RAJALAKSHMI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATION 2019

Vision

To promote highly ethical and innovative computer professionals through excellence in teaching, training and research.

Mission

- To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.
- To promote research activities amongst the students and the members of faculty that could benefit the society.
- To impart moral and ethical values in their profession.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To equip students with essential background in computer science, basic electronics and applied mathematics.

PEO 2: To prepare students with fundamental knowledge in programming languages and tools and enable them to develop applications.

PEO 3: To encourage the research abilities and innovative project development in the field of networking, security, data mining, web technology, mobile communication and also emerging technologies for the cause of social benefit.

PEO 4: To develop professionally ethical individuals enhanced with analytical skills, communication skills and organizing ability to meet industry requirements.

PROGRAMME OUTCOMES (POs)

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

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

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

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 modeling 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.

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Computer Science and Engineering Program will demonstrate

PSO 1: Foundation Skills: Ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, web design, machine learning, data analytics, and networking for efficient design of computer-based systems of varying complexity. Familiarity and practical competence with a broad range of programming language and open source platforms.

PSO 2: Problem-Solving Skills: Ability to apply mathematical methodologies to solve computational task, model real world problem using appropriate data structure and suitable algorithm. To understand the standard practices and strategies in software project development, using open- ended programming environments to deliver a quality product.

PSO 3: Successful Progression: Ability to apply knowledge in various domains to identify research gaps and to provide solution to new ideas, inculcate passion towards higher studies, creating innovative career paths to be an entrepreneur and evolve as an ethically social responsible computer science professional.

Mapping of Program Educational Objectives (PEOs) and Program Outcomes (POs) with correlation levels (1: Slight, 2: Moderate, 3: Substantial, -: No correlation), based on the provided information:

PEO and PO Mapping Table

PEOs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PEO1	3	3	2	2	3	-	-	-	2	2	2	2	3	3	2
PEO2	2	2	3	2	3	-	-	-	2	2	2	2	3	3	2
PEO3	2	2	3	3	3	3	3	2	2	2	2	2	3	3	3
PEO4	2	2	2	2	2	2	2	3	3	3	3	2	2	2	3

CURRICULUM

B.E. COMPUTER SCIENCE AND ENGINEERING
Regulation 2019 | Total Credits: 164

SEMESTER I								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	HS19151	Technical English	HS	3	2	1	0	3
2.	MA19152	Linear Algebra and Applied Calculus	BS	4	3	1	0	4
LAB ORIENTED THEORY COURSES								
3.	CY19143	Applied Chemistry	BS	5	3	0	2	4
4.	GE19141	Programming using C	ES	6	2	0	4	4
5.	GE19122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1
NON-CREDIT COURSES								
6.	MC19102	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
			TOTAL	**23**	**13**	**2**	**8**	**16**

.

SEMESTER II								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19252	Differential Equations and Complex Variables	BS	4	3	1	0	4
2.	GE19101	Engineering Graphics	ES	4	2	2	0	4
LAB ORIENTED THEORY COURSES								
3.	PH19241	Physics for Information Science	BS	5	3	0	2	4
4.	EE19242	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
5.	CS19241	Data Structures	PC	7	3	0	4	5
LABORATORY COURSES								
6.	GE19121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1
7.	CS19211	Python Programming Lab	PC	4	0	0	4	2
NON-CREDIT COURSES								
8.	MC19101	Environmental Science and Engineering	MC	3	3	0	0	0
			TOTAL	**34**	**17**	**3**	**14**	**24**

SEMESTER III								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19354	Transforms and Discrete Mathematics	BS	4	3	1	0	4
2.	CS19301	Computer Architecture	PC	3	3	0	0	3
3.	EC19306	Communication Engineering	ES	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4
5.	EC19341	Digital Logic and Microprocessor	ES	7	3	0	4	5
6.	CS19342	Object Oriented Programming Paradigm	PC	7	3	0	4	5
NON-CREDIT COURSES								
7.	MC19301	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0
			TOTAL	**32**	**21**	**1**	**10**	**24**

