility, Mobile IP, Managing Mobility in Cellular Network.	**4 hrs**
6	**Multimedia Networking:** Multimedia Networking Applications, Streaming Stored Video, Voice-over-IP, Protocols for Real-Time Conversational Applications.	**4 hrs**

Text Books

1. J. F. Kurose, K. W. Ross, “Computer Networking, A Top-Down Approach”, 8th Edition, Pearson Education, 2021.
2. Raj Jain, “Performance evaluation of computer systems”, Wiley, 1991.

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.

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** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3 & 4	Solve Any **2** out of **3**
III	Q.No.-7, Q.No-8	5 & 6	Solve Any **1** out of **2**

BACK

Program: Bachelor of Engineering		Semester: VI
Course Title: Cloud Computing		Course Code: 24ECSC305
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	Practical Hrs: 28	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.	**5 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.	**5 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.	**5 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.	**5 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.	**5 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.	**5 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. Thamarai Selvi, Mastering Cloud Computing, McGraw Hill, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010.

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**

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

BACK

Program: Bachelor of Engineering		Semester: VI
Course Title: Natural language processing and Gen AI		Course Code: 24ECSC307
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	Practical: 56 hrs	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 Books:

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.

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	

List of Experiments:

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

BACK

Program: Bachelor of Engineering		Semester: VI
Course Title: Computer Networks Lab		Course Code: 24ECSP305
L-T-P:0-0-1	Credits: 1	Contact Hrs: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs: --	Practical Hrs: 28	Exam Duration: 2 hrs

List of Experiments

Sl. No.	Title	No. of slots
Exercises		
1	Introduction to Junos and Demonstration of Initial Configuration	2
2	Configuration and analysis of VLAN.	1
3	Configuration and analysis of DHCP	1
4	Configuration and analysis of OSPF	2
Structured Enquiry		
5	Demo of Mininet	1
6	Demonstration of Mininet and performance analysis of IEEE 802.11 MAC protocols.	1
7	Experimental analysis of the Handover Procedure in a WiFi Network using Mininet	2
8	Assessment: Implementation of a given topology using mininet	1
Open Ended Experiment		
9	Phase 1: Case Study Overview and survey report	1
10	Phase 2: Design a solution and implementation	1
11	Phase 3: Creating a poster and final demonstration	1
Total		**14**

Evaluation

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

	Assessment	Weightage in Marks
Internal Semester Assessment (80%)	Exercises	30
	Structured Enquiry	20
	Open Ended Experiment	30
End Semester Assessment (20%)	Structured Enquiry	**20**
	Total	**100**

BACK

Program: Bachelor of Engineering		Semester: VI
Course Title: Minor Project		Course Code: 24ECSW302
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: --	Practical: 42 hrs	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	-
Blockchain	Computer Vision	-	Generative Models	-
5G, 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
Write up (Problem statement, solution framework and Individual Contribution to the project)	14.3.1	20	1	4
Project demonstration with solution approach to the identified problem	6.1.2	15	3	3
Presentation	9.3.1	10	5	3
Report	10.1.2	05	4	3
Total = 50				

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		Exam Duration: 2 hrs

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

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		**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 Scheme

Assessment	**Weight age in Marks**
ISA 1	15
ISA 2	15
Assignments Written	10
Class Tests	10
Total	**50**

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

BACK

Professional Electives-1, 2 & 3

Program: Bachelor of Engineering			
Course Title: Computer Vision			**Course Code: 24ECSE317**
L-T-P: 2-0-1	**Credits: 3**		**Contact Hrs: 4hrs/week**
ISA Marks: 80	**ESA Marks: 20**		**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**		**Exam Duration: 2 hrs**
Unit – I			
1	**Introduction:** Computer Vision Overview, Pixels and image representation, Filters: Linear systems, Convolutions and cross-correlations; Lab: Basics, Filters		**4hrs**
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		**8hrs**
Unit – II			
3	**Semantic segmentation:** Perceptual grouping, Agglomerative clustering, Super pixels and over segmentation; Clustering: K-means, Mean shift; Visual Bag of Words: Texture features, Visual bag of words; Lab: Resizing, clustering, recognition		**6 hrs**
4	**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		**6hrs**
Unit – III			
5	**Advanced Techniques:** Image stitching, Image pyramids, Object recognition, Dimensionality reduction, Face identification, Detecting objects by parts		**6hrs**

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.

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 3 out of 4
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any 3 out of 4
III	Lab exam	5	Lab exam evaluation

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

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	**Practical Hrs: 112**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Design Philosophy and Reflections:** Algorithm Design Techniques and Principles, Case Studies and Reflections	**5 hrs**
2	**Competitive Programming and Problem Solving:** Why Competitive Programming, Handbook and Rules, Theoretical Implications, Global Level Standard Sets	**5 hrs**
3	**System Design:** Roadmap, System Design Components, Principles and Theorems, Backend and Front End Design, Communication and Interaction	**5 hrs**
	Unit –II	
4	**Dynamic Programming:** Common and Typical Problem Sets, Idea and Intuition, Design of DP Problems	**5 hrs**
5	**Search Space Analysis:** Search Space, Graph Algorithms, Heuristic Space Analysis	**5 hrs**
6	**Special Topics:** Special Topics and Case Studies – Contemporary Problems	**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. Laaksonen A., "Competitive Programmer's Handbook", CSES Set, 2018.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2010.
2. Online Coding Platforms

Evaluation Scheme

In-Semester Assessment Scheme

Assessment	**Conducted for marks**	**Weightage in Marks**
ISA-1 (Theory)	30	17
ISA-2 (Theory)	30	
Lab Activity	50	33
Total		**50**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	50
	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: Semantic Web			**Course Code: 19ECSE303**
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: 03 hrs**
Unit –I			
1	**Introduction to Semantics** History of the Web, Limitations, Vision of Semantic Web, Principles, Data Integration Across Web, Data Modeling Methods, Semantic Relationships, Metadata, Perpetual Data		**4 hrs**
2	**Expressing Meaning** Triple Store, Merging Graphs, Querying: Case Study		**4 hrs**
3	**Using Semantic Data** Query Language, Feed Forward Inference, Searching for Connections, Linked Data, Freebase		**8 hrs**
Unit –II			
4	**Working with Semantics** RDF—The Basis of the Semantic Web, OWL, Metadata with RDF, Metadata Taxonomies, Ontology		**8 hrs**
5	**Reasoning and Social Web** Reasoning types: Approximate Reasoning and Bounded Reasoning, Social Semantic Web, Semantic Crawlers		**8 hrs**
Unit –III			
6	**Semantic Modeling** Semantic Modeling, Semantic Web Applications, Logic for Semantic Web, Case Studies: Dr. Watson, Yahoo! SearchMonkey		**8 hrs**

Text Books

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, A Semantic Web Primer, MIT Press; 3rd edition, 2012.
2. Toby Segaran, Colin Evans, and Jamie Taylor, Programming the Semantic Web: Build Flexible Applications with Graph Data, O'Reilly Media; 2 edition, July 2009.

Reference Books:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, Chapman and Hall; 1st edition, 2009.
2. Dean Allemang, and James Hendler, Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2nd edition, 2011.
3. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean (Foreword), Semantic Web Programming, Wiley Publishers, 1 edition 2009.

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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	6	

BACK

Program: Bachelor of Engineering		
Course Title: Signals & Systems		**Course Code: 21ECSE313**
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	**Chapter No. 01: Signal Representation** Definition of a signals and systems, classification of signals,(analog and discrete signal, periodic and aperiodic, deterministic and random signals, even and odd signals, energy and power) , basic operation on signals(independent variable, dependent variable , time scaling, multiplication, time reversal), elementary signals (Impulse, step, ramp, sinusoidal, complex exponential), Systems Interconnections(series, parallel and cascade), properties of linear systems. (homogeneity ,superposition, linearity and time invariance, stability, memory, causality)	**10hrs**
2	**Chapter No. 02 : LTI System Representation** Impulse response representation and properties, Convolution, convolution sum and convolution integral. Differential and difference equation Representation, Block diagram representation	**10hrs**
	Unit –II	
3	**Chapter No. 03 : Fourier representation for signals** Introduction, Discrete time Fourier series (derivation of series excluded) and their properties. Discrete Fourier transform (derivation of transform excluded) and properties	**10hrs**
4	**Chapter No. 04 : Applications of Fourier transform** Introduction, frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling of continuous time signals.	**10hrs**
	Unit –III	
5	**Chapter No. 05: Z-transform** Definition of z-transform, Properties of ROC, Properties of Z-transforms: Inverse z-transforms (Partial Fraction method, long division method), Unilateral Z-transform, Transform of LTI.	**10hrs**

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

1. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition Wiley,2007
2. Alan V Oppenheim ,Alan S Willsky and S. Hamid Nawab , Signals and Systems, Second, PHI public,1997

Reference Books:

1. H. P Hsu, R. Ranjan, Signals and Systems , 2nd edition, McGraw Hill ,2017

2. Ganesh Rao and Satish Tunga, Signals and Systems 1st edition, Cengage India, 2017
3. M. J. Roberts, Fundamentals of Signals and Systems 2nd edition, McGraw Hill Education, 2017

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** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	5	

BACK

Program: Bachelor of Engineering			
Course Title: Fundamentals of Image and Video Processing			Course Code: 24ECSE312
L-T-P: 2-0-1	Credits: 3		Contact Hrs: 4hrs/week
ISA Marks: 50	ESA Marks: 50		Total Marks: 100
Teaching Hrs: 30	Practical Hrs: 28		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.		4hrs
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.		4 hrs
3	**Fourier Transform and Sampling:** 2D Fourier transform, sampling, discrete Fourier transform, and filtering in the frequency domain.		4 hrs
4	**Motion Estimation:** Applications of motion estimation, phase correlation, block matching, spatio-temporal gradient methods, and fundamentals of color image processing.		4 hrs
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	**Image Recovery:** Introduction to image and video recovery, image restoration, matrix-vector notation for images, inverse filtering, constrained least squares (CLS), set-theoretic restoration approaches, iterative restoration algorithms, and spatially adaptive algorithms. Wiener restoration filter, Wiener noise smoothing filter, maximum likelihood and maximum a posteriori estimation, and Bayesian restoration algorithms.		5 hrs
7	**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.		5 hrs

8	**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		
9	**Image and Video Segmentation :** Intensity discontinuity and intensity similarity, watersheds and K-means algorithms, and other advanced methods.	**4 hrs**
10	**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:

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

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, 2,3,4	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	5,6,7,8	Solve Any **2** out of **3**
III	Q.No.-7	9	Solve Any **1** out of **2**
	Q.No.-8	19	

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.	

