KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Batch: **2019-2023**
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 recognized 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 and Engineering 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 wide range of computing and information technology businesses and occupations.

- To be at the forefront of research through new and exciting innovations leading to the future of computing technologies.

- To collaborate within and beyond discipline to create solutions that benefit humanity and society.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
PEO: 1. Graduates will demonstrate peer recognized technical competency to solve analyze, design, develop, deploy and maintain computing solutions for contemporary problems.
PEO: 2. Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.
PEO: 3. Graduates will be engaged in ongoing learning and professional development through pursuing higher education and self-study.
PEO: 4. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.
Program Outcomes-PO's
PO 1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
PO 2: **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3: **Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PO 4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12: **Life-long learning**: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Objectives -PSO's
PSO 1: **Domain-specific knowledge**: An ability to apply techniques to develop computer based solutions in the domain of data, system and network engineering.
PSO 2: **Software System Construction**: Apply design and development principles in the construction of software systems of varying complexity.

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Curriculum Structure-Overall

Semester					**Total Program Credits: 177.5 (44+133.5)**			**Year: 2019-23**	
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 15ECSC301 (3-0-0)	Computer Networks-2 20ECSC303 (3-0-0)	Big Data & Analytics 17ECSC401 (2-0-1)	PE-6 XXECSE4XX (3-0-0)	Industry Training 18ECSI493 (0-0-6)
	Engineering Physics 15EPHB101 (3-0-0)	Engineering Chemistry 15ECHB102 (3-0-0)	Discrete Mathematical Structures 19ECSC202 (3-1-0)	Microcontroller: Programming & Interfacing 20ECSC206 (3-0-1)	Computer Networks-1 19ECSC302 (3-1-0)	Distributed & Cloud Computing 20ECSC305 (2-0-1)	Information Security 20ECSC402 (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 20ECSC201 (4-0-0)	Object Oriented Programming 20ECSC204 (3-0-0)	System Software 17ECSC302 (3-0-0)	Professional Aptitude & Logical Reasoning 16EHSC301 (3-0-0)	PE-3 XXECSE4XX (3-0-0)	Capstone Project 20ECSW402 / Industry Project 20ECSW494 (0-0-11)	
	C Programming for Problem Solving 18ECSP101 (0-0-3)	Engineering Exploration 15ECRP101 (0-0-3)	Data Structures and Algorithms 20ECSC205 (4-0-0)	Database Management System(15ECSC208) (4-0-0)	Web Technologies Lab 21ECSP304 (0-0-2)	PE-1 XXECSE3XX (3-0-0)	PE-4 XXECSE4XX (3-0-0)		
	Basic Electrical Engineering 18EEEF101 (3-0-0)	Basic Electronics 18EECF101 (4-0-0)	Principles of Compiler Design (19ECSC203) (3-1-0)	Operating System Principles and Programming 18ECSC202 (4-0-1)	Machine Learning 17ECSC306 (2-0-1)	PE-2 XXECSE3XX (3-0-0)	PE-5 XXECSE4XX (3-0-0)		
	Social Innovation 15EHSP101 (0-1-1)	Basic Mechanical Engineering 15EMEF101 (2-1-0)	Data Structures and Algorithms Lab 19ECSP201 (0-0-2)	Database Applications Lab(15ECSP204) (0-0-1.5)	System Software Lab 19ECSP302 (0-0-1.5)	Blockchain and Distributed Ledgers 21ECSC307 (2-0-1)	Senior Design Project 20ECSW401 (0-0-6)		
	Engineering Physics Lab 16EPHP101 (0-0-1)	Professional Communication 15EHSH101 (1-1-0)	Computer Organization and Architecture Lab (20ECSP202) (0-0-1.5)	Object Oriented Programming Lab 20ECSP203 (0-0-1.5)	Data Mining & Analysis 18ECSC301 (3-0-1)	Computer Networks Lab 20ECSP305 (0-0-1.5)	CIPE 15EHSA401 (Audit)		
					Mini Project 15ECSW301 (0-0-3)	Minor Project 15ECSW302 (0-0-6)			
Credits	**21**	**23**	**23.5**	**23**	**23.5**	**25.5**	**21**	**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 (in hrs)
1	18EMAB101	Single Variable Calculus	BS	4-1-0	5	6	50	50	100	3 hours
2	15EPHB101	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	15EHSP101	Social Innovation	HSS	0-1-1	2	3	80	20	100	3 hours
7	16EPHP101	Engineering 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 (in hrs)
1	18EMAB102	Multivariable Calculus	BS	4-1-0	5	6	50	50	100	3 hours
2	15ECHB102	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	15ECRP101	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	15EMEF101	Basic Mechanical Engineering	ES	2-1-0	3	4	50	50	100	3 hours
7	15EHSH101	Professional Communication	HSS	1-1-0	2	3	50	50	100	3 hours
TOTAL				**14-3-6**	**23**	**32**	**410**	**290**	**700**	

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Semester- III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	15EMAB204	Graph Theory and Linear Algebra	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	20ECSC201	Computer Organization and Architecture	PC	4-0-0	4	4	50	50	100	3 hours
4	20ECSC205	Data Structures and Algorithms	PC	4-0-0	4	4	50	50	100	3 hours
5	19ECSC203	Principles of Compiler Design	PC	3-1-0	4	5	50	50	100	3 hours
6	19ECSP201	Data Structures and Algorithms Lab	PC	0-0-2	2	4	80	20	100	3 hours
7	20ECSP202	Computer Organization and Architecture Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
TOTAL				**18-2-3.5**	**23.5**	**29**	**410**	**290**	**700**	

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Date: Program Head

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Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	20EMAB209	Applied Statistics with R	BS	3-1-0	4	5	50	50	100	3 hours
2	20ECSC206	Microcontroller: Programming and Interfacing	PC	3-0-1	4	5	50	50	100	3 hours
3	20ECSC204	Object-Oriented Programming	PC	3-0-0	3	3	50	50	100	3 hours
4	15ECSC208	Database Management System	PC	4-0-0	4	4	50	50	100	3 hours
5	18ECSC202	Operating System Principles and Programming	PC	4-0-1	5	6	50	50	100	3 hours
6	15ECSP204	Database Applications Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
7	20ECSP203	Object Oriented Programming Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
TOTAL				**17-1-5**	**23**	**29**	**410**	**290**	**700**	

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Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	15ECSC301	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	17ECSC302	System Software	PC	3-0-0	3	3	50	50	100	3 hours
4	21ECSP304	Web Technologies Lab	PC	0-0-2	2	4	80	20	100	3 hours
5	17ECSC306	Machine Learning	PC	2-0-1	3	4	50	50	100	3 hours
6	19ECSP302	System Software Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
7	18ECSC301	Data Mining & Analysis	PC	3-0-1	4	5	80	20	100	3 hours
8	15ECSW301	Mini Project	PW	0-0-3	3	3	50	50	100	3 hours
TOTAL				**14-1-8.5**	**23.5**	**30**	**490**	**310**	**800**	

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Date:

Program Head

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Semester- VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	20ECSC303	Computer Networks-2	PC	3-0-0	3	3	50	50	100	3 hours
2	20ECSC305	Distributed & Cloud Computing	PC	2-0-1	3	4	50	50	100	3 hours
3	16EHSC301	Professional Aptitude & Logical Reasoning	HSS	3-0-0	3	3	50	50	100	3 hours
4	XXECSE3XX	Professional Elective-1	PE	3-0-0	3	3	50	50	100	3 hours
5	XXECSE3XX	Professional Elective-2	PE	3-0-0	3	3	50	50	100	3 hours
6	21ECSC307	Block chain and Distributed Ledgers	PC	2-0-1	3	4	50	50	100	3 hours
7	20ECSP305	Computer Networks Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
8	15ECSW302	Minor Project	PW	0-0-6	6	3	50	50	100	3 hours
TOTAL				**16-0-9.5**	**25.5**	**26**	**430**	**370**	**800**	

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

Date: Program Head

Semester- VII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	17ECSC401	Big Data & Analytics	PC	2-0-1	3	4	50	50	100	3 hours
2	20ECSC402	Information Security	PC	2-0-1	3	4	50	50	100	3 hours
3	XXECSE4XX	Professional Elective-3	PE	3-0-0	3	3	50	50	100	3 hours
4	XXECSE4XX	Professional Elective-4	PE	3-0-0	3	3	50	50	100	3 hours
6	XXECSE4XX	Professional Elective-5	PE	3-0-0	3	3	50	50	100	3 hours
7	20ECSW401	Senior Design Project	PW	0-0-6	6	3	50	50	100	3 hours
8	15EHSA401	CIPE(Audit)	HSS	0-0-0	0	2	50	50	100	3 hours
TOTAL				**13-0-8**	**21**	**22**	**350**	**350**	**700**	

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Date: Program Head

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Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
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*	18ECSI493	Industry Training	PW	0-0-6	6	12	50	50	100	3hours
4	20ECSW494	Industry Project	PW	0-0-11	11	22	50	50	100	3 hours
	20ECSW402	Capstone Project								
TOTAL				**6-0-11**	**17**	**28**	**150**	**150**	**300**	

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

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

Date: Program Head

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	23	23.5	23	23.5	25.5	21	17	177.5

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List of Open Electives

Sr. No	Name of the Course	Course Code
1	High Performance Computing for Engineering Applications (3-0-0)	(15ECSO404)
2	Essential of IT (3-0-0)	(15ECSO405)
3	Software Engineering (3-0-0)	(15ECSO403)
4	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)		
Data Engineering		
1	Signals & Systems (3-0-0)	(21ECSE313)
2	Fundamentals of Image & Video Processing (2-1-0)	(21ECSE312)
3	Computer Vision (2-0-1)	(18ECSE301)
4	Neural Networks & Deep Learning(2-1-0)	(21ECSE314)
Networking		
1	Multimedia Networks (3-0-0)	(21ECSE311)
2	Data Integration & Cloud Services (0-0-3)	(21ECSE332)
3	Internet of Things (2-0-1)	(17ECSE303)
4	Active Directory Domain Services (2-0-1)	(17ECSE304)
Systems Engineering		
1	The ARM Architecture (2-1-0)	(19ECSE302)
2	Embedded Intelligent Systems (0-0-3)	(18ECSE302)
3	Robotic Process Automation Design and Development (3-0-0)	(20ECSE301)
4	Parallel Computing (3-0-0)	(17ECSE307)
5	Quantum Computing (3-0-0)	(17ECSE306)
Electives for Skill Enhancement		
1	Algorithmic Problem Solving(0-0-6)	(17ECSE309)
2	Semantic Web (3-0-0)	(19ECSE303)
3	DevOps (0-0-3)	(21ECSE310)
4th Year (Professional Electives- 3, 4, 5 & 6)		
Data Engineering		
1	Advanced computer graphics(0-0-3)	(22ECSE433)
2	Advanced computer vision(0-0-3)	(22ECSE434)
3	Social Network Analysis (3-0-0)	(18ECSE402)
4	Natural Language Processing (2-0-1)	(22ECSE403)
Networking		
1	Mobile and Wireless Networks (3-0-0)	(20ECSE412)
2	Wireless Communication Networks(3-0-0)	(22ECSE415)
3	Cyber Security (2-0-1)	(19ECSE401)
4	Software Defined Networks (3-0-0)	(20ECSE405)
Systems Engineering		
1	Advanced Parallel Computing (3-0-0)	(18ECSE408)
2	Software Architecture and Design Thinking (3-0-0)	(18ECSE410)
3	Compiler Optimization for HPC	(22ECSE431)