SEMESTER IV								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19454	Probability, Statistics and Queuing Theory	BS	4	3	1	0	4
2.	GE19301	Life Science for Engineers	BS	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	CS19441	Operating Systems	PC	7	3	0	4	5
4.	CS19442	Software Engineering Concepts	PC	7	3	0	4	5
5.	CS19443	Database Management Systems	PC	7	3	0	4	5
EMPLOYABILITY ENHANCEMENT COURSES								
6.	GE19421	Soft Skills–I	EEC	2	0	0	2	1
			TOTAL	**30**	**15**	**1**	**14**	**23**

SEMESTER V								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	CS19501	Theory of Computation	PC	3	3	0	0	3
2.		Professional Elective-I	PE	3	3	0	0	3
3.		Open Elective – I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS19541	Computer Networks	PC	7	3	0	4	5
5.	CS19542	Internet Programming	PC	7	3	0	4	5
6.	AI19341	Principles of Artificial Intelligence	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE19521	Soft Skills-II	EEC	2	0	0	2	1
			TOTAL	**30**	**18**	**0**	**12**	**24**

SEMESTER VI								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	CS19601	Fundamentals of Mobile Computing	PC	3	3	0	0	3
2.	BA19602	Fundamentals of Accounting	HS	3	3	0	0	3
3.		Professional Elective-II	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS19641	Compiler Design	PC	5	3	0	2	4
5.	CS19642	Cryptography and Network Security	PC	4	2	0	2	3
6.	CS19643	Foundations of Machine Learning	PC	5	3	0	2	4
LABORATORY COURSES								
7.	CS19611	Mobile Application Development Laboratory	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	GE19612	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	6	0	0	6	3
9.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1
			TOTAL	**35**	**17**	**0**	**18**	**26**

SEMESTER VII								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective-III	PE	3	3	0	0	3
2.		Professional Elective-IV	PE	3	3	0	0	3
3.		Professional Elective-V	PE	3	3	0	0	3
4.	CS19721	Block Chain Fundamentals	PC	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
5.	CS19741	Cloud Computing	PC	4	2	0	2	3
LABORATORY COURSES								
6.	CS19711	Project-I	EEC	6	0	0	6	3
			TOTAL	**20**	**12**	**0**	**8**	**16**

SEMESTER VIII								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective-VI	PE	3	3	0	0	3
2.		Open Elective-II	OE	3	3	0	0	3
LABORATORY COURSES								
3.	CS19811	Project-II	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

TOTAL NO. OF CREDITS: 164

PROFESSIONAL ELECTIVES (PE)

Theory and Algorithms								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	CS19P01	Graph Theory	PE	3	2	1	0	3
2.	CS19P02	Computational Number Theory	PE	3	2	1	0	3
3.	CS19P03	Parallel and Distributed Algorithms	PE	3	2	1	0	3
4.	CS19P04	Computational Complexity	PE	3	2	1	0	3
5.	CS19P05	Quantum Computing	PE	3	2	1	0	3
6.	CS19P17	Comprehension Study	PE	3	3	0	0	3

Applications								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	EC19P66	Digital Image and Video Processing	PE	3	3	0	0	3
2.	EC19P01	Principles of Digital Signal Processing	PE	3	3	0	0	3
3.	CS19P06	Human Computer Interaction	PE	4	2	0	2	3
4.	CS19P07	Electronic Design Automation	PE	4	2	0	2	3
5.	CS19P08	Computer Graphics	PE	4	2	0	2	3
6.	CS19P09	C# and .Net Programming	PE	4	2	0	2	3
7.	CS19P25	Immersive Experience in AR/VR	PE	1	1	0	4	3

Systems								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	CS19P10	Advanced Computer Architecture	PE	3	3	0	0	3
2.	CS19P11	Internet of Things Essentials	PE	4	2	0	2	3
3.	CS19P12	Distributed Systems	PE	4	2	0	2	3
4.	CS19P13	Robotics and Embedded Programming	PE	4	2	0	2	3
5.	CS19P14	Information Security and Management	PE	4	2	0	2	3
6.	CS19P22	Linux System Administration	PE	5	1	0	4	3
7.	CS19P26	IoT: Concepts and Hands-On Applications	PE	5	1	0	4	3