BACK

Program: Bachelor of Engineering		
Course Title: Neural Network and Deep Learning		**Course code: 24ECSE314**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs./week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Practical:28 hrs**	**Exam Duration: 2 hrs**

	Unit-I	
1	**Introduction to Deep Neural Network – 1** Convolution and pooling, Activation functions, data processing, Batch Normalization, transfer learning, back propagation algorithms.	**6hrs**
2	**Deep Neural Network – 2** Update rules, hyper parameter tuning, vs learning rate scheduling, data augmentation Architectures: AlexNet, VGG, ResNet,MobileNet	**8 hrs**
	Unit-II	
3	**Deep Unsupervised Learning** Autoencoders (standard, denoising, contractive etc), Variational Autoencoders, Adversarial Generative Networks, Adversarial Examples and attacks, Conditional GAN, Super-Resolution GAN, CycleGAN	**8 hrs**
4	**Recurrent Neural Networks** Introduction, Long Short-Term Memory Network, Implementation of RNN & LSTM, Embeddings & Word2vec, Sentiment Prediction RNN	**6 hrs**
	Unit-III	
5	**Improving Deep Neural Networks** Regularization,Mini-batch Gradient Descent, Hyperparameter Tuning, Batch Normalization and Programming Frameworks	**4 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 Aurélien Géron , Publisher: O'Reilly Media, July 2016
3. Advanced Machine Learning with Python Paperback, 28 Jul 2016 by John Hearty.

List of experiments

Experiment No.	Brief description about the experiment	Number of slots
1.	Introduction to Neural networks training techniques.	2
2.	Designing the DNN model using transfer learning technique.	1
3.	Implementation of GAN: Experiment on Auto encoders and Variational Autoencoders	1
4.	Implementation of GAN: Experiments on Conditional GAN, Super-Resolution GAN, CycleGAN	2
5.	Implementation of RNN: Implementation of RNN & LSTM and Embeddings & Word2vec	1
6.	Experiments on Model Optimization Techniques: Hyper parameter tuning, Regularization and Optimization	1
7.	Course Project	4

BACK

Program: Bachelor of Engineering		
Course Title: Natural Language processing with Neural Network models		**Course Code: 24ECSE315**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30 hrs		**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to NLP and Deep Learning:** Introduction to Natural Language Processing, Applications of Natural Language Processing, Word2vec introduction, Word2vec objective function gradients.	**07 hrs**
2	**Recurrent Neural Networks, Machine Translation, Seq2Seq and Attention:** Recurrent Neural Networks and Language Models, Vanishing Gradients, Fancy RNNs, Machine Translation, Seq2Seq and Attention, Advanced Attention.	**08 hrs**
	Unit –II	
3	**Transformer Networks, Memory Networks:** Transformer Networks and CNNs, Advanced Architectures and Memory Networks**.**	**07 hrs**
4	**Reinforcement Learning for NLP applications:** Reinforcement Learning for NLP, Semi-supervised Learning for NLP, Future of NLP Models, Multi-task Learning and QA Systems.	**08 hrs**

Text Book

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing, 2016.

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

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Lab Experiments	15	17
Certification	15	
Total		**50**

End-Semester Assessment Scheme

Assessment	Conducted for marks	Weightage in Marks
Theory	60	33
Laboratory	20	17
	Total	**50**

Laboratory Plan
List of Exercises

Expt./ No.	Brief description about the experiment/job	No. of Lab. Slots
1.	Implement Bag of Words and TF-IDF vectorization on sample text data, and visualize the feature vectors using t-SNE plots.	2
2.	Train a Word2Vec model on the text corpus and calculate cosine similarity between words.	2
3.	Train RNN models for sentiment analysis and demonstrate the functionality of LSTM and GRU networks. Demonstrate the functionality of grid-based hyperparameter tuning and early stopping.	2
4.	Construct a Seq2Seq model with attention for language translation.	2
5.	Demonstrate the functionality of a Transformer-based encoder and decoder network, and visualize the attention heads and maps.	2
6.	Build a 1D CNN model for text classification, experimenting with different kernel sizes to analyse how the CNN captures local patterns.	2
7.	Develop a multi-task learning model for sentiment analysis and entity recognition, and analyze how multi-task learning enhances generalization.	2

BACK

Program: Bachelor of Engineering		
Course Title: DevOps		**Course Code: 24ECSE310**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hrs: 5hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 20	**Practical: 56**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction to Devops and Linux for Automation:** Introducing DevOps, Software development life cycle, Agile practice applied to Devops, Infrastructure As Code, Continuous Integration and Development. **Linux and Automation**: File System and Directory Management, Process Management, User and Group Management, Network Management, Package Management	**3 hrs**
2	**Introduction to AWS and Version Control Systems: AWS Cloud**: Introduction to cloud computing & AWS, Regions & AZ's, EC2, EBS, EFS, Auto scaling, Load balancing & Route 53, VPC, Object storage (S3), AWS Lambda & CLI. **Version Control with Git:** Source Code Management (SCM), Git branching and merging, Git Overview, creating pull request, Code Review, Merging changes, Create a repo and push code on GibHub / Bitbucket.	**3 hrs**
3	**Containerization and Continuous Integration in AWS: Jenkins**- launching Jenkins through Terraform, configuration, integrating Git with Jenkins, integrating Maven with Jenkins, Building first Jenkins job. **Docker:** Containers Concepts, Container Vs Virtual Machine, Docker installation, Managing Container with Docker Commands, Building your own docker images.	**5 hrs**
4	**Configuration Management and Continuous Monitoring: Ansible:** Introduction, integrating Ansible with Jenkins, creating Docker image and pushing in ECR, creating CI playbook, Integrating CI playbook in CI job, creating CD playbook, Integrating CD playbook in CD job, Nagios.	**4 hrs**

Text Books:

1. Joakim Verona, "Practical DevOps." Packt Publishing Ltd, Feb. 2016, ISBN: 9781785882876
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans." Leanpub, 2015.
3. John Ferguson, "Jenkins: The Definitive Guide" Smart Publisher: O'Reilly Media, Release Date: June 2016.

Reference Books:

1. Jennifer Davis, Ryn Daniels, "Effective DevOps, Building a Culture of Collaboration, Affinity, and Tooling at Scale", Publisher: O'Reilly Media, Release Date: June 2016.
2. Gene Kim, Patrick Debois, John Willis, Jez Humble, "The DevOps Handbook: How to Create World-Class Speed, Reliability, and Security in Technology Organizations", IT Revolution Press, 2016.

List of Experiments:

Expt. No.	Experiments	No. of Slots
1.	• Exploring AWS cloud services • Exploring Linux commands for automation on AWS cloud server	1
2.	• Exploring Git Commands through Collaborative coding. • Implement GitHub Operations	2
3.	• Applying CI/CD Principles to Web Development • Using Jenkins, Git, and Local HTTP Server	2
4.	• Exploring Containerization and Application • Deployment with Docker • Applying CI/CD Principles to Web Development • Create the GitHub A/C to demonstrate CI/CD pipeline using Cloud Platform.	3
5.	• Certification Courses: Infosys Springboard ➢ Linux for Cloud & DevOps Engineers (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01415770309187993629 3/overview) ➢ Practical AWS for DevOps: Exploring AWS DevOps Services (https://infyspringboard.onwingspan.com/web/en/viewer/html/lex_auth_013817506349555712536) ➢ Jenkins (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094440521957376255 3_shared/overview) ➢ Ansible (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094418591735808203 6_shared/overview) ➢ Docker(https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013295074240634880453 76_shared/overview)	4
6.	• Course Project Review (3 Reviews)	3

Evaluation Scheme (ISA)

Assessment	Conducted for Marks		Weightage in Marks
Theory	**ISA**	**40**	**33**
Lab	Evaluation 1	10	
	Project review -Phase 1	10	
	Project Review – Phase 2	10	
	Project Review – Phase 3	10	

	Infosys Springboard certification	20	
	Lab Assessment Total	**60**	**33**
		Total	**66**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
ESA Lab	40	34
	Total	**34**

BACK

Program: Bachelor of Engineering		
Course Title: Informatica-Intelligent Data Management Cloud		**Course Code: 24ECSE322**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hrs: 5 hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs: 15	**Practical Hrs: 56**	**Exam Duration: NA**

Unit - I

1	**Informatica Cloud Overview**: Fundamentals of Data warehouse, Overview of Informatica cloud services, Cloud Data Integration, Cloud Application Integration, Cloud Data Quality, Cloud MDM & 360 Applications, Cloud Data Governance and Catalog, Cloud Integration Hub, Cloud B2B, Cloud Data Marketplace	**3 hrs**
2	**IDMC Administration Fundamentals**: Informatica Cloud Architecture, Introduction to IICS Services, Administration services, User Management, Agent group and services, Types of connectors, Asset management and Schedule.	**3 hrs**
3	**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).	**5 hrs**
4	**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**

Text book:

1. Rahul Malewar: Learning Informatica Cloud Services: Learn the art of implementing ETL on Cloud.

Reference Weblink:

1. https://now.informatica.com/Customer-360-SaaS-for-Business-Users-Instructor-Led.html

Evaluation Scheme (ISA)

Assessment	Conducted for Marks	Weightage in Marks
IS (Theory)	40	33
Lab	60	33
	Total	**64**

Evaluation Scheme (ESA)

Assessment	Conducted for Marks	Weightage in Marks
Lab	40	34
	Total	**34**

Laboratory Plan

Sl. No.	Experiments	Number of slots
1.	Creating Informatica Intelligent Cloud Services (IICS) Setting up Lab Environment, Configure SQL Server Database, Navigating the IICS Interface, Installing Secure Agent	2
2.	Creating Flat File Connections using Cloud Data Integration	1
3.	Creating a Salesforce Connection, Creating SQL Server Connections, Creating a Synchronization Task,	2
4.	Using Filter, Expression, and Lookup in a Synchronization Task, Using Saved Query in a Synchronization Task, Creating a Data Transfer Task	2
5.	IICS Transformations, Joiner and Lookup Transformations, Mapplets	3
6.	Course Project (Reviews -03, Demonstration of project-01)	4

BACK

Program: Bachelor of Engineering			
Course Title: Multimedia Networks			**Course Code:21ECSE311**
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	**Introduction to Multi media** Media and Data stream: Perception Media, Representation Media, Presentation Media, Storage Media; Key properties of Multimedia, Characterizing data streams and Continuous Media Data Streams.		**4 hrs**
2	**Graphics and Image Data representation** Graphics / Image data types, popular file formats, color science, color models in images, color models in video, Image analysis: Color, Texture identification, Edge detection using sobel operators, canny edge detection method, Image segmentation: pixel oriented, edge oriented, Region oriented, Image recognition. Image synthesis, Radon transforms.		**6 hrs**
3	**Fundamental concepts of Video and Audio** Types of video signal, digital video, Digitization of audio, MIDI standard, Quantization and transmission of audio		**6 hrs**
Unit –II			
4	**Image compression techniques.** Lossless compression algorithms: Run-Length Coding, Variable-Length Coding (VLC), Shannon–Fano Algorithm, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lossless JPEG, Lossy compression algorithms: Distortion Measures, The Rate-Distortion Theory, Quantization, Uniform Scalar Quantization, Non-uniform Scalar Quantization, Vector Quantization, Transform Coding, Discrete Cosine Transform (DCT), Introduction, Continuous Wavelet Transform, Discrete Wavelet Transform		**6 hrs**
5	**Video compression techniques.** Video compression based on motion compensation, H.261, H.263, MPEG -1. Basic audio compression techniques		**6 hrs**
6	**Computer based Animation** Basic concepts, specifications of animations, methods of controlling animation, display, transmission of animation, VRML		**4 hrs**
Unit –III			
7	**Optical storage media** Basic technology, video disc, CDDA, CDROM, CDR/W, DVD		**4 hrs**
8	**Content Analysis** Simple and complex features: text recognition, similarity based search in image database, analysis of individual images, image sequences, applications.		**4 hrs**

Text Books:

1. Ze-Nian Li & Mark S.Drew, Jiangchuan Liu,"Fundamentals of Multimedia", Second Edition,Springer, 2014.
2. Ralf Steinmetz, Klara Narstedt, "Multimedia Fundamentals: Vol 1-Media Coding and Content Processing", 2nd Edition, Pearson Education / PHI, 2003.