4	Quantum Computing fundamentals (3-0-0)	(22ECSE416)
Electives for Skill Enhancement		
1	Software Testing (3-0-0)	(18ECSE407)
2	C# Programming & .Net (3-0-0)	(18ECSE409)
3	Model Thinking (3-0-0)	(18ECSE411)
4	Fuzzy Set Theory (3-0-0)	(19ECSE402)
5	Unix Network Programming (3-0-0)	(18ECSE404)

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 hrs	**Tutorial: 28 hrs**	**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). **MatLab**: Graphing functions, Domain-Range and Interpreting the models	**05 hrs**
3	**Calculus of functions and models:** Limit of a function, Infinite limits- graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton- Raphson Method Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L- Hospital's rule-Examples **MatLab:** optimization problems. Curvature problems	**11 hrs**
	Unit II	
4	**Infinite Series:** Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series **MatLab:** Convergence of series	**06 hrs**
5	**Integral calculus:** Tracing of standard curves in Cartesian form, Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's 1/3 rule **MatLab**: problems on arc length, area, volume and surface area	**14 hrs**
6	**Ordinary differential equations of first order** • 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 • Applications of first order differential equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies.	**10 hrs**

	MatLab: Solve differential equations	

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: 15EPHB101
L-T-P: 3-0-0	Credits:3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs -40 Hrs		Exam Duration:3 Hrs

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

	(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

BACK

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 hrs		**Exam Duration: 3 hours**

	Unit I	
1	**Overview of Civil Engineering: Evolution of Civil Engineering** Specialization, scope and role. **Impact of Civil Engineering on** National economy, environment and social & cultural fabric. **Challenges and Opportunities for Civil Engineers** Civil Engineering Marvels, Future challenges, Higher education and Research.	**04 hrs**
2	**Coplanar concurrent force system: Introduction to Engineering Mechanics:** Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition, Newton's laws of motion. Classification of force systems **Resultant of coplanar concurrent force system:** Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces. **Equilibrium of coplanar concurrent force system:** Conditions of equilibrium, Action & Reaction, Free body diagram, Lamis' theorem. Numerical problems on equilibrium of forces.	**12 hrs**
3	**Coplanar non-concurrent force system : Resultant of a force system**: Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignons principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems.	**05 hrs**
	Unit II	
4	**Equilibrium of a force system (Chapter 3 contd..)** Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam.	**5 hrs**
5	**Static Friction:** Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge and belt friction theory. Derivation of belt friction formula. Numerical problems on, impending motion on horizontal and inclined planes (including connected bodies); wedge friction; Ladder friction and Belt friction.	**8 hrs**
6	**Simple Stress and Strain:** Introduction, Properties of Materials, Stress, Strain, Elasticity, Elastic limit, Hooke's law & Young's modulus, Stress – Strain	**6 hrs**

	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.	
	Unit – III	
7	**Centroid of Plane Figures:** Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle and sector of a circle etc,.) using method of integration, Numerical problems on Centroid of simple built up sections.	**5 hrs**
8	**Second moment of area (Plane figures):** Introduction, Definition, Method of determining the second moment of area, Section Modulus, Radius of gyration, perpendicular and Parallel axis theorems, Polar second moment of area, second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using method of integration, Numerical problems on MI of simple built up sections.	**5 hrs**

Text Book:

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

References:

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

BACK

Program: Bachelor of Engineering			**Semester - I**
Course Title: C Programming for Problem Solving			**Course Code: 18ECSP101**
L-T-P: 0-0-3	**Credits: 3**		**Contact : 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 : 40 Hrs.		**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.	**2 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.	**5 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	**8 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.	**5 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.	**5 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: Social Innovation		Course Code: 15EHSP101
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 **(Thomas Alva Edison)**	**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 Confidence by**

		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)**		**David Kelley – IDEO Founder)**
	Process of Social Innovation	**Engage** Community study and Issue Identification	**Reading assignments** • Handout on Community Study and Issue Identification • Case Study on "EGramSeva" • Case Study on "Janani Agri Serve" **Class Presentations** • 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 **Use template 1: Frame your Design Challenge**	• 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

		PEER REVIEW		
		2. Inspiration • Plan for the Research • Development of Interview guide • Capture your Learnings	**Reading assignments** • Handout on Overview of Inspiration **Class Presentations** • 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	**Reading assignments** • Handout on Overview of Ideation-Synthesis **Class Presentations** • Create insights • "How might we" questions **Use template 5: Create Insights** **Template 6: Create "How Might We' Questions**	• Familiarization of the respective templates with the help of sample case study

		3.0 Ideation **3.2 Prototyping** • Generate Ideas • Select Promising Ideas • Determine what to prototype • Make your prototype • Test and get feedback	**Reading assignments** • Handout on Overview of Ideation-Prototyping **Class Presentations** • Story board- demonstrating the possible solutions **Use template 7: Select your best ideas** **Template 8 : Determine what to prototype**	• Brain storming • Familiarization of the respective templates with the help of sample case study • Activity on Risk management • Activity on Resource management Structure building games
		PEER REVIEW		
		4.0 Implementation • Create an action plan • Community Partners (if any) • Budgeting & Fundraising 1. **Peer to Peer** 2. **Crowd Funding** 3. **Giving Kiosks** 4. **Donation** 5. **Envelop Funding** 6. **Marathons/ Walkathons** 7. **Conducting Yoga Classes** **(www.causevox.com / www.blog.fundly.com)** • Duration • Ethical concerns • Launch your solution • Feedback (Impact**)**	**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

		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: Engineering Physics lab		Course Code: 16EPHP101
L-T-P: 0-0-1	Credits : 1	Contact Hrs.: 2hrs/Week
ESA 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 hrs	**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	**8 hrs**
	Unit-II	
3	**Triple integrals:** Triple integrals, Cartesian, change to Cylindrical and Spherical coordinates Application of Triple integrals	**7 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. **Matlab:** application of differential equations	**(5+5) hrs**

Text Books :

1. Early Transcendental Calculus- James Stewart, Thomson Books, 7ed 2010

Reference Books:

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

BACK

Program: Bachelor of Engineering		**Semester - II**
Course Title: Engineering Chemistry		**Course Code: 15ECHB102**
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.	**4 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.	**6 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.	**6 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.	**4 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.	**9 hrs**

	Fabrication process: thermal oxidation, diffusion, ion implantation – numerical problems, epitaxial growth, masking and photolithography, wet etching, dry etching.	
6	**Material Chemistry:** Liquid Crystals – Types of liquid crystals, applications of Liquid Crystal in Display system. Fluorescence and Phosphorescence – Jablonski diagram, Thermoelectric and Piezoelectric materials – meaning, properties and applications	**3 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	**4 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.	**4 hrs**

Text Books :

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

Reference Books:

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

BACK

Program: Bachelor of Engineering		**Semester - II**
Course Title: Problem Solving with Data Structures		**Course Code: 18ECSP102**
L-T-P: 0-0-3	**Credits: 3**	**Contact: 6 Hrs./week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching :	**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:** 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: 15ECRP101
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: 50Hrs.		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.	**3 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).	**7 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.	**6 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	**7 hrs**

	suppressed carrier modulation (DSBSC), Generation of DSBSC wave : balanced modulator, Super heterodyne principle.	
	Linear Power Supply, UPS & CRO: Working principle of linear power supply, UPS and CRO. Measurement of amplitude, frequency and phase of a given signal.	**3 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: 15EMEF101	
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 hrs	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 a moving experience, 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 hrs.	Tutorial: 28 hrs.	Exam Duration: 3 hrs.

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

References:

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

BACK

Semester-III

Program: Bachelor of Engineering		**Semester-III**
Course Title: 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 hrs		**Exam Duration: 3 hrs**

	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.	**8 hrs**
	Unit –III	
5	**Integral Transforms:** (a) Laplace transformation and its applications (b) Fourier transforms, Discrete Fourier transforms and its applications. Fourier Series, Properties, Fourier Transforms, Discrete Cosine Transform, Discrete Fourier Transform, Case Studies on Multimedia Processing.	**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 Science by Narsingh Deo, PHI publications (1986).