Data Science and Machine Intelligence								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	CS19P15	Data Mining	PE	4	2	0	2	3
2.	CS19P16	Data Analytics	PE	4	2	0	2	3
3.	CS19P18	Deep Learning Concepts	PE	4	2	0	2	3

4.	CS19P19	Cognitive Science	PE	4	2	0	2	3
5.	CS19P20	Social, Text and Media Analytics	PE	4	2	0	2	3
6.	CS19P21	Advanced Robotic Process Automation	PE	6	0	0	6	3
7.	CS19P23	Advanced Application Development with Oracle APEX	PE	6	0	0	6	3
8.	CS19P24	Introduction to Modern Databases with MongoDB	PE	6	0	0	6	3
9.	CS19P27	Data Analytics and Insights in MindSphere	PE	5	1	0	4	3

OPEN ELECTIVE COURSES OFFERED BY CSE TO OTHER DEPARTMENTS

SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	OCS1901	Data Structures Using C	OE	6	0	0	6	3
2.	OCS1902	Object Oriented Programming Using JAVA	OE	6	0	0	6	3

SUBJECTS OFFERED BY CSE TO OTHER DEPARTMENTS

SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	GE19211	Problem Solving and Programming in Python	ES	5	1	0	4	3
2.	CS19411	Python Programming for Machine Learning	ES	5	1	0	4	3
3.	CS19242	Fundamentals of Data Structures using C	ES	7	3	0	4	5

SUMMARY OF ALL COURSES

B.E. COMPUTER SCIENCE AND ENGINEERING										
S.NO	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3					3			06
2	BS	8	8	4	7					27
3	ES	5	9	8						22
4	PC		7	12	15	17	16	4		71
5	PE					3	3	9	3	18
6	OE					3			3	6
7	EEC				1	1	4	3	6	15
8	MC	0	0	0						0
	Total	**16**	**24**	**24**	**23**	**24**	**26**	**16**	**12**	**165**

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS19151	TECHNICAL ENGLISH	HS	2	1	0	3

Objectives:	
●	To enable learners to acquire basic proficiency in English reading and listening.
●	To write in English precisely and effectively.
●	To speak flawlessly in all kinds of communicative contexts.

UNIT-I	VOCABULARY BUILDING	9
The concept of word formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives - Synonyms, antonyms, and standard abbreviations. Compound words – abbreviation – single word substitution – Listening: Listening comprehension, listening to motivational speeches, podcasts and poetry. Speaking: Short talks on incidents - place of visit – admiring personalities, etc.		
UNIT-II	**BASIC WRITING SKILLS**	**9**
Sentence structures - Use of phrases and clauses in sentences - punctuation - coherence - Organizing principles of paragraphs in documents - Techniques for writing precisely. **Reading & Writing** – Free writing – paragraphs - article reading and writing criticism - change of tense forms in short text or story – inferential reading – rewrite or interpret text - prepare questions based on the text. **Speaking:** Everyday situations – conversations and dialogues, speaking for and against.		
UNIT-III	**GRAMMAR AND LANGUAGE DEVELOPMENT**	**9**
Subject-verb agreement- Noun-pronoun agreement - Articles – Prepositions – Redundancies. Reading & Writing: Read from innovation and ideas that changed the world, newspaper column writing – Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps, pictures, etc.)		
UNIT-IV	**WRITING FOR FORMAL PRESENTATION**	**9**
Nature and Style of sensible Writing - Describing – Defining – Classifying - Providing examples or evidence - Writing introduction and conclusion. Reading & Writing – Read from Literary pieces – identify different parts text – Difference between print and digital writing. Writing: Recommendations - Foreword - Review of book. Speaking- Formal Presentations – Debate on social issues/taboos and solutions.		
UNIT-V	**EXTENDED WRITING AND SPEAKING**	**9**
Writing: Précis writing – Essay writing – workplace communication: Resume – Business letters and emails – Proposals. Speaking: Panel discussion – reporting an event – mock interview – Master Ceremony.		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course students will be able to

●	Discuss and respond to the listening content.
●	Read and comprehend different texts and appreciate them .
●	Understand structures and techniques of precise writing
●	Analyze different genres of communication and get familiarized with new words, phrases, and sentence structures.
●	Write and speak appropriately in varied formal and informal contexts.