Reference Books:

3. James E Shuman, "Multimedia in Action" 2nd Indian reprint 2008, Cengage learning.

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: Internet of Things		**Course Code: 24ECSE303**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28 hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Internet of Things (IoT):** Definition & Characteristics of IoT, Things in IoT, IoT protocols, IoT functional blocks, communication models and APIs, IoT Levels. Enabling technologies: Sensors, Zigbee, Bluetooth/BLE, IoT ecosystem, Data Link protocols: IEEE 802.15.4e, IEEE 802.11.ah, DASH7, Low Power Wide Area Network (LPWAN), LTE-m, NB-IoT, LoRa, Z-Wave.	**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 Identity Management Solutions for IoT Platforms:** IoT Design Methodology, Case Study on IoT System for Weather Monitoring etc., Basic building blocks of an IoT device, Raspberry Pi, IoT Operating Systems: Contiki, RIOT, ARM Mbed OS. IoT IAM infrastructure – Authorization with Publish / Subscribe schemes	**05 hrs**
5	**Programming with Raspberry Pi & WiFi controllers (CC3200/ESP8266) & 6LoWPAN Controller (CC2650):** XML, JSON, SOAP and REST-based approach, WebSocket protocol.	**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**
	Unit –III	
7	**IoT prototyping** Business models, example applications: Case studies on Home automation, Smart Cities, Environment, Energy, Agriculture, Health,	**06 hrs**

	Retail with emphasis on data analytics and security. Industrial IoT (IIoT). Role of AI/ML in IoT (AIoT).	

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

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.

ISA Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment-1	10	17
Course Project	50	
Total		**50**

Laboratory evaluation criteria and schedule: (ISA)

Assessment		Description	Marks	Schedule	Blooms Level	PI Addressed
Experiment		Assessment on developing the IoT application.	10 Marks	5th Week	L3	1.4.1
Course Project	Review 1	Problem Identification and suitable IoT protocols	10 Marks	6th Week	L2	1.4.1
	Review 2	Design and Implementation of IoT application	20 Marks	8th Week	L3	13.2.6
	Review 3	Develop an IoT application	20 Marks	10th Week	L3	13.3.2

BACK

Program: Bachelor of Engineering			
Course Title: Blockchain and Distributed Ledgers		**Course Code: 24ECSE316**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 30	**Tutorial/Practical: 28hrs**	**Exam Duration: 2 hrs**	
Unit –I			
1	**Introduction:** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Types of blockchain, blockchain platforms, Blockchain Architecture, Blockchain Use Cases: Finance, E-Governance, Supply chain management, Healthcare management and cyber security.		**05 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 –Permissionless:** 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.		**04 hrs**
Unit –II			
4	**Consensus Mechanisms and Mining – Permissioned:** RAFT, Practical Byzantine Fault Tolerance (PBFT), Scalability of consensus algorithms.		**04 hrs**
5	**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**
6	**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.		**05 hrs**

Text Books:

1. Imran Bashir "Mastering Blockchain", 3st Edition, PacktMedia, 2020.
2. William Stallings “Cryptography and network security principles and practice”, 7th edition Global edition.

Reference Books:

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

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in Marks
ISA-1 (Theory)	30	17
ISA-2 (Theory)	30	
Laboratory Assessment	60	33
	Total	**50**

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 Primitive Data Types- Integer, Floating Point, Character, Boolean Composite/Derived Data Types- String, Array, Structure (struct).	1
3.	Solidity programming- control structures and functions	1
4.	Remix with Ganache and Meta mask	1
5.	Deploying contract using external blockchain using Remix, ganache and Metamask (Evaluation 1)	1
6.	Demonstration on block chain use cases (Regarding Open-ended Experiment)	1
7.	Creating smart contract on RSA and D_H, SHA-512, Digital signature. Structured Enquire : Cryptography	1
8.	Creating custom Ethereum blockchain using Geth.	1
9.	Connecting to Geth node using Web3	1
10.	Structured Enquire: Case study (specified in chapter 1) implementation using Geth (Evaluation 2)	1
11.	Create distributed storage using IPFS.	1
12.	Connect IPFS to Ethereum or Hyperledger Fabric (Evaluation 3)	1
13.	Open ended Experiment: Problem statement, Backend Design and Front end design	1
14.	Open ended Experiment: Implementation and Results (Evaluation 4)	1

BACK

Program: Bachelor of Engineering			
Course Title: Blockchain and Distributed Ledgers		**Course Code: 24ECSE324**	
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:** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Types of blockchain, blockchain platforms, Blockchain Architecture, Blockchain Use Cases: Finance, E-Governance, Supply chain management, Healthcare management and cyber security.		**05 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 –Permissionless:** 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.		**04 hrs**
Unit –II			
4	**Consensus Mechanisms and Mining – Permissioned:** RAFT, Practical Byzantine Fault Tolerance (PBFT), Scalability of consensus algorithms.		**04 hrs**
5	**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**
6	**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.		**05 hrs**

Text Books:

3. Imran Bashir "Mastering Blockchain", 3st Edition, PacktMedia, 2020.
4. William Stallings “Cryptography and network security principles and practice”, 7th edition Global edition.

Reference Books:

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

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in (%)
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	33
	Total	**66**

ESA Scheme

Assessment	Conducted for marks	Weightage in (%)
ESA (Theory)	60	34
	Total	**34**

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 Primitive Data Types- Integer, Floating Point, Character, Boolean Composite/Derived Data Types- String, Array, Structure (struct).	1
3.	Solidity programming- control structures and functions	1
4.	Remix with Ganache and Meta mask	1
5.	Deploying contract using external blockchain using Remix, ganache and Metamask (Evaluation 1)	1
6.	Demonstration on block chain use cases (Regarding Open-ended Experiment)	1
7.	Creating smart contract on RSA and D_H, SHA-512, Digital signature. Structured Enquire : Cryptography	1
8.	Creating custom Ethereum blockchain using Geth.	1
9.	Connecting to Geth node using Web3	1
10.	Structured Enquire : Case study (specified in chapter 1) implementation using Geth (Evaluation 2)	1
11.	Create distributed storage using IPFS.	1
12.	Connect IPFS to Ethereum or Hyperledger Fabric (Evaluation 3)	1
13.	Open ended Experiment: Problem statement, Backend Design and Front end design	1
14.	Open ended Experiment: Implementation and Results (Evaluation 4)	1

BACK

Program: Bachelor of Engineering		
Course Title: Security Operations		**Course Code: 24ECSE321**
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 Security Operations:** 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,	**07 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	**08 hrs**
	Unit –II	
3	**Security Information and Event Management** (SIEM)**:** Key SIEM Components, Introduction to SIEM solutions, Overview and Key Features, SIEM Architecture, Log collection methods, Security Event Correlation and Rule Writing.	**07 hrs**
4	**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	**08 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.

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in (%)
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	33
Total		**66**

ESA Scheme

Assessment	Conducted for marks	Weightage in (%)
ESA (Theory)	60	34
Total		**34**

Lab Experiments

S. No	Experiments	No of Lab Slots
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.	03
8	Network attack detection.	02
9	SIEM alert management.	03

BACK

Program: Bachelor of Engineering			
Course Title: Edge Computing		**Course Code: 24ECSE323**	
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:** Definition and key concepts, Difference between edge, fog and cloud computing Importance and benefits of edge computing, Case studies and real-world applications, Edge computing architecture.		**07 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		**08 hrs**
Unit –II			
3	**Edge Cloud:** Introduction to Edge Data Center, use cases and applications, Lightweight edge clouds and its services, Edge cloud architectures using Kubernetes, Edge Networking: 5G Architecture, SDN, NFV, SFC and AI.		**07 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.		**08 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.

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in (%)
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	33
	Total	**66**

ESA Scheme

Assessment	Conducted for marks	Weightage in (%)
ESA (Theory)	60	34
	Total	**34**

Lab Experiments

S. No	Experiments	No of Lab Slots
1	Kubernetes Setup – Single node	01
2	KubeEdge Setup	01
3	LF Edge	01
4	Edge Cloud- Multi-node	01
5	Edge Application Deployment on KubeEdge- IoT	01
6	Edge Application Deployment on KubeEdge- Video Streaming	01
7	MEC- Edge device, Edge cloud and private 5G integration	03
8	Open Ended Activity	04

BACK

Program: Bachelor of Engineering		
Course Title: Cyber Security		**Course Code: 24ECSE318**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Cybercrime**: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, A global Perspective on cybercrimes. Cyber-attack plans, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era. Impact of Cybersecurity in Industry & daily lives, Strategy & Operating Model (Roles), Confidentiality, Integrity & Availability	**6 hrs**
2	**Methods used in Cybercrime**: Phishing, password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless networks, Identity theft Identity and Access Management, Asset Security, Security Operations	**6 hrs**
	Unit –II	
3	**Cybercrimes and Cyber security**: The Legal Perspectives Why do we need Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment. Standards and Regulations	**6 hrs**
4	**Cybercrime**: Illustrations, Examples and Case studies Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Online Scams. Governance Risk & Compliance	**6 hrs**
	Unit –III	
5	**Digital Forensics**: Historical background of cyber forensic, Forensic analysis of email, Digital forensic life cycle, Network forensic, Setting up a computer forensic Laboratory, Forensic analysis of digital media	**6 hrs**

Text Books:

1. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012
2. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

Reference Books:

1. "Cybersecurity Essentials" by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short
2. "Principles of Information Security" by Michael E. Whitman and Herbert J. Mattord
3. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown
4. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012
5. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