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	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: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40 hrs	Tutorial: 28 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Logic and Proofs**: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Rules of Inference. Introduction to Proofs, Mathematical Induction and Well-Ordering	**8hrs**
2	**Functions and Relations:** Types of sets, Functions, Relations, Equivalence relations partial ordering (Poset), HasseDiagram, Counting	**8hrs**
	Unit –II	
3	**Recurrence Relations:** Introduction, Applications of Recurrence Relations, Solving Recurrence Relations, Formulating Recurrence relations, Generating Functions, Inclusion–Exclusion, Applications of Inclusion–Exclusion	**8 hrs**
4	**Groups:** Binary Operations, Semi groups, Products and Quotients of Semi Groups, Groups, Product and Quotients of Groups	**8 hrs**
	Unit –III	
5	**Cryptography:** Cryptography and Modular Arithmetic, Introduction to Cryptography, Private Key Cryptography, Public-key Cryptosystems. Arithmetic modulo n, Cryptography using multiplication mod n	**4hrs**
6	**RSA Cryptosystem:** The RSA Cryptosystem; RSA Encryption, RSA Decryption, RSA as a Public Key System, Cryptographic Protocols	**4 hrs**

Text Books:

1. Rosen K.H., Discrete Mathematics and its Applications with Combinatorics and graph theory, 7th Ed, Tata Mc-GrawHill Publications, 2012

Reference Books:

1. Kolman, Busby and Ross, Discrete Mathematical Structures, 5Ed., PHI, 2004
2. Grimaldi R.P. and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, 5Ed., Pearson Education, 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	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		Semester - III
Course Title: Computer Organization and Architecture		Course Code:20ECSC201
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50 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	**5 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	**8 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	**7 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	**10 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.	**10 hrs**
	Unit –III	

6	General-Purpose Graphic Processing Units, GPU versus CPU, GPU Architecture Overview	**5 hrs**
7	Control Unit Operation ,Micro-Operations , Control of the Processor , Case studies and Projects	**5 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	

BACK

Program: Bachelor of Engineering		**Semester - III**
Course Title: Data Structures and Algorithms		**Course Code: 20ECSC205**
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 hrs		**Exam Duration: 3hrs**

	Unit –I	
1	**Fundamentals of Algorithms and Problem Solving**: Space and Time Complexities, Order of an algorithm, Efficiency Analysis of Stacks and Queues Revisited, Recursive Definitions, Recursive Functions, Towers of Hanoi, Backtracking, Recursion Vs. Iteration	**8 hrs**
2	**Hashing and Hash tables:** Direct Address Table, Hash Table, Hash Functions, Collision Resolution Techniques.	**4 hrs**
3	**Graphs and Trees:** Graphs, Computer Representation of Graphs, Trees, Tree Traversals, AVL Trees, 2-3 Trees, Application of Binary Trees, Tries, DFS, BFS	**8 hrs**
	Unit –II	
4	**Sorting Techniques:** Sorting, Bubble sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort.	**8 hrs**
5	**Substring Search Algorithms:** Brute-force method, Boyer-Moore Algorithm, Knuth-Morris-Pratt Algorithm, Rabin-Karp Algorithm	**4 hrs**
6	**Graph Algorithms:** Union-Find Data Structure, Shortest Path algorithms, Minimum Spanning Tree Algorithms	**8 hrs**
	Unit –III	
7	**Problem Case Studies:** Travelling Sales Person Problem, Knapsack Problem, Fake Coin Problem, Strassen's Matrix Multiplication, Huffman Coding	**5hrs**
8	**Limitation of Algorithm Power:** Undecidability, P and NP Classes, P vs NP, NP-Hard, NP-Complete	**5 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

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 - III
Course Title: Principles of Compiler Design		Course Code: 19ECSC203
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 hrs		Exam Duration: 3 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.	**6hrs**
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	**6hrs**
3	**Introduction to Syntax Analysis:** Introduction To Grammars, Context-Free Grammars (CFGs), Ambiguity In Grammars And Languages, Role Of Parsing.	**4 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.	**8 hrs**
5	**Bottom up Parsing:** Introduction, SLR (1) Parsing, General LR (1) And LALR (1) Parsing, Error Recovery In Bottom Up Parsing.	**8 hrs**
	Unit –III	
6	**Semantic Analysis:** Attributes And Attributes Grammars, Algorithm For Attribute Computation, Symbol Table, Data Types And Data Checking.	**4 hrs**
7	**Intermediate Code Generation:** Intermediate Code And Data Structure For Code Generation, Code Generation Of Data Structure References, Code Generation Of Control Statements.	**4 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 - III
Course Title: Data Structure and Algorithms Lab		Course Code: 19ECSP201
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs:	Practical Hrs: 56 hrs.	Exam Duration: 3 hrs

Tentative plan of lab Implementation

Week No	Lab Assignments
1	03 Programming Assignments on Stacks, Queues, Lists, Files
2	
3	
4	01 Assignment on Fundamentals of Algorithms
5	01 Assignment on Trees
6	02 Assignments on Graphs
7	
8	01 Assignment on Sorting
9	01 Assignment on Searching
10	01 Assignment on Sorting and Searching Applications
11	03 Assignments on Graph algorithms
12	
13	
14	Open Ended Experiment

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 : Computer Organization and Architecture Lab		Course Code: 20ECSP202
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: 56 hrs	Practical Hrs: 42 hrs.	Exam Duration: 3 hrs

Tentative plan of lab Implementation

Week No	Lab Assignments
1	Logisim Tool Demo
2	Combinational Circuits (Half Adder, Full Adder, Decoder, Multiplexer)
3	
4	Building ALU
5	1-bit RAM Cell and building bigger RAM
6	Cache Memory
7	[Cache Simulator + Time Analysis]
8	Instruction Format & Decoding, Control Signal Generation
9	Data Path Design for Given Set of Instructions
10	
11	MIPS 5-Stage Pipeline: Simulates the pipeline.
12	Loop unrolling: A software technique for exploiting instruction-level
13	parallelism.
14	Technical Paper reading, summarizing / Paper Presenting

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

BACK

IV Semester

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 hrs	**Tutorial Hrs: 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 Quantitle, Qunatile plots	**8 hrs**
2	**Probability:** Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Baye's rule, Applications: Data Classification Methods - Decision Tree Induction, Bayesian Classification. **R-tutorial**: Introduction to Data handling, Description of data graphically, Histogram, Skewness, Boxplot, QQ-norm, Decision tree	**6 hrs** **8 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.	**8 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 **R-tutorial**: Probability distribution, Testing of Hypothesis for proportions, means(single and differences)	**8 hrs** **8 hrs**
	Unit-III	
5	**Correlation and Regression:** Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression, Logistic Regression.	**5 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) **R-tutorial:** Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach	**5 hrs** **4 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: 20ECSC206
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs:40 hrs	Practical hrs: 84 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction to Microcontroller and Embedded System:** Micrcontrollers 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.	**4-hrs**
2	**AVR Architecture and Assembly Language Programming on AVR Microcontrollers:** Simplified View of an AVR Micrcontroller, 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 Tyes 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 featues of ACR Microcontrollers, Viewing registers and memory with AVR Studio IDE.	**8-hrs**
3	**AVR Time Delay and Instruction Pipeline:** Delay Calculation of AVR, AVR Multistage execution Pipeline, Timers/Counters, C Data Types, AVR Timer/Counter Programming.	**4hrs**
	Unit –II	
4	**Chapter No. 4. 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,	**4-hrs**
5	**Chapter No. 5. 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 Disablibng Interrupts, Programming Timer Interrupts, Programming external interrupts,	**6-hrs**
6	**Chapter No. 6. 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	**6 hrs**

	register and USART, UCSR Registers and USART Configuration, Programming AVR for Serial Communication.	
Unit –III		
7	**Chapter No. 7. LCD and KeyBoard Interfacing** LCD Interfacing, Sending Commands and Data to LCD (4 Bits and/or 8 Bits at a time). Keyboard Interfacing, Matrix Keyboard connection to AVR Ports, Key Identification,	**4 hrs**
8	**Chapter No. 8. ADC, DAC and Sensor Interfacing** Need for ADC and DAC in Interfacing, ADC Characteristics, ADC devices, ATmega32 ADC features, Programming A/D Converter, DAC Interfacing, Sensor Interfacing and Signal Conditioning.	**4 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		

List of Experiments

Experiments		**Total Weightage: NA**		**No. of Lab Sessions**	
Expt/Job No.	Experiment/ Job details	No. of Lab sessions/batch	Marks/ experiment	PI Code	Correlation of experiment with course content
1	Assembly language programming	1	--	1.3.1	Chapter 2
2	Assembly language programming	1	--	1.3.1	
3	Problem statement discussion on course project	1	--	2.1.2 3.3.1 4.2.1	Entire Syllabus
4	AVR C programming to interface external peripherals	4	--	1.3.1 4.2.1 5.3.1	
5	Project : discussion on progress status & implementation	2	--	2.1.2 3.3.1 4.2.1	

6	Intermediate evaluation of project	1	20	5.3.1 10.1.3	
7	Final evaluation of project	1			

Scheme for Semester End 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**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2**
II	Q.No.-7	7	Solve Any **1**
	Q.No.-8	8	

BACK

Program: Bachelor of Engineering		Semester - IV
Course Title: Object Oriented Programming		Course Code: 20ECSC204
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40 hrs		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. 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:** Virtual functions, Friend functions, static functions, The 'this' pointer	**6 hrs**
5	**Templates and Exception Handling:** Function and class templates. Introduction to exceptions, Throwing an Exception, Try Block, Exception Handler (Catching an Exception), Multiple exceptions. Exceptions with arguments	**6hrs**
6	**Design Patterns:** Creational, Structural and Behavioural design patterns.	**4 hrs**
	Unit –III	
7	**Streams and Files:** Stream classes, File I/O with streams.	**4 hrs**
8	**Standard Template Library:** container classes**:** Sequence and Associative Containers	**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

Scheme for End Semester Assessment (ESA)

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

BACK

Program: Bachelor of Engineering		Semester- IV
Course Title: Database Management System		Course Code: 15ECSC208
L-T-P:4-0-0	Credits: 4	Contact Hrs: 05 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50 hrs.	Tutorial: --	Exam Duration: 03 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.	**6hrs**
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.	**8hrs**
3	**SQL:** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; JOIN operations, Complex SQL Queries.	**6hrs**
	Unit –II	
4	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	**7 hrs**
5	**Introduction to Transaction Processing:** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializibilty.	**7 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.	**6 hrs**
	Unit –III	
7	**Database Security:** Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks;	**5 hrs**
8	**Introduction to NOSQL and Columnar database:** Introduction; Difference between SQL and NoSQL; Scaling of Databases; Applications; Columnar Database: Introduction; Row-oriented Systems; Column-	**5 hrs**

	oriented systems; Benefits; An Example of Columnar Database;	

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 Semester End 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**
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: Operating Systems Principles and Programming		Course Code: 18ECSC202
L-T-P: 4-0-1	Credits: 5	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50 hrs	Practical: --	Exam Duration: 3 Hrs