Text Book(s):	
1	English for Technologists & Engineers, Orient BlackSwan Publications, Chennai, 2012.

Reference Books(s):	
1	Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press.
2	Bushan Kumar, Effective Communication Skills, Khanna Publishing House, Delhi.
3	Pushplata, Sanjay Kumar, Communication Skills, Oxford University Press.
4	Michael Swan, Practical English Usage, Oxford University Press, 1995.
5	F.T. Wood, Remedial English Grammar, Macmillan, 2007.
6	William Zinsser, On Writing Well, Harper Resource Book, 2001.
7	Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press, 2006.
8	Exercises in Spoken English, Parts I-III, CIEFL, Hyderabad,Oxford University Press.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO 3
HS19151.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
HS19151.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
HS19151.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS19151.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
HS19151.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	**1.0**	**1.7**	**1.0**	**1.25**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**2.8**	**1.0**	**1.75**	**2.0**	**2.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19152	LINEAR ALGEBRA AND APPLIED CALCULUS	BS	3	1	0	4

Objectives:	
●	To gain knowledge in using matrix algebra techniques and the concepts of basis and dimension in vector spaces.
●	To understand the techniques of calculus those are applied in the Engineering problems.

UNIT-I	**MATRICES**	**12**
Symmetric and skew – symmetric matrices, orthogonal matrices – Eigen values and Eigen vectors - Cayley – Hamilton theorem (without proof) and applications - orthogonal transformation and quadratic forms to canonical forms - Nature of quadratic forms.		
UNIT-II	**VECTOR SPACES**	**12**
Vector space – Linear dependence and independence of vectors, bases, dimensions - range and kernel of a linear map, rank and nullity – matrix of Linear transformation - inverse of a linear transformation - rank nullity theorem – composition of Linear maps – Matrix Associated with Linear Map - inner products and norms – Gram – Schmidt orthogonalization.		
UNIT-III	**DIFFERENTIAL CALCULUS AND APPLICATIONS**	**12**
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes and Envelopes - Partial derivatives: Definitions and Simple problems - Jacobian and properties – Taylor's series for functions of two variables – Lagrange's method of undetermined multipliers.		
UNIT-IV	**APPLICATION OF INTEGRATION AND IMPROPER INTEGRALS**	**12**
Evaluation of area, surface area and volume of revolution - Centre of Gravity – Moment of inertia – Improper integrals: Beta and Gamma integrals and their properties.		
UNIT-V	**MULTIPLE INTEGRAL**	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.		
	Total Contact Hours :	**60**

Course Outcomes: On completion of the course students will be able to	
●	Apply the concept of Eigenvalues and eigenvectors, diagonalization of a matrix for solving problems.
●	Use concepts of basis and dimension in vector spaces in solving problems and to construct orthonormal basis using inner products.
●	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
●	Apply the techniques of Integration in engineering problems.
●	Evaluate surface area and volume using multiple integrals.

Text Book(s):	
1	Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2	T. Veerarajan, Linear Algebra and Partial Differential Equations, McGraw Hill Education,2019

Reference Books(s):	
1	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt Ltd, New Delhi, 2016.
2	Friedberg, A.H., Insel, A.J. and Spence, L., Linear Algebra, Prentice - Hall of India, New Delhi, 2004.
3	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.
4	Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt Ltd., New Delhi, 2006.
5	T Veerarajan, Engineering Mathematics –II, McGraw Hill Education, 2018
6	T Veerarajan, Engineering Mathematics –I, McGraw Hill Education, 2018