BACK

Program: Bachelor of Engineering			
Course Title: Cyber Security		**Course Code: 24ECSE325**	
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	**Practical Hrs: 28**	**Exam Duration: 2 hrs**	
Unit –I			
1	**Introduction to Cybercrime**: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, A global Perspective on cybercrimes. Cyber-attack plans, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era. Impact of Cybersecurity in Industry & daily lives, Strategy & Operating Model (Roles), Confidentiality, Integrity & Availability	**6 hrs**	
2	**Methods used in Cybercrime**: Phishing, password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless networks, Identity theft Identity and Access Management, Asset Security, Security Operations	**6 hrs**	
Unit –II			
3	**Cybercrimes and Cyber security**: The Legal Perspectives Why do we need Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment. Standards and Regulations	**6 hrs**	
4	**Cybercrime**: Illustrations, Examples and Case studies Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Online Scams. Governance Risk & Compliance	**6 hrs**	
Unit –III			
5	**Digital Forensics**: Historical background of cyber forensic, Forensic analysis of email, Digital forensic life cycle, Network forensic, Setting up a computer forensic Laboratory, Forensic analysis of digital media	**6 hrs**	

Text Books:

3. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012
4. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

Reference Books:

6. "Cybersecurity Essentials" by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short
7. "Principles of Information Security" by Michael E. Whitman and Herbert J. Mattord
8. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown
9. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012
10. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

BACK

Program: Bachelor of Engineering			
Course Title: Parallel Computing			**Course Code: 17ECSE307**
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: 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			
Reference Books:			

1. Michael Quinn, Parallel Computing Theory and Practice, Tata McGraw Hill, 2003

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	5	

BACK

Program: Bachelor of Engineering			
Course Title: Quantum Computing			**Course Code: 17ECSE306**
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: 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: Applied Computational Medicine		**Course Code: 24ECSE320**
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	**Advanced Systems Biology:** Integrative Omics Approaches, Advanced Network Analysis, Multi-Scale Modeling Applications in Precision Medicine	**05 hrs**
2	**Computational Genomics:** Genomic Data Analysis, Machine Learning in Genomics, Genome-Wide Association Studies (GWAS), Functional Genomics	**05 hrs**
3	**Computational Proteomics:** Protein Structure Prediction, Mass Spectrometry Data Analysis, Proteomics Data Integration, Applications in Drug Discovery	**05 hrs**
	Unit –II	
4	**Computational Metabolomics:** Metabolic Pathway Analysis, Metabolomics Data Interpretation, Metabolic Flux Analysis, Applications in Disease Modeling	**05 hrs**
5	**Computational Neuroscience:** Neural Network Modeling, Brain-Computer Interfaces, Neuroinformatics, Case Studies: Brain Disorders	**05 hrs**
6	**Advanced Computational Anatomy:** 3D Reconstruction Techniques, Imaging Data Analysis, Organ-Specific Computational Models, Case Studies: Organs Beyond Brain and Heart	**05 hrs**

Text Books:

NA

Reference Books:

1. Lecture Notes and Handouts
2. Reference papers / Slides/ Videos

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage in (%)
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	33
	Total	**66**

ESA Scheme

Assessment	Conducted for marks	Weightage in (%)
ESA (Theory)	60	34
	Total	**34**

List of Exercises

Expt. No	Brief description about the experiments	No of lab slots
1.	a. To integrate genomics, transcriptomic, proteomics, and metabolomics data to identify potential disease biomarkers. or b. To construct and analyze biological networks, such as gene regulatory networks (GRNs) or protein-protein interaction (PPI) networks.	02
2.	a. To analyze genomic sequences, perform DNA sequence alignment, and detect genetic variations (mutations, SNPs). Or a. To develop a machine learning model that predicts drug response for personalized medicine based on patient omics data.	02
3.	a. To analyze population-scale genomic data and identify genetic markers associated with specific diseases. Or b. To analyze RNA sequencing (RNA-Seq) data for gene expression profiling in normal vs. diseased tissues	03
4.	a. To predict the 3D structure of a protein from its amino acid sequence using computational methods. Or b. To process and analyze mass spectrometry (MS) data to identify proteins in a biological sample.	02
5.	a. To integrate proteomics datasets with other omics data (e.g., genomics, transcriptomics) to identify disease biomarkers. Or b. To use molecular docking techniques to predict drug binding interactions with a target protein.	03
6.	a. To create a computational model of lung airflow and study respiratory function. Or b. To analyze organ structures, functions, and disease impact beyond the brain and heart.	02

BACK

Program: Bachelor of Engineering		
Course Title: Embedded Intelligent Systems		**Course code: 24ECSE302**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hrs: 5 hrs/week**
ISA Marks: 66	**ESA Marks: 34**	**Total Marks: 100**
Teaching Hrs : 15	**Practical Hrs: 56**	**Exam Duration: NA**

1	**ML Frameworks lab with the target device:** TensorFlow, PyTorch, 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.	**5 hrs**
2	**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.	**5 hrs**
3	**Android Anatomy:** Android Architecture, Linux Kernel, Binder, HAL Native Libraries, Android Runtime, Dalvik Application framework, Applications, IPC.	**5 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.
3. Deep Learning, MIT Press book, Goodfellow, Bengio, and Courville's.
4. TensorFlow for Deep Learning, by Bharath Ramsundar, Reza Bosagh Zadeh, O'Reilly Media, Inc.
5. Beginning Android, by Wei-Meng Lee, Publisher: Wrox , O'Reilly Media.

Reference Books:

1. Deep Learning with PyTorch, Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning Publication.
2. Machine Learning with PyTorch and Scikit-Learn, Sebastian Raschka, Yuxi (Hayden) Liu , Vahid Mirjalili, Packt Publishing.

Evaluation Scheme (ISA)

Section	Chapter Numbers	Conducted for marks	Weightage in Marks
ISA - I	1, 2, 3	40	33 Marks
Lab Evaluation	1, 2, 3	60	33 Marks

Evaluation Scheme (ESA)

Section	Chapter Numbers	Conducted for marks	Weightage in Marks
Lab Exam (ESA)	1, 2, 3	40	34 Marks

List of experiments

Expt. No.	Brief description about the experiment	No. of Lab Slots
1.	Comparative analysis and execution of pre-trained neural networks using TensorFlow, PyTorch, and TensorFlow Lite for edge deployment.	**1**
2.	Design and deployment of lightweight convolutional neural networks for resource-constrained embedded environments.	**2**
3.	Implementation and performance evaluation of quantization techniques on DNN models for on-device execution.	**1**
4.	Implementation of structured model pruning with emphasis on parameter compression, retraining methodologies, and accuracy evaluation on embedded platforms.	**1**
5.	Implementation of knowledge distillation framework focusing on transferring representational capabilities from high-capacity teacher networks to lightweight student models.	**2**
6.	Development of native android applications for incorporating embedded machine learning models with focus on android runtime, inter-process communication, and user interface integration.	**1**
7.	Integration of cross-platform PyTorch models into android applications through TorchScript conversion and deployment using the PyTorch mobile framework.	**2**
8.	Design and development of computationally optimized and quantized deep neural network architectures on heterogeneous android platforms with real-time inference profiling, multi-hardware delegate analysis, and comprehensive evaluation of accuracy-latency-memory trade-offs.	**4**

BACK

Program: Bachelor of Engineering		
Course Title: The ARM Architecture		**Coursecode:19ECSE302**
L-T-P: 2-1-0	**Credits: 3**	**Contact Hrs: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial Hrs: 28**	**Exam Duration: 3 hrs**

	Unit –I	
1	**ARM Embedded Systems and Processor Fundamentals:** The RISC Design Philosophy , The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families	**06 hrs**
2	**Introduction to the ARM Instruction Set & Assembly Programming:** Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, Conditional Execution, Thumb instruction set.	**06 hrs**
	Unit –II	
3	**Efficient C Programming:** Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division.	**06 hrs**
4	**Writing and Optimizing ARM Assembly Code:** Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Handling Unaligned Data.	**06 hrs**
	Unit –III	
5	**Introduction to LPC-2148 controller:** Input output Ports, Pin select registers, Input output select registers, direction control and control registers, Introduction to interfacing standards	**03 hrs**
6	**ARM Interfacing:** ARM interfacing to peripherals like LED, LCD, Seven segments, Motors, Converters, Keypad.	**03 hrs**

Text Books

1. Andrew N.Sloss et al, ARM System Developer's Guide- Designing and Optimizing System Software

Reference Books:

1. Marilyn Wolf, Computers as Components: Principles of embedded computing system design, Morgan Ka, 2012
2. Steve Furber, ARM System-on-chip Architecture, 2, Pearson, 2000

Tutorial Plan

Expt./ Job No.	Assignments/Experiment	No. of Lab. Slots per batch (estimate)
1	ALP on arithmetic instructions set	01
2	ALP on logical instructions set	01
3	ALP on loop and branch instructions	02
4	Interface LED and Seven segments to ARM for displaying message.	02
5	Interface LCD to ARM for displaying message.	02
6	Interface Keypad to read the characters	02
7	Rotate DC and stepper motor for variable speed and direction	02
8	Interface DAC to ARM controller	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	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7, 8	5	Solve Any **1** out of **2**

BACK

Program: Bachelor of Engineering		
Course Title: Robotic Process Automation Design & Development		**Course Code: 24ECSE301**
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: 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 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	**8 hrs**

	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**
	Q.No.-8	5	

BACK

Program: Bachelor of Engineering		
Course Title: Computational Medicine		**Course Code: 24ECSE319**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Tutorial/Practical: 28 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 - 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.

BACK

Semester – VII

Program: Bachelor of Engineering			**Semester - VII**
Course Title: Big Data and Analytics			**Course Code: 24ECSC404**
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 hrs	**Practical: 28 hrs**		**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.		**5 hrs**
2	**Big Data Storage**: Clusters, File Systems and Distributed File Systems, NoSQL, **No SQL Database:** Document-oriented, Column-oriented, Graph-based, MongoDB. Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.		**5 hrs**
3	**Big Data Processing**: Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce, Examples on MapReduce, Spark.		**5 hrs**
Unit – II			
4	**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.		**5 hrs**
5	**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.		**5 hrs**
6	**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		**5 hrs**

Text Books:

1. Thomas Erl, WajidKhattak, and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques, Prentice Hall, 2015.
2. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Second Edition, Wiley India Pvt Ltd 2022.
3. Gerard Maas and François Garillot, Stream Processing with Apache Spark Mastering Structured Streaming and Spark Streaming, O'REILLY, 2019.

References:

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	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 - VII
Course Title: Cryptography & Network Security		Course Code: 24ECSC403
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	Practical: 28 hrs	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.	**3 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**
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**
	Unit –II	
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**
5	**Application and Transport Security Protocols:** Introduction, Pretty Good Privacy and S/MIME, Secure Socket Layer, Transport Layer Security, SSH.	**4 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.	**5 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.