	Unit –I	
1	**Introduction and Systems structures:** Operating System Definition; Operating System Operations; Modules of OS,Overview of UNIX Operating System,UNIX APIs	**4 Hrs**
2	**Process Management:** Process Concept, Process Scheduling, Operations on Processes, Inter-Process Communication (Pipes and FIFOs), Threads, Process Scheduling, Basic Concepts, Scheduling Criteria, Scheduling Algorithms Process Management Using UNIX Apis**:** Process Management Functions, User Ids and Group Ids, Creating Process, Parent Child Relationship	**10 Hrs**
3	**Process Synchronization:** Synchronization, The Critical Section Problem, Peterson's Solution, Semaphores, Classical Problems of Synchronization, Process Synchronization UNIX APIs	**6 Hrs**
	Unit –II	
4	**Deadlocks:** Deadlocks, System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock	**6 Hrs**
5	**File management:** File Concepts, Directory Structure, File Types, File Systems, File Attributes, Inodes in UNIX, UNIX Kernel Support for Files, Directory Files, Hard and Symbolic Names, General File APIs, File and Record Lock API, Symbolic File API	**7 Hrs**
6	**Memory Management:** Memory Management Strategies, Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory Management, Background, Demand Paging, Page Replacement	**7 Hrs**
	Unit –III	
7	**Secondary Storage Management:** Mass Storage Structures, Disk Structure, Disk Attachment, Disk Scheduling; Disk Management	**5 Hrs**
8	**Case study:** Architecture of Mobile OS, Introduction, Overall Architecture, Linux Kernel, Various Components, Network OS, Applications.	**5 Hrs**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 9th edition, Wiley-India, 2015
2. W. Richard Stevens, Stephen A. Rago, Advanced Programming in the UNIX Environment, 3rd Edition, Addison Wesley Professional, 2013

Reference Books:

1. William Stallings, "Operating System Internals and Design Principles", 7th edition, Pearson Education, Asia, 2013
2. Terrence Chan, "Unix System Programming Using C++", 1st ed., Prentice Hall India, 2015

List of Experiments

Expt. No.	Experiments	No. of Slots
1	Process control (Using fork, wait, exec, exit API's)	2
2	Inter Process Communication using Pipes, FIFO's	2
3	Concurrent operations using Threads	2
4	File/ record locking and unlocking using *fcntl*	1
5	Simulation of CPU scheduling algorithms	1
6	Deadlock avoidance(Banker's algorithm), Deadlock detection	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	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: 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: 36 hrs	Practical 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%)

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

BACK

Program: Bachelor of Engineering		Semester - 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: 39 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 ISA (80%) + ESA (20%)

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

BACK

Semester - V

Program: Bachelor of Engineering		**Semester - V**
Course Title: Software Engineering		**Course Code: 15ECSC301**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 Hrs / week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 Hrs**

	Unit - I	
1	**Software Engineering Process:** Professional software development Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, The rational unified process, Continuous Integration and Continuous Deployment and Tools.	**6 hrs**
2	**Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management.	**4 hrs**
3	**Requirement Engineering:** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirements 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 (List of books as mentioned in the approved syllabus)

1. Ian Somerville, Software Engineering, 10th, Pearson Ed, 2015

References

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 8th, McGraw, 2007

2. Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering Theory and Practice, 4th, Pearson Ed, 2010
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**
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 - 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 hrs.	Tutorial:	Exam Duration: 3 hrs.

	Unit –I	
1	**Introduction:** Internet, The Network Edge and Core, Protocol Layer and Service Models: OSI and TCP/IP, Networks Attacks, History of Computer Network and Internet.	**8 hrs**
2	**Application Layer:** Principles of Network Applications, HTTP, SMTP, DNS, DHCP	**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.

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Computer Networks-I Tutorial

Sl. No	Exercise	No of Slots (2 hrs/per week)
1	Demonstration of n/w commands and tools.	2
2	Demonstration of socket programming- Connection oriented/Connectionless.	2
3	Application layer protocol implementation - FTP, Mail server, HTTP.	3
4	Demonstration of NS3 / Qualnet tools.	1
5	Performance analysis of TCP, UDP and SCTP.	1
6	Exercise on congestion control techniques.	1
7	Exercise on flow control techniques.	1
8	Design of network topology with IP addressing scheme.	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	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		**Semester - V**
Course Title: System Software		**Course Code: 17ECSC302**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3hrs**

	Unit –I	
1	**Introduction to a 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.	**6hrs**
2	**Assembler:** Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.	**9hrs**
	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 Examples: Assembler(8086): MASM	**7 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, Implementation Examples: 8086 Linker.	**8 hrs**
	Unit –III	
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 Examples: 8086 Macro Processor.	**5 hrs**
6	**Back end of Compiler: Code generation and Machine dependent features.** Review of phases of compilers, code generation routines, machine dependent features.	**5 hrs**

Text Books:

1. Leland L.Beck , D. Manjula, System Software, 3rd edition, Pearson Education, 2012
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, 2nd edition, Addison-Wesley, 2011

Reference Books:

1. Muhammad Ali Mazidi et al,The 8051 Microcontroller and Embedded systems, 2nd Edition, Pearson education, 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	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	7	

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: Machine Learning		Course Code: 17ECSC306
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	Practical: 28 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction Neural Network:** Introduction to perceptron learning, Model representation, Forward and back propagation, multi-layer perceptron and Applications.	6hrs
2	**Deep Neural Network – 1:** Convolution and pooling, Activation functions, data processing, Batch Normalization, transfer learning, back propagation algorithms.	8 hrs
	Unit –II	
3	**Deep Neural Network – 2:** Update rules, hyper parameter tuning, v learning rate scheduling, data augmentation Architectures: AlexNet, VGG, ResNet ,MobileNet	8 hrs
4	**Unsupervised Learning :** Dimensionality reduction and Learning Theory, Expectation Maximization (EM), Factor Analysis, Dimensionality reduction, Principal component analysis and Generative Adversial Networks.	6 hrs
	Unit –III	
5	**Reinforcement Learning:** Reinforcement Learning: Introduction, Model of the environment, Policy search. Evaluating actions: The credit assignment problem, Policy gradients, Markov decision processes, Q-learning.	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, VahidMirjalili.

Reference book:

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

BACK

Program: Bachelor of Engineering		**Semester - V**
Course Title: Data Mining & Analysis		**Course Code:18ECSC301**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: 40	**Exam Duration: 3hrs**	

	Unit –I	
1	**Data Pre-Preprocessing:** Introduction to data mining, Data Warehouse and OLAP Technology for Data mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Major tasks in data preprocessing- data reduction, data transformation and data discretization, data cleaning and data integration.	**8 hrs**
2	**Frequent Pattern Mining:** Frequent item sets and association rules; Item set mining algorithms; Generating association rules; Summarizing item sets: maximal and closed frequent item sets; Interesting patterns: pattern evaluation methods;	**8 hrs**
	Unit –II	
3	**Classification Techniques:** Probabilistic classification: naïve Bayes classifier, K-nearest neighbours; Decision tree classifier: decision tree induction, tree pruning; Model evaluation and selection: metrics, cross validation, random sampling, ROC curves;	**8hrs**
4	**Cluster Analysis:** Cluster Analysis- Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.	**8hrs**
	Unit –III	
5	**Advanced Mining Techniques:** Popular data pre-processing techniques: One hot encoding, stacking; Techniques to improve classification accuracy: ensemble methods, random forests, XGBoosting; Bias-variance trade-off; Post processing: Visualization and Interpretation;	**8 hrs**

Text Books:

1. Jiawei Han, MichelineKamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd edition, Morgan Kaufmann, 2012.

Reference Books:

1. Ian H. Witten, Eibe Frank, Mark A. Hall and Christopher J. Pal, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann; 4th edition, 2016.
2. Pang-Ning, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson, International edition, 2016.
3. Mohammed J. Zaki and Wagner Meira, Jr., Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, 2014.
4. M. H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education, 1st edition, 2006.

List of Experiments

Expt. No.	Experiments	No. of Slots
1	Introduction to Data Science , Basics of Python libraries	2
2	Pre-processing: Assessing and analyzing data, cleaning, transforming and adding new features	2
3	Learning model: Constructing and testing learning model	1
4	Post-processing: Creating final predictions	1

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

BACK

Program: Bachelor of Engineering		Semester – V
Course Title: Web Technologies Lab		Course Code: 21ECSP304
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 30	Practical : 56 hrs.	Exam Duration: 3 hrs

1	**Introduction to HTML basics, JavaScript:** Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics	**4 hrs**
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.	**12 hrs**
3	Angular Building blocks of Angular Apps, Components, Templates, Directives. Services, Dependency injection, Bindings, observables, pipes, component communications, Forms, Interacting with servers using HTTP. RouteGuard, Interceptors, Bundling and deploying applications, Hosting	**12 hrs**
4	React JSX, React Components, Interaction of Components, Lifecycle methods, Form	**8 hrs**

Reference Books:

1. Robert W. Sebesta.” Programming the World Wide Web”, Pearson Publications 8th Edition, 2014.
2. Nathan Murray, Felipe Coury, et al, "ng-book: The Complete Guide to Angular", FullStack.io Publications, 2019
3. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
4. Den Ward, “React Native Cookbook: Recipes for solving common React Native development problems”, 2nd Edition.2019

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Lab Plan

Expt./ Job No.	Lab assignments/experiment	No. of Lab. Slots per batch (estimate)
1	Demonstration on HTML, JavaScript	**02**
2	Exercise on JavaScript	**01**
3	Demonstration on Node	**03**
4	Exercise on Node	**01**
5	Demonstration on Angular	**02**
6	Exercise on Angular	**01**
7	Demonstration on React	**02**
8	Exercise on React	**01**
9	Structured enquiry 1 – MEAN	**02**
10	Structured enquiry 2 – React	**02**

BACK

Program: Bachelor of Engineering		Semester - V
Course Title: System Software Lab		Course Code:19ECSP302
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: 36	Exam Duration: 3hrs	

Sl No	Experiments	Slots/Hrs
1.	Practice programs on user defined functions, structures and programs on file handling	3 hrs
2.	Introduction to basics of given assembly language Programs	3 hrs
3.	Evaluation on given assembly language Program	3 hrs
4.	Implementation of Pass 1 Assembler	3 hrs
5.	Implementation of Pass 2 Assembler	6 hrs
6.	Implementation of Pass 1 Linking loader	3 hrs
7.	Implementation of Pass 2 linking loader	6 hrs
8.	Course Project on identifying machine to implement assembler , learning its architectural features and design Pass 1 Assembler or Pass2 Assembler	6 hrs

Reference Books:

1. Leland.L.Beck and D. Manjula, System Software, 3rd edition, Pearson Education, 2011.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2011.