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO 3
MA19152.1	3	3	3	3	3	1	-	-	-	-	2	2	3	3	3
MA19152.2	3	3	3	3	2	1	-	-	-	-	-	2	3	3	3
MA19152.3	3	3	3	3	3	1	1	-	-	-	2	3	2	3	3
MA19152.4	3	3	3	3	3	1	1	-	-	-	1	3	2	3	3
MA19152.5	3	3	3	3	2	1	-	-	-	-	1	3	2	3	3
Average	**3**	**3**	**3**	**3**	**2.6**	**1**	**1**	**-**	**-**	**-**	**1.5**	**2.6**	**2.4**	**3**	**3**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CY19143	APPLIED CHEMISTRY	BS	3	0	2	4

Objectives:	
•	To acquire theoretical and practical knowledge on water quality parameters.
•	To understand the principles of electrochemistry, corrosion and in turn construction of batteries.
•	To get familiarized with engineering materials including polymers.

UNIT-I	WATER TECHNOLOGY	9
Water quality parameters - physical, chemical &biological significance- BOD, COD- definition significance - estimation of hardness by EDTA method - boiler feed water – boiler troubles - softening of water - zeolite process - demineralization process - internal treatment methods - specifications for drinking water BIS - WHO standards - treatment of water for domestic use - desalination - reverse osmosis -electro dialysis – UASB process.		
UNIT-II	**ELECTROCHEMISTRY AND CORROSION**	**9**
Electrode potential - electrodes - standard and reference electrodes, glass electrode. Nernst equation - EMF series– applications. Galvanic cells and concentration cells-applications-pH measurement, acid-base titration, potentiometric redox titration – conduct metric titrations. Corrosion - causes- effects of corrosion - theories of chemical and electrochemical corrosion – types of corrosion – galvanic, water-line, inter-granular and pitting corrosion - passivity - factors affecting rate of corrosion - corrosion control methods -cathodic protection-sacrificial anode and impressed current cathodic protection		
UNIT-III	**BATTERIES AND FUEL CELLS**	**9**
Batteries- types - characteristics-fabrication and working of lead-acid battery- NICAD battery - lithium-ion batteries - super capacitors- introduction - types - electrochemical double layer capacitor - activated carbon - carbon aerogels. Fuel cells - classification – principle, working and applications of hydrogen-oxygen fuel cell - solid oxide fuel cell - direct methanol fuel cell and proton exchange membrane fuel cells-biofuel cells.		
UNIT-IV	**POLYMERS**	**9**
Introduction to thermoplastics and thermosetting plastics- phenolic and epoxy resins - silicone polymers– polyelectrolytes - polymers with piezoelectric, pyro electric and ferroelectric properties- photonic polymers -photo resists - conducting polymers - polyaniline, polypyrrole - preparation, structure, properties and applications - liquid crystals-classification, chemical constitution, liquid crystalline polymers-applications in displays-introduction to OLED.		
UNIT-V	**ENGINEERING MATERIALS**	**9**
Composite materials - definition - classification – fibers - types - properties - matrix - properties - applications of composites - advantages and limitations of composites. Lubricants - definition -characteristics of lubricants-theories of lubrication –properties- viscosity, viscosity index, oiliness, pour point and cloud point, flash point and fire point - additives to lubricants - solid lubricants.		
	Contact Hours : 45	

	List of Experiments
1	Estimation of mixture of acids by conductometry.
2	Estimation of extent of corrosion of iron pieces by potentiometry.
3	Estimation of the extent of dissolution of copper / ferrous ions by spectrophotometry.
4	Estimation of acid by pH metry
5	Determination of total, temporary and permanent hardness by EDTA method.
6	Estimation of DO by winkler‟s method.
7	Estimation of alkalinity by indicator method.
8	Estimation of chloride by argentometric method
9	Estimation of sodium and potassium in water by flame photometry.
10	Determination of flash and fire point of lubricating oil
11	Determination of cloud and pour point oflubricating oil
12	Determination of corrosion rate on mild steel by weight loss method
13	Determination of molecular weight of a polymer by viscometry method.
14	Adsorption of acetic acid by charcoal
15	Determination of phase change temperature of a solid.

	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Course Outcomes:	
●	Analyze the quality of water practically.
●	Apply the knowledge of electrochemistry on corrosion and its control.
●	Be assertive on types of batteries and fuel cells.
●	Apply the knowledge of different types of polymers in various fields.
●	Be conversant on the types of composites and lubricants used in engineering industry.