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**

Laboratory Plan

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots (each lab 2 hrs)
8.	Demo and practice on Crypto Library	2
9.	Implementation of symmetric key algorithm	2
10.	Implementation of Asymmetric key algorithm and	2
11.	Implementation of Hash functions, MAC, Digital signature	2
12.	Simulation of Access Control Matrix and illustration of user updates access rights.	1
13.	Demonstrate access in a multi-user cloud system with role-based access and mutual authentication using certificates.	1
14.	Implementation of Applications of SSH, SSL, HHTPS, IPSC	2
15.	Field Survey on : Network Endpoint Security and network security protocols	2
	Total number of hours	**14*2=28**

BACK

Program: Bachelor of Engineering		Semester - VII
Course Title: Senior Design Project		Course Code: 20ECSW401
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: 2hrs/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, KesavanandBharati vs. UOI, Maneka Gandhi vs. UOI, Air IndiaLtd. vs. NargeesMeerza, 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

Program: Bachelor of Engineering			
Course Title: Advanced Computer Vision			**Course Code: 25ECSE434**
L-T-P: 2-0-1	**Credits: 3**		**Contact Hrs: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**		**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**		**Exam Duration: 2 hr**
Unit – I			
1.	**Introduction:** Basics of machine learning, and convolutional neural networks. optimization strategies for training deep neural networks. advanced architectures for image classification (VGGNet, ResNet, DenseNet, MobileNets, etc.).		**7 Hrs**
2.	**Visualization and Object Detection:** Techniques for visualizing cnns for image analysis. traditional techniques for object detection (Viola-Jones, Parts-based models).Modern techniques for object detection(Single shot and two shot detectors, keypoint based detectors).		**8 Hrs**
Unit – II			
3	**Image Segmentation Techniques:** Traditional techniques for image segmentation(Watershed Segmentation, Clustering-Based Segmentation). modern techniques for image segmentation(FCN, SegNet, U-Net, Mask-RCNN).		**8 Hrs**
4	**Vision and Security in Computer Vision:** Generating synthetic images (AR models, VAEs and GANs). vision and language: image captioning, visual qa, visual dialog; learning models for geometrical vision problems. object tracking. attack and defense techniques for computer vision systems		**7 Hrs**

Reference Books:

1. Forsyth and ponce, computer vision: a modern approach, published by pearson, 2012
2. Richard hartley and andrew zisserman, multiple view geometry in computer vision, second edition, cambridge university press, march 2004.
3. Ian goodfellow, yoshuabengio and aaron courville, deep learning, mit press, 2016.

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**

Laboratory Plan

List of Exercises

Expt./ No.	Brief description about the experiment/job	No.of Lab. Slots
1.	Image classification architectures.	2
2.	Cnn visualizing techniques.	2
3.	Object detection techniques (traditional and morden techniques)	2
4.	Image segmentation techniques (traditional and morden techniques).	2
5.	Generating synthetic images using ar models/vaes / gans	2
6.	Vision and learning models	2
7.	Certification courses: infosys springboard ➢ master computer vision opencv3 in python and machine learning(7hr 13m) ➢ hands-on computer vision with opencv 4, keras, and tensorflow 2(7hr 6m**)	2

BACK

Program: Bachelor of Engineering		
Course Title: Responsible AI		**Course Code: 25ECSE459**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 05 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Practical: 42 hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Fundamentals of Artificial Intelligence and Responsible AI:** Introduction to Artificial Intelligence Fundamentals, Introduction to Responsible AI, Need for Ethics in AI: AI for Society and Humanity.	**05 Hrs**
2	**Fairness and Bias in AI Systems:** Sources of Biases in AI, Exploratory Data Analysis and Dataset Limitations, Bias Mitigation Techniques: Preprocessing, Inprocessing, Postprocessing, Fairness Metrics: Group Fairness, Individual Fairness, Counterfactual Fairness	**07 Hrs**
3	**Interpretability and Explainability in AI:** Interpretability through Simplification and Visualization, Intrinsic Interpretable Methods, Post Hoc Interpretability, Explainability through Causality, Model-Agnostic Interpretation Techniques.	**05 Hrs**
	Unit –II	
4	**Ethics, Accountability, and Privacy in AI (6 hours):** Auditing AI Models and Fairness Assessment, Principles for Ethical AI Practices, Privacy Concerns in AI and Introduction to Privacy Attacks, Privacy-Preserving Techniques: Differential Privacy, Federated Learning	**06 Hrs**
5	**Real-World Applications and Case Studies (3 hours):** Case Studies (Pick any 3): Recommendation Systems, Medical Diagnosis, Hiring / Education, Computer Vision, Natural Language Processing	**05 Hrs**

Textbooks:

1. "Fairness and Machine Learning: Limitations and Opportunities", Solon Barocas, Moritz Hardt, Arvind Narayanan
2. "Interpretable Machine Learning",Christoph Molnar
3. "The Ethical Algorithm: The Science of Socially Aware Algorithm Design" Michael Kearns and Aaron Roth
4. "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" Virginia Dignum

Lab Plan:

Experiment No.	Brief description about the experiment	Number of slots
1.	Building and Understanding a Simple AI System	2
2.	Bias Detection and Fairness Mitigation in Classification	2
3.	Visualize and interpret the Black-Box Models with SHAP and LIME	2
4.	Implement Privacy-Preserving Learning	2
5.	Ethical Impact Analysis of AI Applications	2
6.	• Fine-Tuning for Specific Tasks • Ethical Considerations and Bias Detection • Real-World Application Development Performance Optimization and Scaling	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: Agentic AI			**Course Code: 25ECSE331**
L-T-P: 2-0-1	**Credits: 3**		**Contact Hrs:**
ISA Marks: 67	**ESA Marks: 33**		**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**		**Exam Duration: 2 hrs**
Unit –I			
1	**Basics of Agentic AI:** Introduction, Flipped Interaction Pattern, The Agent Loop, Adding Structure to AI Agent Outputs		**08 hrs**
2	**AI Agents, Tools, Actions and Language:** GAIL - Goals, Actions, Information, Language, Giving Agents Tools, Tool Descriptions and Naming, Tool Results and Agent Feedback		**07 hrs**
3	**GAME: A conceptual Frameworks for AI Agents:** Overview of the GAME Framework, Simulating Agents in ChatGPT		**07 hrs**
Unit –II			
4	**AI Tool Management**: Keeping Agent Tools Up to Date with Python Decorators, Tool Organization for Agents, Refactoring Our README Agent		**04hrs**
5	**Rethinking How software is built in the age of AI Agents:** Build the Impossible with AI Agents, Rethinking How We Teach Innovation, Hallucination is a New Form of Computing, New Ways to Access and Extract Information		**04hrs**
Text Books: 4. Agentic AI - Maria Johnsen - Google Books (2025) https://books.google.co.in/books?id=bMg7EQAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false 2. Agentic Artificial Intelligence: Harnessing AI Agents to Reinvent Business, Work and Life by Pascal Bornet (2025) https://www.amazon.com/Agentic-Artificial-Intelligence-Harnessing-Reinvent-ebook/dp/B0F1DS36YC			
References: **1.** https://www.coursera.org/learn/ai-agents-python			

Agentic AI Lab Plan:

Experiment No.	Brief description about the experiment	Number of slots
1	Design and implement Programmatic Prompting and Customer Service Agent	2
2	Simulate agents by role-playing different GAME elements via prompting.	4
3	Simulate collaboration between multiple agents using the GAME framework.	4
4	Evaluate and improve agent simulations.	2
5	Fine-Tuning for Specific Tasks	2

	Ethical Considerations and Bias Detection Real-World Application Development Performance Optimization and Scaling	

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: Social Network Analysis		**Course Code: 25ECSE402**
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: 28 hrs**	**Exam Duration: 02 hrs**

	Unit –I	
1	**Introduction:** Introduction: Motivation, different sources of network data, types of networks, tools for visualizing network data.	**05 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.	**08 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.	**07 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	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: Multimodal AI		**Course Code: 25ECSE460**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 04 hrs/week**	
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**	
Teaching Hrs: 30	**Practical: 28 hrs**	**Exam Duration: 2 hrs**	
Unit –I			
1	**Introduction to Multimodality:** Definitions, scope, and significance; Data Modalities: Text, image, audio, video; Characteristics and challenges; Methods for extracting features from different modalities; Different Learning methods.		**07 Hrs**
2	**Multimodal Mechanisms:** Self-attention, cross-attention, and their applications, Generative Models: GANs, VAEs, and their multimodal variants, Multimodal Representation Learning: Joint and coordinated representations, Fusion Strategies: Early fusion, late fusion, hybrid fusion techniques, Evaluation Metrics: Assessing the performance		**08 Hrs**
Unit –II			
3	**Multimodal translation**: Multimodal Emotion Recognition, Multimodal Dialogue Systems: Integrating text, speech, and visual inputs in conversational AI, Multimodal Machine Translation: Techniques and challenges in translating across modalities,		**08 Hrs**
4	**Multimodal Information Retrieval:** Searching and retrieving information from multimodal datasets, Addressing bias, fairness, and privacy in multimodal AI.		**07 Hrs**

Reference books:

1. Zhou, Zheng. Multimodal AI: Algorithms and Applications. Springer, 2021.
2. Baltrusaitis, Tadas, Chaitanya Ahuja, and Louis-Philippe Morency. Multimodal Machine Learning: Techniques and Applications. San Rafael, CA: Morgan & Claypool, 2018

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: Business Intelligence		**Course Code: 25ECSE461**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hrs: 5 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 15	**Practical Hrs: 56**	**Exam Duration: NA**

	Unit –I	
1	**Foundations of Business Intelligence and Data Preparation:** Definition, Importance, and Applications of BI, BI vs. Data Analytics vs. Data Science, BI Architecture and Components, Role of BI in Decision Support Systems, Overview of the Microsoft Power Platform and Power BI Ecosystem, Understanding Data Sources: Structured, Semi-structured, Unstructured, Data Connections, Import vs. DirectQuery vs. Live Connections, ETL Process in BI, Power Query Editor: Filtering, Replacing, Splitting, Merging, Handling Missing Values and Error Rows, Combining Data from Multiple Sources, User-friendly Naming Conventions, Using Parameters in Queries.	**03 Hrs**
2	**Data Modeling and Calculations Using DAX**: Concepts of Star Schema and Snowflake Schema; Relationships: One-to-One, One-to-Many, Many-to-Many; Role-playing Dimensions and Hierarchies; Cardinality and Cross-filter Direction; Best Practices for Semantic Modeling; Introduction to DAX; Calculated Columns and Measures; Filter Context and Row Context; Time Intelligence,	**04 Hrs**
3	**Building Interactive and Intelligent BI Reports:** Designing Effective Reports and Dashboards, Selecting and Customizing Visualizations (Charts, KPIs, Tables), Enhancing Interactivity: Drill-Downs, Drill-Throughs, Filters, Conditional Formatting and Dynamic Elements, Using Bookmarks, Buttons, and Navigation for Better UX, Ensuring Accessibility: Alt Text, Color Contrast, and Keyboard Navigation, Mobile Optimization for BI Reports, Advanced Analytics in Power BI: Trend Analysis, Forecasting, Decomposition Tree, Key Influencers Visuals, Natural Language Q&A and R/Python Integration in Power BI.	**04 Hrs**
4	**Managing and Deploying Power BI Assets:** Publishing and Managing Datasets in Power BI Service, Configuring Row-Level Security (RLS), Scheduling Refresh and Monitoring Dataflow, Managing Reports and Dashboards, Version Control and Sharing Reports, Creating and Managing Workspaces, Role Management and Content Sharing, Power BI Apps: Publishing and Distribution, Deployment Pipelines for Lifecycle Management, Data Governance and Compliance.	**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	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: Advanced Computer Graphics		**Course Code:22ECSE433**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6hrs/week**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical hrs: 84**	**Exam Duration: -NA-**