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	**SEE Marks: 50**	**Total Marks: 100**
Teaching Hrs: 39		**Exam Duration: 3 Hrs**

Student Evaluation Matrix

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

Scheme for End Semester Assessment (ESA)

ESA Evaluation (50 Marks)

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

BACK

Semester - VI

Program: Bachelor of Engineering		**Semester - VI**
Course Title: Computer Network-2		**Course Code: 20ECSC303**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**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.	**08 hrs**
2	**Network Layer:** Broadcast and Multicast Routing algorithms, Error Reporting, Router structure, Buffering strategies: Input queuing, Output queuing, Application of queuing theory for performance of queuing mechanisms, M/M/1, M/M/m system, M/M/B system.	**08 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),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.	**08 hrs**
4	**Switched Local Area Networks:** Link-Layer Addressing and ARP, Ethernet802.3, Token ring 802.5, FDDI, and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANs),Multiprotocol Label Switching (MPLS), Data Center Networking, Retrospective: A Day in the Life of a Web Page Request.	**08 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.	**04 hrs**
6	**Multimedia Networking:** Multimedia Networking Applications, Streaming Stored Video, Voice-over-IP, Protocols for Real-Time Conversational Applications.	**04 hrs**

Text Books:

1. J. F. Kurose, K. W. Ross, Computer Networking, A Top-Down Approach, 7th Edition, Pearson Education, 2017
2. Raj Jain, "Performance evaluation of computer systems", Wiley, 1991.
3. Behrouz A. Forouzan , TCP/IP protocol suite, 4th , McGraw Hill, 2010.

Reference Books:

1. Peterson, Larry L, Computer networks : a systems approach, 5th Edition, The Morgan Kaufmann series in networking, 2012
2. Dimitri P. Bertsekas and Robert G. Gallager, Data Networks (2nd Edition),PHI,2009.

Scheme for Semester End 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	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		Semester - VI
Course Title: Distributed and Cloud Computing		Course Code: 20ECSC305
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:

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

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, Mastering Cloud Computing, McGraw Hil, 2013.

2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010.

List of Experiments:

Expt./Job No.	Brief description about the experiment/job
1.	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization
2.	Implementation of cloud service models(IaaS, PaaS, SaaS)
3.	OS-level virtualization
4.	Building containerized application
5.	Cloud resource scheduling and security mechanisms

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: 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

Program: Bachelor of Engineering		Semester - VI
Course Title: Blockchain and Distributed Ledgers		Course Code: 21ECSC307
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	Practical: 28 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction:** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy, Types of blockchain, blockchain platforms, Blockchain Architecture and use cases, Introduction to Bitcoin, Bitcoin transactions and scripts	**6 hrs**
2	**Cryptography Basics:** Introduction to cryptography, Public key crypto: Introduction, RSA, Digital certificate, PKI, Hash Functions: Introduction, SHA, Digital signature Schemes: RSA, Digital Signature Standard, Merkle trees.	**6 hrs**
	Unit –II	
3	**Consensus Mechanisms:** Basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Proof of Activity, Practical Byzantine Fault Tolerance (PBFT), Federated PBFT, Consensus protocols in Blockchain platforms, Scalability issues of consensus protocols.	**6 hrs**
4	**Blockchain Platforms:** Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling, architecture and components of Hyperledger, Fabric membership and identity management, chaincode as a smart contract	**6 hrs**
	Unit –III	
5	**Blockchain Applications:** Blockchain in Financial Software and Systems: Settlements, KYC, Insurance Government: Digital identity, land records, public distribution system, social welfare systems, Blockchain for cyber security: Cloud forensics, Identity management, Intrusion detection.	**6 hrs**

Reference Books:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
2. Rogen Wattenhofer, “Blockchain Science: Distributed Ledger Technologies”, 1st Edition, Inverted Forest Publishing, 2019
3. Andreas A, Gavin Wood, "Mastering Etherium: Building smart contracts and DApp", 1st Edition, O'Reilly Media, 2018.

4. Matt Zand, Xun Wu, Mark Anthony Morris, “Hands-On Smart Contract Development with Hyperledger Fabric V2”, 1st Edition, O'Reilly Media, 2018.

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 - VI
Course Title: Computer Network Laboratory		Course Code: 20ECSP305
L-T-P:0-0-1.5	Credits: 1.5	Contact Hrs: 3hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 42	Practical: 42 hrs	Exam Duration: 3 hrs

List of Experiments

Sl. No	Experiments	Number of lab Slots (3 hrs)
1.	Demonstration of Mininet and Performance analysis of IEEE 802.11 MAC protocols.	1
2.	Traffic measurement and traffic volume control using the POX controller.	1
3.	Implementation of load balancing/routing technique.	2
4.	Error Detection and Correction using Socket programming.	1
5.	Demonstration of Junos.	1
6.	Configuration and analysis of VLAN.	1
7.	Configuration and analysis of STP/MPLS.	1
8.	Configuration and analysis of OSPF and BGP routing protocols.	2
9.	Experimental analysis of the Handover Procedure in a WiFi Network using Mininet	1
10.	Performance analysis of IEEE 802.11 MAC protocols.	1

BACK

Program: Bachelor of Engineering		Semester - VI
Course Title: Minor Project		Course Code: 15ECSW302
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 39	Practical: 42 hrs	Exam Duration: 3hrs

Sixth semester minor project themes:

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	Problem Definition and Synopsis
Review-2	Requirements, Algorithms, Design
Review-3	Implementation

Scheme for End Semester Assessment (ESA)

Sl. No	Expectation	Marks
1	Write up 1. Problem Statement. 2. Existing and Proposed system. 3. System Model with brief description. 4. Functional and Non Functional Requirements.	05
2	Presentation: Prepare minimum of 15-18 slides of presentation with consultation of your respective guides.	08
3	Demo (Complete execution of the project with results) and Viva voce.	25
4.	Project Report.	12

BACK

Semester: VII

Program: Bachelor of Engineering		Semester: VII
Course Title: Big Data and Analytics		Course Code: 17ECSC401
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30 hrs	Practical: 28 hrs	Exam Duration: 3 hrs

	Unit –I	
1.	**Introduction:** Big Data, Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	**3 hrs**
2.	**Big Data Storage:** Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.	**5 hrs**
3.	**Big Data Processing:** Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce, Examples on Map Reduce.	**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.	**6 hrs**
5.	**Big Data Technologies:** MongoDB – Introduction to MongoDB, RDBMS Vs MongoDB, Data Types in MongoDB, MongoDB Query Language.	**6 hrs**
	Unit – III	
6.	**Big Data Visualization:** Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).	**5 hrs**

Text Books:

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

Reference Books:

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

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

Sl. No.	Experiments	CO	Blooms level	Timeline wrt 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 Data Identification (10 M) a) Learning the domain (2M) b) Assessment of resources available(2M): i) People ii) Technology iii) 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	2	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					**24**	**50**

Scheme for End Semester Assessment (ESA)

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

BACK

Program: Bachelor of Engineering		Semester: VII
Course Title: Information Security		Course Code: 20ECSC402
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	Practical: 28 hrs	Exam Duration: 3 hrs

	Unit –I	
1.	**Cryptography Basics:** Introduction, OSI Security architecture, Secure design principles, A model for network security, Classic Crypto: Substitution and Transposition ciphers, Taxonomy of Cryptography and Cryptanalysis.	**6 hrs**
2.	**Symmetric and Asymmetric Key Crypto:** Symmetric Key Crypto: Stream ciphers, Feistel Cipher, Block Ciphers-AES, DES, IDEA, Block cipher modes, Asymmetric Key Crypto: Knapsack, Diffie-Hellman, Elgamal cryptosystem, Elliptic Curve Cryptography	**6 hrs**
	Unit –II	
3.	**Data Integrity Algorithms and Key Management:** Cryptographic Hash Functions: Hash functions based on cipher block chaining, Message authentication codes: requirements and functions, HMAC. Digital signatures: Elgamal Digital signature scheme, Elliptic Curve Digital Signature Algorithm (ECDSA). Key Management: Symmetric key distribution, Distribution of public keys	**6 hrs**
4.	**Authentication and Authorization:** Introduction, Authentication Methods: Passwords, Two-Factor Authentication, Single Sign-On, Authentication Protocols. Authorization: Access Control Matrix, Multilevel Security Models, Multilateral Security, Firewalls, Intrusion Detection, Access control in Cloud	**6 hrs**
	Unit –III	
5.	**Application and Transport Security Protocols:** Introduction, Pretty Good Privacy and S/MIME, Secure Socket Layer, Transport Layer Security, SSH, Kerberos	**3 hrs**
6.	**Network and Wireless Security Protocols:** IPSec overview, Encapsulating security payload, combining security associations, Internet key exchange, GSM Security, IEEE 802.11 Wireless LAN Security.	**3 hrs**

Text Book

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

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.

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	

Laboratory Plan

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots each of 2 hours
1.	Demo and practice on Crypto Library	1
2.	Implementation of symmetric key algorithm	1
3.	Implementation of Asymmetric key algorithm and Hash functions	2
4.	Course project	4
Total Lab hours		**16**

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:39	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(Audit)		Course Code: 15EHSA401
L-T-P : 0-0-0	Credits: Audit	Contact Hrs: 2 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30 hrs		Exam Duration: 3 hrs

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

Unit – III		
10.	**Effects of human activities on environment:** Effects of human activities on environment - Agriculture, Housing, Industry, Mining, and Transportation activities, Environmental Impact Assessment, Sustainability and Sustainable Development.	**2 hrs**
11.	**Environmental Protection:** Environmental Protection – Constitutional Provisions and Environmental Laws in India.	**2 hrs**

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

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

References:

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

Evaluation Scheme

ISA Scheme

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

BACK

KLE Technological University | Creating Value, Leveraging Knowledge

Semester-VIII

Industry Internship and Industry Project : Rules and Regulations

Total Duration: 5 months full time (No breaks)

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

Program: Bachelor of Engineering		Semester: VIII
Course Title: Industry Training		Course Code: 20ECSI493
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs:		Exam Duration: 3 hrs

Overview of the Course

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

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

Course Learning Outcomes.

CO 1. Enhance their employ ability skills and become job ready along with real corporate exposure.

CO 2. Acquire knowledge in one particular technology.

CO 3. Demonstrate leadership ability and responsibility to perform the given task.

CO 4. Offered jobs in the organizations in which they undergo their Industrial Training.

CO 5. Demonstrate common practices, employment opportunities and work ethics in their relevant

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

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Training	18ECSI493	50	50	Students must secure minimum of 40% marks in both ISA and ESA.

BACK

Program: Bachelor of Engineering		Semester-VIII
Course Title: Industry Project		Course Code: 20ECSW494
L-T-P: 0-0-11	Credits: 11	Contact Hrs: 22 hrs/week
ESA Marks: 50	ISA Marks: 50	Total Marks: 100
Teaching Hrs: --		Exam Duration: 3 hrs

Overview of the Course

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

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

Course Learning Outcomes.