Text Book(s):	
1	P. C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai Publishing Company (P) Ltd,New Delhi, 2015.
2	O.G.Palanna, Engineering Chemistry, McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2017.

Reference Books(s) :	
1	Gowarikar V. R., Viswanathan N.V. and JayadevSreedhar, Polymer Science, New Age International (P) Ltd, New Delhi, 2011.
2	Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co, New Delhi, 2005.
3	F.W. Billmayer, Textbook of Polymer Science", 3rd Edition, Wiley. N.Y. 2007.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CY19143.1	3	3	3	3	3	2	3	2	3	2	2	3	2	2	1
CY19143.2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1
CY19143.3	3	2	2	2	2	2	1	1	2	1	1	1	2	1	1
CY19143.4	3	2	2	1	1	2	2	1	1	1	1	1	1	1	1
CY19143.5	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1
Average	**2.6**	**2.0**	**2.0**	**1.8**	**2.0**	**1.8**	**1.8**	**1.2**	**1.6**	**1.4**	**1.2**	**1.4**	**1.4**	**1.2**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
GE19141	PROGRAMMING USING C	ES	2	0	4	4

Objectives:	
●	To develop simple algorithms for arithmetic and logical problems.
●	To develop C Programs using basic programming constructs
●	To develop C programs using arrays and strings
●	To develop applications in C using functions, pointers and structures
●	To do input/output and file handling in C

UNIT-I	GENERAL PROBLEM-SOLVING CONCEPTS	6
Computer – components of a computer system-Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.		
UNIT-II	**C LANGUAGE - TYPES OF OPERATOR AND EXPRESSIONS**	**6**
Introduction- C Structure- syntax and constructs of ANSI C - Variable Names, Data Type and Sizes, Constants, Declarations - Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment and Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation.		
UNIT-III	**I/O AND CONTROL FLOW**	**6**
Standard I/O, Formatted Output – Printf, Variable-length argument lists- Formatted Input – Scanf, Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, GoTo Labels.		
UNIT-IV	**FUNCTIONS AND PROGRAM STRUCTURE**	**6**
Basics of functions, parameter passing and returning type, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, C Pre-processor, Standard Library Functions and return types.		
UNIT-V	**POINTERS, ARRAYS AND STRUCTURES**	**6**
Pointers and addresses, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional arrays, Strings, Initialization of Pointer Arrays, Command line arguments, Pointers to functions, complicated declarations. Basic Structures, Structures and Functions, Array of structures, Pointer of Structures, Self-referential Structures, Table look up, Typedef, Unions, Bit-fields, File Access -Error Handling, Line I/O, Miscellaneous Functions.		
	Contact Hours : 30	

List of Experiments			
1	Algorithm and flowcharts of small problems like GCD.		
2	Structured code writing with:		
3	Small but tricky codes		
4	Proper parameter passing		
5	Command line Arguments		
6	Variable parameter		
7	Pointer to functions		
8	User defined header		
9	Make file utility		
10	Multi file program and user defined libraries		
11	Interesting substring matching / searching programs		
12	Parsing related assignments		
	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**90**

Course Outcomes: On completion of the course, the students will be able to	
●	Formulate simple algorithms for arithmetic and logical problems.
●	Implement conditional branching, iteration and recursion.
●	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
●	Use arrays, pointers and structures to formulate algorithms and programs.
●	Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Text Books:	
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India; 2nd Edition, 2015.
2	Byron Gottfried, Programming with C, Second Edition, Schaum Outline Series, 1996.

Reference Books:	
1	Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.
2	YashavantKanetkar, Let Us C, BPB Publications, 15th Edition, 2016.