*No Units

1	Review of Rasterization and Ray tracing	3hrs
2	Rendering acceleration data structures	3hrs
3	Applications of Texture mapping	3hrs
4	Physically based lighting models, global illumination	3hrs
5	Multi-pass shading techniques	6hrs
6	Surface design and representation (Implicit and Parametric forms)	3hrs
7	Mesh Parameterization	6hrs
8	Mesh simplification	3hrs
9	Animation	3hrs
10	Virtual world design	6hrs
11	Volume rendering	3hrs

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. Pharr, M., Jakob, W., and Humphreys, G. Physically Based Rendering: From Theory To Implementation.
14. 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: Wireless and Mobile Networks			**Course Code: 25ECSE462**
L-T-P: 2-0-1	**Credits: 03**		**Contact Hours: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**		**Total Marks: 100**
Teaching Hours: 30	**Tutorial/Practical: 28hrs**		**Exam Duration: 2 hrs**
Unit I			
1	**Wireless Networks:** Wireless Links and Network Characteristics, CDMA, Wi-Fi: 802.11 Wireless LANs, The 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IP Subnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee.		**05 hrs**
2	**Cellular Networks:** Cellular network evolution (1G to 4G), System Design Fundamentals, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference.		**06 hrs**
3	**Mobile Radio Propagation:** Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.		**04 hrs**
Unit II			
4	**5G Architecture and applications:** 5G Standards and Specifications: ITU-R, ITU-T and IMT-2020, 3GPP; 5G Architecture and Use Cases: NGMN 5G Architecture Framework, 3GPP 5G Architecture. Enhanced Mobile Broadband, Massive Machine Type Communications, Ultra-Reliable and Low-Latency Communications.		**06 hrs**
5	**Radio Access Network:** RAN Architecture, RAN–Core Functional Split, RAN Protocol Architecture.		**05 hrs**
6	**Network Slicing:** Core Network Requirements, Network Functional Architecture, Network Slicing.		**04 hrs**

Text Books

1. J. F. Kurose, K. W. Ross, "Computer Networking, A Top-Down Approach", 8th Edition, Pearson Education, 2021.
2. Theodore S. Rappaport, "Wireless Communications Principles and Practice", Cambridge University Press, 2024.
3. William Stallings, "5G Wireless: A Comprehensive Introduction", 1st Edition, Addison-Wesley, 2021.

Reference Books:

1. Erik Dahlman, Stefan Parkvall, Johan Skold, "5G NR: The next generation wireless access technology", 2nd Edition, Academic Press Inc, 2020.
2. Cory Beard and William Stallings, "Wireless Communication Networks and Systems", Global Edition 1, Pearson, 5 January 2016.

Evaluation Scheme

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	34
	Total	**67**

ESA Scheme

Assessment	Conducted for marks	Weightage
ESA (Theory)	60	33
	Total	**33**

Lab experiments:

Expt./Job No.	Brief description about the experiment/job	No. of Lab Slots
1	**Packet analysis** of Wi-Fi and Bluetooth	02
2	**Mobile network Use Case Simulation** ○ Simulate eMBB, mMTC, and URLLC traffic scenarios using NS-3 or MATLAB. ○ Measure latency, throughput, and packet loss.	02
3	**Network Slicing** ○ Create virtual network slices using Mininet or Kubernetes for isolated services. ○ Demonstrate how slices are used for different use cases (e.g., IoT, video streaming).	04

4	**Radio Access Network** ○ Simulate centralized vs distributed RAN using srsRAN or OpenAirInterface (OAI). ○ Identify performance trade-offs.	03
5	**Simulate Mobile Edge Compute with Network Slicing** ○ Combine MEC and network slicing: assign slices to different edge applications and analyze performance.	03

BACK

Program: Bachelor of Engineering			
Course Title: Wireless Communication Networks			**Course Code: 22ECSE415**
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	**Introduction to Wireless Transmissions:** Reference model for communication systems; Frequencies for radio transmission; Signal propagation – path loss of radio signals, additional signal propagation effects, multi-path propagation; Multiplexing – SDM, FDM, TDM, CDM; Modulation – Amplitude shift keying, frequency shift keying, phase shift keying, advanced frequency shift keying, advanced phase shift keying, multicarrier modulation; Spread spectrum – DSSS, FHSS; Cellular systems		**8hrs**
2	**Medium Access Control:** Motivation for a specialized MAC – hidden and exposed terminals, near and far terminals; SDMA; FDMA; TDMA; CDMA; Comparison of S/T/F/CDMA; OFDMA		**8hrs**
3	**Telecommunication and Satellite Systems:** GSM – Mobile services, system architecture, radio interface, protocols, localization and calling, handover, security, new data services; Applications of satellite systems; Types of satellite systems – GEO, LEO, MEO.		**8hrs**
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, newer developments; HIPERLAN; Bluetooth		**8hrs**
5	**4G Networks and Beyond:** Evolution from 1G to 4G and beyond; What is 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 virtualization		**8hrs**
Textbooks: 1. Jochen H. Schiller, “Mobile Communications”, second edition, Addison-Wisely.			

Reference Books:

1. Theodore S Rappaport, "Wireless communications: Principles and Practise", 2nd Edition, Pearson.
2. William Stallings, "Wireless Communications & Networks", 2nd Edition, Pearson

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, Q.No.-4, Q.No.-5	1, 2, 3	Solve Any **3** out of **5**
II	Q.No.-6, Q.No.-7, Q.No.-8	4, 5	Solve Any **2** out of **3**

BACK

Program: Bachelor of Engineering		
Course Title: Software Defined Networks		**Course Code: 25ECSE405**
L-T-P : 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**	**Exam Duration: 2 hrs**

	Unit – I	
1	**Introduction:** Evolving network requirements, Types of Network and Internet Traffic, The SDN approach, Data plane functions and protocols	**05 hrs**
2	**OpenFlow:** OpenFlow logical network device, OpenFlow protocol, OpenFlow messages, OpenFlow events.	**05 hrs**
3	**Control Plane:** SDN Control plane architecture, POX architecture, OpenDaylight architecture, REST, Mininet based examples,	**05 hrs**
	Unit-II	
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.	**06 hrs**
5	**Software Application plane:** SDN Application Plane Architecture, Traffic Engineering, Measurement and Monitoring.	**04hrs**
6	**Network Functions Virtualization (NFV):** OpenFlow VLAN Support, Virtual Private Networks, Network Virtualization: A Simplified Example, Network Virtualization Architecture.	**05 hrs**

Laboratory Plan: Experiments

Lab Slot	Experiment	Correlation to Unitization
1.	Introduction to Mininet.	UNIT-I
2.	Setting up the Environment and Implementation of Controllers.	
3.	Custom Topology: POX, ODL, Floodlight.	
4.	Legacy Network: BGP Example.	
5.	Early efforts of SDN: MPLS Example.	UNIT-II
6.	Configuration of SDN Networks.	
7.	Configuring VXLAN.	
8.	Open flow Protocol Management.	
9.	Interaction between Legacy Networks and SDN Networks.	
10.	Configuring VPLS.	UNIT-II
11.	Network function virtualization	

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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: Cloud Security		**Course Code: 25ECSE463**
L-T-P: 2-0-1	**Credits: 03**	**Contact Hours: 4hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hrs: 30	**Practical Hrs: 28**	**Exam Duration: 2hrs**

	Unit I	
1	**Principles and Concepts:** Zero Trust, Threat Actors and Trust Boundaries, Cloud Service Delivery Models, The Cloud Shared Responsibility Model, Risk Management Data Asset Management and Protection: Data Identification and Classification, Data Asset Management in the Cloud, Tagging Cloud Resources, Protecting Data in the Cloud	**7 hrs**
2	**Cloud Asset Management and Protection:** Types of Cloud Assets, Asset Management Pipeline, Tagging Cloud Assets. Identity and Access Management: Life Cycle for Identity and Access ,Request, Authentication, Authorization, Revalidate, Sample Application	**8 hrs**
	Unit II	
3	**Vulnerability Management:** Vulnerable Areas, Finding and Fixing Vulnerabilities, Risk Management Processes, Vulnerability Management Metrics, Change Management, Sample Application	**7 hrs**
4	**Security Incidents:** Privileged User Access, Logs from Defensive Tooling, Cloud Service Logs and Metrics, Operating System Logs and Metrics, Aggregation and Retention, Parsing Logs, Searching and Correlation, Alerting and Automated Response, Security Information and Event Managers, Threat Hunting, Preparing for an Incident, Responding to an Incident, Recovery, Redeploying IT Systems, Tools for Detection, Response, and Recovery Sample Application	**8 hrs**

Text Books

1. Chris Dotson, Practical Cloud Security, Published by O'Reilly Media, Inc, October 2023: Second Edition

Reference Books:

1. Tim Mather, Cloud security and Privacy, Published by O'Reilly Media, Inc, September 2009: First Edition.

List of Experiments:

Sl.No.	Experiments	No.of lab slots (1 slot = 2hours)
1	Configuration of Secure EC2 Instance Setup (AWS)	1
2	Demonstration of IAM Roles and Policies (AWS)	1
3	Configuration of Secure S3 Buckets with Encryption	1
4	AWS Cloud Trail Logging	1

5	DDoS and AWS WAF Setup	1
6	Vulnerability Scanning in the Cloud(OpenVAS)	1
7	Survey : AI in Cloud Security Deliverable : Report	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: 25ECSE464**
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	**Practical: 28hrs**	**Exam Duration: 2 hrs**