CO 1. Identify the problem and perform requirement analysis
CO 2. Design potential solutions and evaluate to select optimal solution
CO 3. Apply professional norms of project implementation to meet specified requirements
CO 4. Apply fundamental activities of module, integration and system testing to validate the system
CO 5. Analyze results and present technical/scientific findings effectively through written and oral mode

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

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Project	18ECSW494	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: 3 hrs/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 Elective

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 hrs		**Exam Duration: 3 hrs**

	Unit –I	
1.	**Introduction to High Performance Computing:** Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies like CFD, Bioinformatics, Flow analysis etc.	**8 hrs**
2.	**High Performance Computing Systems:** Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built	**8 hrs**
	Unit –II	
3.	**Parallel Algorithms:** Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques	**8 hrs**
4.	**Parallel Programming:** Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI)	**8 hrs**
	Unit –III	
5.	**Achieving Performance:** Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks	**4 hrs**
6.	**Case Studies and Projects done during the course:** Various case studies from various engineering discipline	**4 hrs**

Text Books 1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003. 2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007
Reference Books: 1. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003. 2. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.

Scheme for End Semester Assessment (ESA)

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

BACK

Program: Bachelor of Engineering		
Course Title: Essentials of Information Technology		**Course Code: 15ECSO405**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs:	**Practical: 84 hrs**	**Exam Duration: 3 hrs**

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

Text Books:

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

Reference Books:

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

Scheme for End Semester Assessment (ESA)

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

BACK

Program: Bachelor of Engineering		
Course Title: Software Engineering		**Course Code: 15ECSO403**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 hrs**

	Unit –I	
1.	**Software Engineering process:** Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, The rational unified process, Continuous Integration and Continuous Deployment and Tools.	**6 hrs**
2.	**Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management.	**4 hrs**
3.	**Requirement Engineering:** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirement's elicitation and analysis; Requirements validation; Requirements management.	**6 hrs**
	Unit –II	
4.	**System Modeling:** Context models, Interaction Models, Structural models, Behavioral models.	**6 hrs**
5.	**Architectural Design:** Architectural Design Decision, Architectural views, Architectural patterns, Application Architectures.	**5 hrs**
6.	**Object-Oriented design and implementation:** Object oriented design using UML, design patterns, Implementation Issues, Open source development.	**5 hrs**
	Unit –III	
7.	**Software Testing:** Development Testing, Test Driven Development, Release Testing, User Testing.	**4 hrs**
8.	**Configuration management:** Change management, Version management, System building, Release management.	**4 hrs**

Text Books:

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

Reference Books:

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

Scheme for End Semester Assessment (ESA)

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

BACK

Program: Bachelor of Engineering			
Course Title: Big Data Analytics			**Course Code: 18ECSO401**
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: 3 hrs**
Unit –I			
1.	**Introduction:** Big Data, Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.		**03hrs**
2.	**Big Data Storage:** Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.		**05 hrs**
3.	**Big Data Processing:** Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce, Examples on MapReduce.		**05 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.		**06hrs**
5.	**Big Data Technologies:** MongoDB – Introduction to MongoDB, RDBMS Vs MongoDB, Data Types in MongoDB, MongoDB Query Language.		**06hrs**
Unit –III			
6.	**Big Data Visualization:** Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).		**05hrs**

Text Books

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

Reference Books:

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

Sl. No.	Experiments	CO	Blooms level	Timeline wrt 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	2	Nil
4.	Data Preparation: (10M) a) Preparing the Analytic Sandbox (2M) b) Performing ETLT(2M)	CO2	L3	5th & 6th Week	1.4.3	4	10

	c) Data Conditioning(3M) Data Visualization(3M)						
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	**24**	**50**

Scheme for End Semester Assessment (ESA)

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

BACK

Professional Electives – 1 & 2

Program: Bachelor of Engineering			
Course Title: Computer Vision		**Course Code: 18ECSE301**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hrs: 30 hrs	**Practical: 28 hrs**	**Exam Duration: 3 hrs**	
.Unit – I			
1	**Introduction:** Computer Vision Overview, Pixels and image representation, Filters: Linear systems, Convolutions and cross-correlations; Lab: Basics, Filters		**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.

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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 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

BACK

Program: Bachelor of Engineering		
Course Title: Algorithmic Problem Solving		**Course Code: 17ECSE309**
L-T-P: 0-0-6	**Credits: 6**	**Contact Hrs: 12hrs/week**
ISA Marks: 70	**ESA Marks: 30**	**Total Marks: 100**
Teaching Hrs: 74 hrs	**Practical: 168 hrs**	**Exam Duration: 2-3 days**

	Unit –I	
1	**Building Blocks, Strategies and Performance:** Understanding Coding Platforms and Tools, Data Structures and Algorithms Revisited, Warm up Problems, Parsing and Formatting Text, Code Performance Analysis and Tools	**12 hrs**
2	**Advanced Data Structures:** Matrix, Grids, Trees and variants, Lists, Skip lists, Hash, Trie and variants	**10 hrs**
3	**Dynamic Programming:** Memory Functions, Optimization Problems	**8 hrs**
	Unit –II	
4	**Graph algorithms** Traversal Algorithms, Shortest Path Algorithms, Spanning Tree Algorithms and Variants	**25 hrs**
5	**Introduction to Computational Geometry** Points, Line Segments, Polygons and Basics of Geometric Problems	**5 hrs**
	Unit –III	
6	**Chapter 6: Problem Solving** Assortment of Problems and Techniques	**14 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.

References:

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

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 hrs		**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! Search Monkey	**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.

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 hrs		**Exam Duration: 3 hrs**

	Unit –I	
1	**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	**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	**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	**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	**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, SignalsandSystems1st 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: 21ECSE312**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 4hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs	**Practical: 28 hrs**	**Exam Duration: 3 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:

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

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	

BACK

Program: Bachelor of Engineering		
Course Title: Neural Network and Deep Learning		**Course code: 21ECSE314**
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	**Practical:28 hrs**	**Exam Duration: 3 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 Autoencoders 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: Internet of Things		**Course Code: 17ECSE303**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 3hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks:**	
Teaching Hrs: 30		**Exam Duration: 3 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.		**04 hrs**
2	**IoT Architecture:** 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.		**04 hrs**
3	**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**
Unit –II			
4	**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**
5	**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**
6	**Programming with Raspberry Pi & WiFi controllers (CC3200/ESP8266) & 6LoWPAN Controller (CC2650):** XML, JSON, SOAP and REST-based approach, WebSocket protocol.		**04 hrs**
Unit –III			
7	**IoT prototyping:** Business models, example applications: Case studies on Home automation, Smart Cities, Environment, Energy, Agriculture, Health, Retail with emphasis on data analytics and security. Industrial IoT (IIoT). Role of AI/ML in IoT (AIoT).		**06 hrs**

Text Books (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.

References

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

List of Experiments

Expt./Job No.	Brief description about the experiments	No. of Lab slots per batch (estimate)
1.	Programming with Raspberry Pi	3
2.	Cloud service interface for data storage and retrieval	2
3.	Performance analysis of Data link protocols, routing and application protocols	3
4.	Open Ended Experiment with focus on data analytics and security	2

Scheme for Semester End Examination (SEE)

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**

BACK

Program: Bachelor of Engineering			
Course Title: Active Directory Domain Services		**Course Code: 17ECSE304**	
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: 84 hrs**	**Exam Duration: 3 hrs**	
Unit –I			
1	**Introduction to ADDS:** Introduction to Microsoft Active Directory, Roles of Active directory services, Features in ADDS**.**		**4 hrs**
2	**Domains and Forests:** Active Directory Structure Storage and Technologies, Data Store Components, Active Directory Domains and Forests, The Logical Structure of Active Directory**.**		**4 hrs**
3	**Physical Structure:** The Physical Structure of Active Directory, Network Ports used by Domains and Forests.		**4 hrs**
Unit –II			
4	**Active Directory and its networking services:** DNS, Domain names, Domain Zones, Domain Records, DNS Servers, DHCP authorization, DHCP and Dynamic DNS		**4 hrs**
5	**Installation of R2 server& Administration:** Requirements for installing ADDS, Understanding of Active Directory Domain Services Functional levels. Guidelines for raising domain and forests functional levels, Introduction to various AD Snap-ins and their functions		**4 hrs**
6	**Domain Services:** Active Directory Users and Computers, Active Directory Domains and Trusts, Active Directory Sites and Services		**4 hrs**
Unit –III			
7	**Backup/Restore:** Backing Up Directory Domain Services Active, Recovering Active Directory Domain Services. Authoritative restore, Methods of authoritative restore		**6hrs**

Text Books:

1. Microsoft reference materials.
2. Brain Desmond, Robbie Allen, Active Directory, 5th Edition, O' Relly Media, 2013.

List of Experiments

Expt./Job No.	Brief description about the experiment	No. of Lab. Slots (2 hrs)
1	Use Virtualization in Windows Server	1
2	Planning and Implementing an Active Directory Infrastructure	1
3	Managing and Maintaining an Active Directory Infrastructure	1

4	Planning and Implementing User, Computer, and Group Strategies	2
5	Backup and Restore	2
6	OEE	3

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, 8	7	Solve Any **1**

BACK

Program: Bachelor of Engineering		
Course Title: DevOps		**Course Code: 21ECSE310**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: 42 hrs	**Practical: 84 hrs**	**Exam Duration: 3 hrs**

	Unit –I	
1	**Introduction to DevOps and Continuous Delivery:** Introducing DevOps, The Agile wheel of wheels, DevOps and ITIL, Infrastructure As A Code, Continuous Integration and Development.	**4hrs**
2	**Linux and Automation:** User Management, Package Management, Networking, Shell Variable, Decision making, Shell test conditions, Shell loops, Re-directors, Exit status.	**4hrs**
3	**AWS Cloud:** Introduction to cloud computing & AWS, Regions & AZ's, EC2, EBS, EFS, Auto scaling, Load balancing & Route 53, VPC, Object storage(S3), IAM & Monitoring(Cloudwatch), Database Services, AWS Lambda & CLI	**6hrs**
	Unit –II	
4	**Version Control with Git:** SCM, Git branching and merging, Git Overview, Creating pull request, Code Review, Merging changes, Create a repo and push code on GibHub / Bitbucket	**4hrs**
5	**Continues Integration using Jenkins:** Introduction, Setup & Launch Jenkins, Creating first job, Notifications, CICD pipeline, Build Pipeline plugin in Jenkins, Scheduling a job using cron tab, Scheduling a job using Poll SCM, Distributed Architecture in Jenkins, Adding linux slave to jenkins master	**7hrs**
6	**Configuration Management using Ansible:** Introduction, Local infrastructure development, Ad-Hoc commands, Playbooks, Playbooks organization – Roles & Includes, Inventories, Ansible for AWS	**7hrs**
	Unit –III	
7	**Containers:** Containers Concepts, Container Vs Virtual Machine, Docker installation, Managing Container with Docker Commands, Building your own docker images, Docker Compose, Docker registry - Docker Hub, Networking inside single docker container	**6hrs**
8	**Continues Monitoring using Prometheus and Grafana:** What is continues monitoring, Goals, Types of Continues monitoring, Prometheus installation, Grafana installation, Integration of Prometheus and Grafana, Adding customised dashboard in Grafana, Introduction to node exporter, Integrating node exporter for monitoring, Monitoring docker and containers	**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.