Web links for virtual lab:	
1	https://www.tutorialspoint.com/compile_c_online.php
2	https://www.codechef.com/ide
3	https://www.jdoodle.com/c-online-compiler
4	https://rextester.com/l/c_online_compiler_gcc

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19141.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE19141.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE19141.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	2
Average	**1.4**	**1.6**	**2.2**	**1.6**	**1.0**	**-**	**-**	**-**	**1.0**	**2.0**	**1.4**	**1.0**	**2.0**	**2.2**	**2.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE19122	ENGINEERING PRACTICES- ELECTRICAL AND ELECTRONICS	ES	0	0	2	1

Objectives:	
●	To provide hands on experience on various basic engineering practices in Electrical Engineering.
●	To impart hands on experience on various basic engineering practices in Electronics Engineering.

List of Experiments				
A. ELECTRICAL ENGINEERING PRACTICE				
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.			
2	Fluorescent lamp wiring.			
3	Stair case wiring.			
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.			
5	Measurement of resistance to earth of electrical equipment.			
B. ELECTRONICS ENGINEERING PRACTICE				
1	Study of Electronic components and equipment‟s – Resistor, colour coding, measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.			
2	Study of logic gates AND, OR, XOR and NOT.			
3	Generation of Clock Signal.			
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.			
5	Measurement of ripple factor of HWR and FWR.			
	Total Contact Hours	**:**	**30**	

Course Outcomes: On completion of the course, the students will be able to	
●	Fabricate electrical and electronic circuits
●	Formulate the house wiring
●	Design the AC-DC converter using diode and passive components

REFERENCE	
1	Bawa H.S., Workshop Practice, Tata McGraw – Hill Publishing Company Limited, 2007.
2	Jeyachandran K., Natarajan S. &Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.
3	Jeyapoovan T., Saravanapandian M. &Pranitha S., Engineering Practices Lab Manual,Vikas Publishing House Pvt.Ltd, 2006.
4	Rajendra Prasad A. &Sarma P.M.M.S., Workshop Practice,SreeSai Publication, 2002.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19122.1	3	2	2	2	3	2	1	-	-	-	-	3	3	2	3
GE19122.2	2	1	3	2	1	2	3	-	-	-	-	-	1	2	2
GE19122.3	2	3	2	1	2	2	2	-	3	-	-	1	2	3	2
GE19122.4	2	2	1	2	1	2	3	-	-	-	2	3	2	2	1
GE19122.5	1	1	3	3	2	1	3	3	2	2	2	2	3	3	1
Average	**2.0**	**1.8**	**2.2**	**2.0**	**1.8**	**1.8**	**2.4**	**3.0**	**2.5**	**2.0**	**2.0**	**2.3**	**2.2**	**2.4**	**1.8**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19102	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0

Objectives:	
•	To inculcate the values enshrined in the Indian constitution
•	To create a sense of responsible and active citizenship
•	To know about Constitutional and Non- Constitutional bodies
•	To understand sacrifices made by the freedom fighters

UNIT-I	**INTRODUCTION**	**9**
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens. Constitution meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.		
UNIT-II	**STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT**	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.		
UNIT-III	**STRUCTURE AND FUNCTION OF STATE GOVERNMENT AND LOCALBODY**	**9**
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayat Raj: Introduction, Elected officials and their roles, ,Village level: Role of Elected and Appointed officials.		
UNIT-IV	**CONSTITUTIONAL FUNCTIONS AND BODIES**	**9**
Indian Federal System – Center – State Relations – President‟s Rule – Constitutional Functionaries – Assessment of working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and other Constitutional bodies-. NITI Aayog, Lokpal, National Development Council and other Non –Constitutional bodies.		
UNIT-V	**INDIAN FREEDOM MOVEMENT**	**9**
British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Rule-Rise of Nationalism in India-Indian Freedom Struggle under Mahatma Gandhi-Non- Cooperation Movement-Civil Disobedience Movement- Quit India Movement-British Official response to National movement- Independence of India Act 1947-Freedom and Partition.		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Understand the functions of the Indian government
●	Understand and abide the rules of the Indian constitution.
●	Gain knowledge on functions of state Government and Local bodies
●	Gain Knowledge on constitution functions and role of constitutional bodies and non-constitutional bodies
●	Understand the sacrifices made by freedom fighters during freedom movement

Text Book(s):	
1	Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, New Delhi., 21st edition, 2013.
2	BipanChandra,History of Modern India, Orient Black Swan, 2009.
3	Bipan Chandra, India's Struggle for Independence, Penguin Books, 2016.
4	Maciver and Page, Society: An Introduction Analysis, MacMilan India Ltd., New Delhi.2nd edition, 2014.
5	P K Agarwal and K N Chaturvedi, PrabhatPrakashan Constitution of India, New Delhi, 1st edition, 2017.