	Unit –I	
1	**Introduction to Web Security:** Security Goals for Web Applications, The fundamentals and state-of-the-art in web security. Common Threats and Vulnerabilities, Attacks and countermeasures	**04 hrs**
2	**Authentication and Session Management :** User Authentication Methods : Passwords, OTPs, OAuth, Biometrics Session Management and Attacks : Session Hijacking, Fixation Secure Login Mechanisms, Multi-Factor Authentication (MFA)	**05 hrs**
3	**Web Application Vulnerabilities:** Injection Attacks: SQL Injection, Command Injection, Cross-Site Scripting (XSS): Stored, Reflected, DOM-based, Cross-Site Request Forgery (CSRF) File Upload Vulnerabilities, Broken Access Control, Insecure Direct Object References (IDOR)	**06 hrs**
	Unit –II	
4	**Web Server and Hosting Security:** Web Server Hardening , HTTPS and SSL/TLS Configuration, Content Security Policy (CSP), Web Application Firewalls (WAF)	**05 hrs**
5	**Secure APIs and Web Services:** REST and SOAP Security, API Authentication :JWT, OAuth2, Limiting and Throttling, Common API Vulnerabilities	**04 hrs**
6	**Secure Web Development Practices:** Input Validation and Output Encoding, Error Handling and Logging, Secure Coding Principles: Least Privilege, Fail Secure, Framework-Specific Security: Django, Node.js, React	**06 hrs**

Reference Books:

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2nd Edition Wiley, ISBN: 978-1118026472, 2011.
2. Malcolm McDonald Web Security for Developers, No Starch Press, 1st Edition , ISBN: 978-1718501041, 2020
3. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Java, .NET, and PHP, 1st Edition (2020) O'Reilly Media, ISBN: 978-149205311

Evaluation Scheme

Scheme for In Semester Assessment (ISA)

Assessment	Conducted for marks	Weightage in (%)
ISA-1 (Theory)	30	33
ISA-2 (Theory)	30	
Laboratory Assessment	60	34
	Total	**67**

Scheme for End Semester Assessment (ESA)

Assessment	Conducted for marks	Weightage in (%)
ESA (Theory)	60	33
	Total	**33**

Lab Experiments

S.No	Experiments	No of Lab Slots
1	Introduction to Web security Tools: XAMPP/LAMP stack, OWASP Juice Shop, DVWA	02
2	Implementing and Bypassing Login Authentication	01
3	Session Hijacking using Cookies	01
4	Web Vulnerabilities	02
5	Input Validation and Output Encoding	02
6	Implement HTTPS Using Self-Signed Certificates	02
7	Testing a REST API for Injections and Misconfigurations	02
8	Implementing Content Security Policy (CSP)	02

BACK

Program: Bachelor of Engineering		
Course Title: Software Architecture and Design Thinking		**Course Code:18ECSE410**
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:18ECSE408**	
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: Compiler optimization for HPC		**Course Code: 22ECSE431**
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: 3hrs**
Content		
Introduction to HPC, Recap of Compilers Compiler Frontend Fortran, C/C++, CLANG based assignments OpenMP pragmas for HPC Intro to DWARF debugging support Compiler Backend – ~2 assignments Vectorization Scalar optimization HLO Few other topics .. HPC Libraries – 1 assignment BLAS, FFT, Solvers – open-source libraries Optimizations Mini Project ~10 hours (students work guided by lab faculty and periodically AMD engineers) Open source HPC code and optimization opportunities		

BACK

Program: Bachelor of Engineering			
Course Title: Quantum Computing Fundamentals			**Course Code: 22ECSE416**
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 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.		**7 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.		**5 hrs**
3	**Introduction to Quantum computing frameworks:** Toolbox in python, QISKIT, Xanadu, Rigetti etc.		**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.		**8 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.		**5 hrs**
6	**Exploring Python for Solving Problems / Projects using Quantum Computing**		**3 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 Book (List of books as mentioned in the approved syllabus) 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
References 1. Internet References, toolbox and other relevant software.

BACK

Program: Bachelor of Engineering			
Course Title: Multicore Architecture and Programming		**Course Code: 25ECSE465**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs:4hrs/week**	
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**	
Teaching Hrs: 30	**Practical Hrs:28**	**Exam Duration: 2**	
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. comminicating 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	**Chapter 6: GPU Programming:** OpenACC, HIP, OpenCL basics, OpenCL for Heterogeneous Computing, GPU Profiling and tools.		**5 hrs**
Text Books: 1. Gerassimos Barlas, "Multicore and GPU Programming: An Integrated Approach Paperback", 1st Edition, Morgan Kaufmann, 2015.			

Reference Books:

1. Robert(Bob) Robey,and Yuliana(Yulie) Zamora, Parallel and High performance computing, Manning publications, 2021.
2. Shameem Akhter and Jason Roberts, Multicore Programming , Increased Performance through Software Multi-threading, Intel Press , 2010

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**

Lab Experiments:

Expt./Job No.	Brief description about the experiment/job	No. of tutorial Slots	Marks
1	Demo on 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

BACK

Program: Bachelor of Engineering		
Course Title: C# Programming and .NET		**Course Code: 18ECSE409**
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.	**The Philosophy of .NET:** Understand the motivation behind the .NET platform, Common Language Infrastructure (CLI). Know the role of the Common Type System (CTS), the Common Language Specification (CLS) and the Common Language Runtime (CLR), Understand the assembly, metadata, namespace, type distinction, Contrast single-file and multi-file assemblies, Know the role of the Common Intermediate Language (CIL), Platform independent .NET(Mono / Portable .NET distributions).	**5hrs**
2.	**C# Language Fundamentals:** Language Fundamentals, Reference and value Types, primitive types the Nullable and enum types, Classes and objects, Defining classes, Creating objects, Using static members, Overloading Methods, Various Constructors. Encapsulating data, access modifiers, properties, indexers arrays and readonly fields. Structures. String and DateTime classes, three pillars of OOPs	**7 hrs**
3.	**Exceptions and Object Life Time:** Ode to Errors, Bugs and Exceptions, The Role of .NET Exception handling, the System. Exception base class, Throwing a generic Exception, Catching Exceptions, CLR System-Level Exceptions (System.SystemException), Custom Application-Level Exceptions (System.ApplicationException). Handling Multiple Exception, The Finally Block, The Last Chance Exception, Understanding Object Life time. The CIL of "new", The Basics of Garbage Collection	**4 hrs**
	Unit –II	
4.	**Event handling paradigm Interfaces and Collections:** Understanding the .NET Delegate type, Multicast Delegate and events. Interfaces, overriding interface implementation. Explicit interface implementation, Collection, IEnumerable, IEnumerator, IList, IComparer and their Generic equivalent. Working with generic List, Stack, Dictionary and Queue	**6 hrs**
5.	**Programming Window Forms Applications:** Anatomy of a Form, Component Class, Control Class, Control Events, Responding to Keyboard Events, Form Class, Building Menus with Windows Forms, Building your Menu System, Creating Pop-Up Menu, Adding Controls to Forms (IDE-Free), Adding Controls to Forms (via VS.NET), Working with Basic Controls like Buttons, Configuring Tab Order.	**5 hrs**

6.	**Working with Database:** Introduction to ADO.NET , Connecting to a database, Understanding DataTables, Creating a DataAdapter, Referencing fields in a DataRow, Navigating records ,Adding, editing, and deleting records, Building an ADO.NET example.	**5 hrs**
	Unit –III	
7.	**Understanding the .NET Assemblies:** Problems with Classic.COM Binaries, An overview of .NET Assembly, Building a single file test assembly, A C# Client Application, A Visual Basic .NET Client Application, Cross-Language Inheritance, Exploring the Car Library's Manifest, Exploring the Car Library's Types.	**4 hrs**
8.	**Using .NET Assemblies:** Building a multi file assembly, Using the Multifile Assembly , Understanding the private Assemblies, Probing for private Assemblies (The Basics), Private Assemblies and XML Configuration Files, Probing for Private Assemblies(The details), Understanding Shared Assemblies, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly.	**4 hrs**

Text Books:

1. Herbert Schildt, "The Complete Reference C# 4.0", Tata McGraw –Hill, 2010
2. Andrew Troelsen, "Pro C# with .NET 3.0", Special Edition, Dream tech Press, India, 2007.

Reference Books:

1. Stephen C. Perry, AtulKahate, Stephen Walther, Joseph Mayo, "Essential of .net and
2. Related Technologies with a focus on C#, XML, ASP.net and ADO.net", 2nd Edition, Pearson, 2009.
3. Paul J. Deitel, Harvey Deitel, "Visual C# 2010 for Programmers", 4th Edition, Pearson, 2010.
4. Joseph Albahari and Ben Albhari, "C# 3.0/4.0 in Nutshell", 3rd Edition, O'Rilley, 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: Model Thinking			**Course Code: 18ECSE411**
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: 03 hrs**
Unit –I			
1	**Why Model:** Model Thinking - The Need, Advantages and Disadvantages, Segregation/Peer Effects, Case Study		**4 hrs**
2	**Modeling People, Tipping Points & Economic Growth:** Rational Models, Behavioral Models, Rule Based Models, Percolation Models, Growth and its Kinds		**6 hrs**
3	**Special Topics:** Standing Ovation Model, Game of Life, Lyapunov Functions: Equilibrium, A cycle, Randomness or Complexity, Coordination and Culture, Urn Models, Polya Process, Paths and Networks, Prisoners' Dilemma, Collective Action & Mechanism Design		**6 hrs**
Unit –II			
4	**Randomness and Learning Models:** Luck as Randomness, Random Walks & Colonel Blotto, Replicator Dynamics, Fisher's Fundamental Theorem, Prediction and the Many Model Thinker, Social Models		**8 hrs**
5	**Model Checking and Modelling Concurrent Systems:** Model Checking, Characteristics of Model Checking, Transition Systems, Parallelism and Communication, The State Space Explosion		**8 hrs**
Unit –III			
6	**Linear-Time Properties:** Linear-Time Behavior, Safety Properties and Invariants, Liveness Properties, Fairness		**4 hrs**
7	**Regular Properties:** Automata on Finite Words, Model-Checking Regular Safety Properties, Automata on Infinite Words, Model Checking with Omega-Regular Properties		**4 hrs**

Text Books:

1. Scott E Page, The Model Thinker, Basic Books Publication, 2018.
2. ChristelBaier and Joost-Pieter Katoen, Principles of Model Checking (Representation and Mind Series), The MIT Press, 2008.

Reference Books:

1. Model Thinking Coursera online course from Michigan University.

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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			
Course Title: Software Testing			**Course Code:18ECSE407**
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 of Software Testing”, John Wiley & Sons, Second edition, 2004.
2. Roger S. Pressman, “Software Engineering. A Practitioners Approach”, McGraw-Hill International Edition, Seventh edition, 2009.