BACK

Program: Bachelor of Engineering			
Course Title: Data Integration and Cloud Services		**Course code: 21ECSE331**	
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hrs: 60 hrs	**Practical : 84 hrs**	**Exam Duration: 3 hrs**	
1	**Data Integration for Developers:** Introduction to PowerCenter, Folders, Sources, and Targets, Design Objects, File Lookups, Relational Lookups, Database Joins in PowerCenter, Workflow Logic, Merging, Routing, and Sorting Data, Command Tasks, Debugging, Parameterization, Updating Database Tables, Mapplets, Mapping Design Workshop, Addendum.		**20 hrs**
2	**PowerCenter Architecture and Transformations:** PowerCenter 10 Architecture, Parameter Files, User-Defined and Advanced Functions, Pivoting Data, Dynamic Lookups, Stored Procedure and SQL Transformations, Troubleshooting Methodology and Error Handling, Transaction Processing, Transaction Control Transformation, Recovery, Command Line Programs, Performance Tuning Methodology, Performance Tuning Mapping Design, Memory Optimization, Performance Tuning: Pipeline Partitioning.		**20 hrs**
3	**Cloud Application Integration Services:** Overview of Cloud Application Integration, Understand the Basics: Process Designer, Working with Assets, Adding Web Services to a Process, Fault Handling, Introduction to Guides Designer, API Management, CAI and CDI Integration, Troubleshooting, Tips & Tricks, Best Practices.		**10 hrs**
4	**Cloud Data Integration Services:** Informatica Cloud Overview, Runtime Environments and Connections, Synchronization Task, Cloud Mapping Designer, Cloud Mapping Designer – Transformations, Mapping Parameters, Expression Macro and Dynamic Linking, Replication Task, Masking Task, Mass Ingestion Task, Task flows, Hierarchical Connectivity, Intelligent Structure Model.		**10 hrs**

Text book:

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

Reference book:

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

BACK

Program: Bachelor of Engineering			
Course Title: Multimedia Networking			**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 hrs			**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: 1. 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: 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 hrs.		**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**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**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	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: Embedded Intelligent Systems		**Course code: 18ECSE302**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 6hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs:	**Practical: 84 hrs**	**Exam Duration: 3 hrs**

1	**Basics of embedded systems:** Linux Application Programming, System V IPC, Linux Kernel Internals and Architecture , Kernel Core, Linux Device Driver Programming, Interrupts & Timers ,Sample shell script, application program, driver source build and execute	**10 hrs**
2	**Heterogeneous computing:** Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b. GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx), Basic OpenCL examples - Coding, compilation and execution	**12hrs**
3	**ML Frameworks lab with the target device:** Caffe, tensorflow, TF Lite machine learning frameworks & architecture, Modelparsing, 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	**16hrs**
4	**Model Development and Optimization:** Significance of on device AI, Quantization, pruning, weight sharing, Distillation, Various pre-trained networks and design considerations to choose a particular pre-trained model, Federated Learning, Flexible Inferencing	**8hrs**
5	**Android Anatomy:** Android Architecture ,Linux Kernel , Binder , HAL Native Libraries , Android Runtime, Dalvik Application framework , Applications, IPC	**8hrs**

Text Books

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

Reference Books:

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

Scheme for End Semester Assessment (ESA)

UNIT	Experiments to be set of 10 Marks Each	Chapter Numbers	Instructions
I	Project Examination	1,2,3,4,5	Project implementation and demonstration 20 marks

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 hrs	**Tutorial: 28 hrs**	**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	**01**
4	Interface LED and Seven segments to ARM for displaying message.	**01**
5	Interface LCD to ARM for displaying message.	**01**
6	Interface Keypad to read the characters	**01**
7	Rotate DC and stepper motor for variable speed and direction	**01**
8	Interface DAC to ARM controller	**01**

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:20ECSE301**
L-T-P:3-0-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 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 -	**8 hrs**

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

Text Books:

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

Reference Books:

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

Scheme for End Semester Assessment (ESA)

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

BACK

Professional Electives – 3, 4, 5 & 6

Program: Bachelor of Engineering		
Course Title: Social Network Analysis		**Course Code: 18ECSE402**
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 hrs		**Exam Duration: 03 hrs**

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

Text Books:

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

Reference Books:

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

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	6	

BACK

Program: Bachelor of Engineering		
Course Title: Natural Language Processing		**Course Code: 22ECSE403**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hrs: 04 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30 hrs	**Practical: 28 hrs**	**Exam Duration: 3 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	**5 hrs**
2.	**Dependency Parsing, Recurrent Neural Networks:** Dependency Grammar , Neural dependency parsing, Recurrent Neural Networks and Language Models, Vanishing Gradients, Fancy RNNs	**7 hrs**
	Unit –II	
3.	**Machine Translation, Seq2Seq and Attention:** Machine Translation, Seq2Seq and Attention, Advanced Attention	**6 hrs**
4.	**Transformer Networks, Coreference Resolution, Memory Networks:** Transformer Networks and CNNs, Tree Recursive Neural Networks and Constituency Parsing , Advanced Architectures and Memory Networks	**6 hrs**
	Unit –III	
5.	**Reinforcement Learning:** Reinforcement Learning for NLP, Semi-supervised Learning for NLP, Future of NLP Models, Multi-task Learning and QA Systems	**6 hrs**

Text Books:

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

Reference Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing 3Ed. Draft.
2. Ian Goodfellow, YoshuaBengio, and Aaron Courville. *Deep Learning*. MIT Press.

List of experiments

Expt./Job No.	Brief description about the experiments	No. of Lab slots per batch (2hrs)
1.	Installation of nltk tool kit in python and practicing of word tokenization, spellchecker programs.	**1**
2.	Compute softmax points (probabilities) for numerical stability.	**1**
3.	Implement the word2vec model for word vector representation.	**1**
4.	Implement the dependency parsing for the following sentence "I parsed this sentence correctly" and show at least three steps for parsing with stack and buffer status.	**2**
5.	Write a program to build seq2seq sentence from word corpora (Tensorflow).	**1**
6.	Implement the neural image caption generator.	**2**
7.	Implement question answering (QA) system, to answer the questions posed in natural language.	**1**

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

BACK

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Bachelor of Engineering		
Course Title: Fuzzy Set Theory		**Course Code:19ECSE402**
L-T-P:3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching hrs: 40 hrs		**Exam Duration: 3 hrs**

	Unit –I	
1.	**Introduction** : Introduction to Fuzzy Logic, Fuzzy Membership Functions, Operations on Fuzzy Sets	**8 hrs**
2.	**Fuzzy Measures:** Fuzzy Relations, Fuzzy Proposition, Fuzzy Implications, Fuzzy Inferences	**8 hrs**
	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	**8 hrs**
	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.

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: Natural Language Processing(NPTEL-SWAYAM)		**Course Code: 22ECSE451**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 weeks**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 hrs**
Content		
Week 1: Introduction and Basic Text Processing		
Week 2: Spelling Correction, Language Modeling		
Week 3: Advanced smoothing for language modeling, POS tagging		
Week 4: Models for Sequential tagging – MaxEnt, CRF		
Week 5: Syntax – Constituency Parsing		
Week 6: Dependency Parsing		
Week 7: Distributional Semantics		
Week 8: Lexical Semantics		
Week 9: Topic Models		
Week 10: Entity Linking, Information Extraction		
Week 11: Text Summarization, Text Classification		
Week 12: Sentiment Analysis and Opinion Mining		
Course registration link :https://onlinecourses.nptel.ac.in/noc21_cs102 **Resource Person : Prof. Pawan Goyal | IIT Kharagpur**		

Books and references

1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.
   Some draft chapters of the third edition are available online: https://web.stanford.edu/~jurafsky/slp3/
2. Chris Manning and Hinrich Schütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999

Evaluation Scheme

Exam will be conducted by SWAYAM and passing criteria is as follows:

Pass criteria

- The weekly assignments are all graded out of 100 marks.
- For the 4/8/12 week courses, normally best 3/6/8 assignments are considered for calculating the Average assignment score (out of 100).
- Final score = 25% of Average assignment score (out of 100) + 75% of proctored certification exam score (out of 100)
- Learner is said to be certified in the course and he/she will be eligible for the e-certificate IF Average assignment score >= 40/100 AND Proctored certification exam score >= 40/100
- e-copy of the course certificate will be given to students which displays the name, roll number, photo, assignment marks, exam marks and total marks of the candidate
- The e-certificate will have the signatures of the NPTEL coordinator, the Head of the Centre for Education in the corresponding institute to which the Course instructor belongs along with the logo of the institute.
- The e-certificate also carries the QR code, on scanning which, the original certificate hosted on NPTEL server will be accessible. This way any one presented with the e-copy can verify against the original hard copies of the certificates can be printed by the learner on downloading the e-copy of the certificate.