References:

1. William E. Perry, “Effective Methods for Software Testing”, John Wiley & Sons, Second edition, 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

Program: Bachelor of Engineering			
Course Title: Fuzzy Set Theory			**Course Code:19ECSE402**
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	**Introduction** : Introduction to Fuzzy Logic, Fuzzy Membership Functions, Operations on Fuzzy Sets		**8hrs**
2	**Fuzzy Measures:** Fuzzy Relations, Fuzzy Proposition, Fuzzy Implications, Fuzzy Inferences		**8hrs**
Unit –II			
3	**Fuzzy Relations and Fuzzy Graphs**: Fuzzy Relations, Compositions of Fuzzy Relations, Properties of the Min-Max Composition, Defuzzificatin Techniques, Lambda-cut method, Weighted average method, Maxima methods, Centroid methods, Output of a Fuzzy System		**8 hrs**
4	**Uncertainty Modeling:** Application-oriented Modeling of Uncertainty, Causes of Uncertainty, Uncertainty Methods, Possibility Theory		**8hrs**
Unit-III			
5	**Fuzzy Data Bases and Queries:** Introduction, Fuzzy Relational Databases, Fuzzy Queries in Crisp Databases		**4 hrs**
6	**Fuzzy Sets and Expert Systems:** Introduction to Expert Systems, Uncertainty Modeling in Expert Systems, Applications		**4 hrs**

Text Books:

1. H. J. Zimmermann, Fuzzy Set Theory-and Its Applications, Fourth Edition, 4th Ed., Springer Science Business Media, LLC , 2001
2. Chander Mohan, An Introduction to Fuzzy Set Theory and Fuzzy Logic,2nd ed. Vivo Books pvt ltd , 2015

Reference Books:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3ed., 2010, A John Wiley and Sons, Ltd., Publication
2. Kumar S. Ray,Soft Computing and Its Applications: Fuzzy Reasoning and Fuzzy Control, 1st Edition, Apple Academic Press 2014
3. Ahmed M. Ibrahim, Fuzzy Logic for Embedded Systems Applications, Elesvier Press, 2004.

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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: Unix Network Programming		**Course Code: 24ECSE404**	
L-T-P: 1-0-2	**Credits: 3**	**Contact Hrs: 5 hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 20	**Tutorial/Practical: 56 hrs**	**Exam Duration: 2 hrs**	
Unit –I			
1	**Communication Protocols:** Introduction TCP/IP – Internet Protocols XNS SNA NetBIOS UUCP Protocol comparisons.		**5 hrs**
2	**Elementary Socket Programming:** Introduction Overview UNIX Domain Protocols Socket Addresses Elementary Socket system calls A simple example.		**5 hrs**
3	**Advanced Socket Programming:** Advanced Socket System calls Reserved Ports Stream Pipes Passing file descriptors Socket options Asynchronous I/O Input/output Multiplexing Out-of-Band Data Sockets and Signals Internet Super server Socket implementation.		**6 hrs**
Unit –II			
4	**Time and Date Routines:** Introduction Internet Time and Date Client Network Time Synchronization.		**5 hrs**
5	**Ping Routines:** Introduction Internet Ping Client XNS Echo Client.		**5 hrs**
6	**Trivial File Transfer Protocol:** Introduction Protocol Data Formats Connections Client user interface UDP implementation TCP implementation.		**6 hrs**
Unit –III			
7	**Remote Command Execution:** Introduction Security Issues rcmd function and rshd Server rexec function and rexecd Server.		**4 hrs**
8	**Remote Login:**Introduction Terminal Line DisciplinesASimple Example.		**4 hrs**

Text Books:

1. W.R. Stevens, Unix Network Programming, PHI 2003.
2. M. J. Rochkind, Advanced Unix Programming, 2nd Edition, Pearson Education 2004.

Reference Books:

1. Sumitabha Das, Unix Concepts and Applications, 3rd Edition, Tata McGraw-Hill 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** 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: Social Network Analysis		**Course Code: 24ECSE405**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**	
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**	
Teaching Hrs: 40	**Practical:**	**Exam Duration: 3 hrs**	

1	COURSE LEVEL Undergraduate/Postgraduate COURSE LAYOUT Week 1: Introduction ; Tutorial 1: Introduction to Python/Colab; Tutorial 2: Introduction to NetworkX - Part I	**6 hrs**
2	Week 2: Network Measures ; Tutorial 3: Introduction to NetworkX -Part II Week 3: Network Growth Models Week 4: Link Analysis	**6 hrs**
3	Week 4: Link Analysis contd.	**4 hrs**
4	Week 5: Tutorial 4: Graph Visualization Tools ; Community Detection - Part I Week 6: Community Detection - Part II	**6 hrs**
5	Week 7: Link Prediction Week 8: Cascade Behavior and Network Effects **Foundations of privacy** - Information privacy, Measurement, Theories.	**6 hrs**
6	**Privacy regulation** - Privacy, Anonymity, Regulation, Data Breach.	**4 hrs**
7	Week 9: Anomaly Detection Week 10: Introduction to Deep Learning; Graph RepresentationLearning - Part I	**4 hrs**
8	Week 11: Graph Representation Learning - Part II ; Tutorial: Codingon Graph Representation Learning Week 12: Applications and Case Studies ; Conclusion	**4 hrs**

Text Books:

Course registration link : https://onlinecourses.nptel.ac.in/noc23_cs106/preview

LMS link: https://learn.kletech.ac.in/course/view.php?id=159

Reference 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.
3. Peter R. Monge, Noshir S, Contractor, Theories of communication networks,Oxford University Press, 2003.
4. Duncan Watts, Six degrees: the science of a connected age, W. W. Norton & Company, 2004.

ISA: Scheme of Evaluation

Details	Marks
SWAYAM Exam will be conducted by SWAYAM and passing criteria is as follows Average assignment score = 25% of average of best 8 assignments out of thetotal 12 assignments given in the course. Exam score = 75% of the proctored certification exam score out of 100 Final score = Average assignment score + Exam score	50
ISA1 & ISA2	50
Total	**100**

BACK

Program: Bachelor of Engineering		
Course Title: Software Testing		**Course Code: 24ECSE402**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 03 hrs/week**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Teaching Hrs: 40		**Exam Duration: 03 hrs**

Week	Content
Week 1	Techniques and algorithms for test case design: Graphs based testing-structural coverage criteria
Week 2	Graphs based testing: Data flow coverage criteria
Week 3	Graphs based testing: Data flow coverage criteria
Week 4	Graphs coverage for source code, design elements and requirements
Week 5	Techniques and algorithms for test case design: Logic based testing-Predicates, logic based coverage criteria
Week 6	Specification based logic coverage, logic coverage on finite state machines
Week 7	Input space partitioning: Input domain modeling, combination strategies criteria
Week 8	Syntax based testing: Coverage criteria based on syntax, mutation testing
Week 9	Test case design (as learnt above) applied to object-oriented applications
Week 10	Test case design (as learnt above) applied to web applications
Week 11	Symbolic testing
Week 12	Concolic testing, Conclusion

Text Books:

1. By Prof. Meenakshi D'souza | IIIT Bangalore
   https://onlinecourses.nptel.ac.in/noc24_cs91/preview

Scheme for In Semester Assessment (ISA) conducted by KLE TECH

Minor	Number of Questions	Week No	Instructions	Marks
I	3 Questions to be set of 20 Marks Each	1-6	Solve Any **2**	25 M
II	3 Questions to be set of 20 Marks Each	1-6	Solve Any **2**	25 M
			ISA Total	**50 M**

Scheme for End Semester Assessment (ESA) Conducted by NPTEL

Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.
Exam score = 75% of the proctored certification exam score out of 100
Final score = Average assignment score + Exam score

BACK

Program: Bachelor of Engineering		
Course Title: Cyber Security and Privacy		**Course Code: 24ECSE401**
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: 03 hrs**

Week	Content
Week 1	Introduction to cyber security, Confidentiality, integrity, and availability
Week 2	Foundations - Fundamental concepts, CIA, CIA triangle, data breach at target
Week 3	Security management, Governance, risk, and compliance (GRC)- GRC framework, security standards.
Week 4	Contingency planning - Incidence response, Disaster Recovery, BCP.
Week 5	Cyber security policy - ESSP, ISSP, SYSSP
Week 6	Risk Management - Cyber Risk Identification, Assessment, and Control
Week 7	Cyber security: Industry perspective - Defense Technologies, Attack, Exploits
Week 8	Cyber security technologies - Access control, Encryption, Standards.
Week 9	Foundations of privacy - Information privacy, Measurement, Theories.
Week 10	Privacy regulation - Privacy, Anonymity, Regulation, Data Breach.
Week 11	Privacy regulation in Europe, Privacy: The Indian Way - Data Protection, GDPR, DPDP, Aadhar.
Week 12	Information privacy: Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy, espionage, Privacy vs safety. R20. The dark side of customer analytics.

Text Books:

1. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.
2. https://onlinecourses.nptel.ac.in/noc24_cs121/preview

Reference Books:

1. Darktrace,"Technology" https://www.darktrace.com/en/technology/#machine-learning, accessed November 2018.
2. Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.

Scheme for In Semester Assessment (ISA) conducted by KLE TECH

Minor	Number of Questions	Week No	Instructions	Marks
I	3 Questions to be set of 20 Marks Each	1-6	Solve Any **2**	25 M
II	3 Questions to be set of 20 Marks Each	1-6	Solve Any **2**	25 M
			ISA Total	50

Scheme for End Semester Assessment (ESA) Conducted by NPTEL

Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.
Exam score = 75% of the proctored certification exam score out of 100
Final score = Average assignment score + Exam score

BACK

Semester - VIII

Internship Training and Internship 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: 25ECSI495
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

Internship Training is a supervised, practical training periods for which Undergraduate, final year students earn academic credits. Internship 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 Internship Training can range from start-ups to large scale industries. The students who got placed in campus interviews may be offered Internship 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 Internship 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
Internship Training	25ECSI495	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: 25ECSW496
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 Internship 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 Internship Project depending upon the need of the company. Other students who wish to do Internship 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
Internship Project	25ECSW496	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: 20ECSW402
L-T-P: 0-0-11	Credits: 11	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs: --	Tutorial/Practical: 42 hrs	Exam Duration: 3hrs

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: 15ECSO401**
L-T-P: 2-0-1	**Credits: 3**		**Contact Hrs: 4hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**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: 4. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, Elsevier, 2013. 5. Dan C. Marinescu, Cloud Computing Theory and Practice, Elsevier, 2013. 6. Nigel Poulton, The Kubernetes Book, Packt Publishing, 2019.			

BACK

Program: Bachelor of Engineering			
Course Title: Database Management System			**Course Code: 15ECSO402**
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**

BACK

Program: Bachelor of Engineering			
Course Title: Software Engineering			**Course Code: 15ECSO403**
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	**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.		**6hrs**
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: High Performance Computing for Engineering Applications		**Course Code:15ECSO404**
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: 3hrs**

	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.	**8hrs**
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	**8hrs**
	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	**8hrs**
4	**Parallel Programming:** Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI)	**8hrs**
	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	**4hrs**
6	**Case Studies and Projects done during the course:** Various case studies from various engineering discipline	**4hrs**

Text Books

1. Introduction to Parallel Computing, AnanthGrama, 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: 15ECSO405**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 6hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical hrs: 84**	**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			
Title: Big Data Analytics			**Course Code: 18ECSO401**
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: 3hrs**
Unit –I			
1	**Introduction:** Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.		**4hrs**
2	**Big Data Technologies:** Parallel Data Processing, Distributed Data Processing, Hadoop , Spark		**8hrs**
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.

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Scheme for End Semester Examination (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