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:	**Practical: 84 hrs**	**Exam Duration: -NA-**

***No Units**

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

Reference Material:

1. Peter Shirley, Fundamentals of Computer Graphics, 2009, A. K. Peters
2. Tomas Akenine-Moller, Eric Haines, and Naty Hoffman, Real-Time Rendering, 2008, A.K. Peters.
3. Henrik Wann Jensen, Realistic Image Synthesis Using Photon Mapping, 2001, A.K. Peters.
4. Watt A. and M. Watt, Advanced Animation and Rendering Techniques Theory and Practice, 1994, Addison-Wesley.
5. Foley, J.D., A. van Dam, S. Feiner, and J. Hughes, Computer Graphics: Principles and Practice, Addison-Wesley, ISBN 0-201-12110-7. (Errata)
6. Neider, J., T. Davis, and M. Woo, OpenGL Programming Guide, Addison-Wesley, ISBN 0-201-63274-8.
7. Blinn J., A Trip Down the Graphics Pipeline. Jim Blinn's Corner, Morgan Kaufmann.
8. Luebke D., M. Reddy, J. Cohen, A. Varshney, B. Watson, R. Huebner, Level of Detail for 3D Graphics, 2003, Morgan-Kaufman.
9. Ebert D., F. Musgrave, D. Peachey, K. Perlin and S. Worley, Texturing & Modeling: A Procedural Approach 2e AP Professional.
10. Parent, R., Computer Animation: Algorithms and Techniques Morgan Kaufmann.
11. Hoffman, C. Geometric and Solide Modeling Morgan Kaufmann.
12. Graphics Gems I-V, AP Professional.
13. 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: Advanced Computer Vision		**Course Code: 22ECSE434**	
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 3 hrs/week**	
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**	
Teaching Hrs:42	**Practical:84 hrs**	**Exam Duration: -NA-**	
***No Units**			
1.	Basics of Machine Learning, and Convolutional Neural Networks		**1.5 hrs**
2.	Optimization strategies for training deep neural networks		**1.5 hrs**
3.	Advanced Architectures for Image Classification (VGGNet, InceptionNet, ResNet, DenseNet, MobileNets etc.)		**3 hrs**
4.	Techniques for Visualizing CNNs for Image Analysis		**3 hrs**
5.	Traditional Techniques for Object Detection (Viola-Jones, Parts based models etc.)		**3 hrs**
6.	Modern Techniques for Object Detection (Single shot and two shot detectors, keypoint based detectors)		**4.5 hrs**
7.	Traditional Techniques for Image Segmentation		**3 hrs**
8.	Modern Techniques for Image Segmentation		**4.5 hrs**
9.	Generating Synthetic Images (AR models, VAEs and GANs)		**4.5 hrs**
10.	Vision and Language		**4.5 hrs**
11.	Learning Models for Geometrical Vision Problems		**3 hrs**
12.	Object Tracking		**3 hrs**
13.	Attack and defense techniques for computer vision systems		**3 hrs**

Reference Material:

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, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

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: Unix Network Programming		**Course Code: 18ESCE404**
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 hrs		**Exam Duration: 3 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 Disciplines A Simple 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: Software Defined Networks		**Course Code: 20ECSE405**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 hrs**

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

Text Books:

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

Reference Books:

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

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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** 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	6	

BACK

Program: Bachelor of Engineering		
Course Title: Cyber Security		**Course Code: 19ECSE401**
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	**Practical: 28 hrs**	**Exam Duration: 3 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. Cyberattack 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.	**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	**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.	**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.	**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, 2018
2. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

Reference Books:

1. Kevin Mandia, Chris Prosise, Matt Pepe, Incident Response and Computer Forensics, Tata McGraw -Hill, New Delhi,, 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	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	

Cyber Security – Tutorial

Practical assignments on

1. Phishing attack
2. SQL injection
3. CSRF attack
4. XSS attack
5. Password cracking
6. Man In The Middle attack
7. Hash calculation
8. File encryption -
9. DoS Attack

BACK

Program: Bachelor of Engineering		
Course Title: Mobile and Wireless Networks		**Course Code: 20ECSE412**
L-T-P:3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 hrs**

	Unit –I	
1.	**Introduction:** Characteristics of Cellular Systems, Fundamentals of Cellular Systems, Cellular System Infrastructure, Satellite Systems, Network Protocols, Ad Hoc Networks, Sensor Networks, Wireless LANs, MANs and PANs.	**4 hrs**
2.	**Mobile Radio Propagation:** Introduction, Types of Radio Waves, Propagation, Mechanisms, Free Space Propagation, Land Propagation, Path Loss, Doppler Effect, Delay Spread, Intersymbol Interference, Coherence and width Cochannel Interference.	**6 hrs**
3.	**Cellular Concept:** Introduction, Cell Area. Signal Strength and Cell Parameters, Capacity of a Cell, Frequency Reuse, How to Form a Cluster, Cochannel interference, Cell Splitting , Cell Sectoring.	**6 hrs**
	Unit –II	
4.	**Mobile Communication Systems:** Introduction, Cellular System Infrastructure, Registration, Handoff Parameters and Underlying Support, Parameters Influencing Handoff, Handoff Underlying Support, Roaming Support, Home Agents, Foreign Agents, and Mobile IP, Rerouting in Backbone Routers, Multicasting. (Chapter 10 from Text book)	**5 hrs**
5.	**Mobile network and transport layer:** Mobile IP Packet delivery-Tunneling-Reverse tunneling, IPV6-Dynamic host routing protocol, Traditional TCP-Congestion control-classical TCP-Snooping Mobile TCP, Transaction oriented TCP-TCP over 2.5/3G Wireless Networks.	**5 hrs**
6.	Fundamentals of 5G Mobile Networks: Drivers for 5G, the 5G Internet, Small Cells for 5G Mobile Networks. Cooperation for Next Generation Wireless Networks	**6 hrs**
	Unit –III	
7.	**Mobile Clouds:** Technology and Services for Future Communication Platforms, Cognitive Radio for 5G Wireless Networks.	**4 hrs**
8.	**Emerging wireless technologies:** Femtocell Network: Introduction, Technical Features, Challenges Push-to-Talk (PTT) Technology for SMS: PTT Network Technology, PTT in iDEN Cellular Networks, PTT in Non-iDEN Cellular Networks: PoC. (Chapter 16)	**4 hrs**

Text Books:

1. Dharma Prakash Agrawal, Qing –An Zeng, “Introduction to wireless and mobile systems”, Cengage Learning, 2014.
2. Rodriguez, Jonathan. Fundamentals of 5G mobile networks. John Wiley & Sons, 2015.
3. Roy Blake, “Wireless communication technology”, Cengage Learning, sixth Indian reprint 2013.
4. Singal T.L., “Wireless communication”, Tata McGraw Hill Education private limited , 2011.

Reference Books:

1. Wireless telecommunications systems and networks by Gray J. Mullet, Cengage Learning, Reprint 2014.
2. Upena Dalal, “Wireless communication” Oxford University press, first edition 2009.
3. Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley Dreamtech India Pvt. Ltd., 2004.
4. Jochen Schiller, “Mobile Communications”, Addision Wesley, 2nd Edition, 2011.

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: Wireless Communication Networks			**Course Code: 22ECSE415**
L-T-P: 3-0-0	**Credits: 3**		**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**		**Total Marks: 100**
Teaching Hrs: 40 hrs			**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		**8 hrs**
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		**8 hrs**
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.		**8 hrs**
Unit – II			
4.	**Wireless LAN:** Infra-red vs radio transmissions; Infrastructure and ad-hoc network; IEEE 802.11 – system architecture, protocol architecture, physical layer, MAC layer, MAC management, 802.11b, 802.11a, newer developments; HIPERLAN; Bluetooth		**8 hrs**
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		**8 hrs**

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 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 hrs		**Exam Duration: 3 hrs**

	Unit – 1	
1.	**Software Testing Principles:** Need for testing ,The Psychology and Economics of Program Testing Program ,Inspections, Walkthroughs, and Reviews.	**4 hrs**
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.	**6 hrs**
3.	**Higher-Order Testing**: Function testing, System testing, Acceptance testing, Installation testing, Test planning and Control, Test completion criteria, Extreme testing.	**6 hrs**
	Unit – 2	
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.	**10 hrs**
5.	**CMM Model and its stages** – Introduction to PCMM, CMMI and Six Sigma concept – ISO 9000.	**6 hrs**
	Unit – 3	
6.	**Software Quality and Testing:** Introduction to software quality and quality control – Benefits of quality control - Quality assurance - quality circles and quality improvement.	**4 hrs**
7.	**Introduction to quality cost** – Measuring quality cost – Total Quality Management (TQM).Architecture, Process, memory and file management in Mobile OS, Network OS.	**4 hrs**

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.

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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, Q.No.-8	6, 7	Solve Any **1**

BACK

Program: Bachelor of Engineering		
Course Title: C# Programming and .NET		**Course Code: 18ECSE409**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**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).	**5 hrs**
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 read only 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, Atul Kahate, 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: 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 hrs		**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: Software Architecture and Design Thinking		**Course Code: 18ECSE410**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40 hrs		**Exam Duration: 3 hrs**

	Unit – 1	
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 - 2	
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 – 3	
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, Regine Meunier, 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, Nenad Medvidovic 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, 20

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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Bachelor of Engineering		
Course Title: Compiler Optimization for HPC		**Course Code: 22ECSE431**
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**

Session	Topics	Hrs
1	HPC Session	2
2	Compiler Intro	1.5
3	Compiler Frontend	1.5
4	Parallel Programming	1.5
5	Debuggability	1.5
6	Iterative data flow analysis - A couple of analysis examples – maybe reaching definitions and live variable analysis (one forward analysis and one backward analysis)	2
7	SSA representation - SSA construction - Advantages as opposed to CFG	2
8	Scalar optimizations - Inlinling, Unrolling, LICM, CSE. Dead code elimination, copy propagation etc	2
9	Simple dependence analysis (GCD test, Banerjee's test)	1.5
10	Loop transformations - Loop interchange, loop reversal, loop tiling, loop distribution, loop splitting, loop un-switching etc	2
11	Loop vectorization (SLP vectorization is not included) and a high-level walk-through of LLVM's loop vectorizer implementation	2
12	High Performance Libraries - 1	1.5
13	Basic block instruction scheduling, loop scheduling such as module scheduling	2
14	High Performance Libraries - 2	1.5
15	Register Allocation (Graph coloring based register allocation, linear scan if time permits) (2 hours	2
16	High Performance Libraries - 3	1.5

17	Introduction to profilers - what is profiling - why do we need do to profiling - existing profilers and types - uprof features - skillset required to work in profilers Basic micro architecture understanding (core pmc) OS concepts File formats - elf, pe Debug info - dwarf, pdb Managed code runtime- Java, .net HPC - MPI, openmp and runtime	2
18	Testing of Compilers and Optimizers	2
	Project 2 Assignments	

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 hrs			**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. Christel Baier 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.

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: 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 hrs			**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
Internet References, toolbox and other relevant software.

BACK