Reference Books(s) / Web links:	
1	Sharma, Brij Kishore, Introduction to the Constitution of India, Prentice Hall of India, New Delhi.
2	U.R.Gahai, Indian Political System, New Academic Publishing House, Jalandhar.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MC19102.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
Average	**-**	**-**	**-**	**-**	**-**	**1.0**	**1.0**	**3.0**	**2.0**	**-**	**-**	**1.0**	**-**	**-**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19252	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES	BS	3	1	0	4

Objectives:	
●	To handle practical problems those, arise in the field of engineering and technology using differential equations.
●	To solve problems using the concept of Vectors calculus, Complex analysis, Laplace transforms.

UNIT-I	**SECOND AND HIGHER ORDER DIFFERENTIAL EQUATIONS**	**12**
Second and higher order Linear differential equations with constant coefficients - Method of variation of parameters – Legendre‟s linear equations - Formation of partial differential equations - Solutions of standard types of first order partial differential equations - Lagrange‟s linear equation – Linear homogenous partial differential equations of second and higher order with constant coefficients.		
UNIT-II	**VECTOR CALCULUS**	**12**
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green‟s theorem, Gauss divergence theorem and Stokes‟ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallel pipeds.		
UNIT-III	**ANALYTIC FUNCTIONS**	**12**
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by Functions $w = z + c$, cz,, z^2- Bilinear transformation.		
UNIT-IV	**COMPLEX INTEGRATION**	**12**
Cauchy‟s integral theorem – Cauchy‟s integral formula (excluding proof) – Taylor‟s and Laurent‟s series – Singularities – Residues – Residue theorem (excluding proof) – Application of residue theorem for evaluation of real integrals - Evaluation of real definite integrals as contour integrals around semi-circle (excluding poles on the real axis).		
UNIT-V	**LAPLACE TRANSFORM**	**12**
Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions, periodic functions - Inverse Laplace transform – Problems using Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.		
	Total Contact Hours : 60	

Course Outcomes: On completion of the course, the students will be able to

- Apply various techniques in solving ordinary differential equations and partial differential equations.
- Use the concept of Gradient, divergence and curl to evaluate line, surface and volume integrals.
- Use the concept of Analytic functions, conformal mapping and bilinear transformation.
- Use complex integration techniques to solve Engineering problems.
- Use Laplace transform and inverse transform techniques in solving differential equations.

Text Book (s):	
1	Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2	T Veerarajan, Transforms and Partial Differential Equations, Mc Graw Hill Education, 2018
3	T Veerarajan, Engineering Mathematics –II, Mc Graw Hill Education, 2018

Reference Books(s):	
1	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.
3	Bali, N.P. and Manish Goyal, “A Text Book of Engineering Mathematics”, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19252.1	3	3	3	3	3	2	-	-	-	-	2	2	3	3	1
MA19252.2	3	3	3	3	2	1	-	-	-	-	2	2	3	3	1
MA19252.3	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
MA19252.4	3	3	2	3	2	1	-	-	-	-	1	1	3	3	1
MA19252.5	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
Average	**3.0**	**3.0**	**2.4**	**2.6**	**2.2**	**1.2**	**-**	**-**	**-**	**-**	**1.4**	**1.4**	**3.0**	**3.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE19101	ENGINEERING GRAPHICS	ES	2	2	0	4

Objectives:	
●	To understand the importance of the drawing in engineering applications
●	To develop graphic skills for communication of concepts, ideas and design of engineering products
●	To expose them to existing national standards related to technical drawings
●	To improve their visualization skills so that they can apply this skill in developing new products
●	To improve their technical communication skill in the form of communicative drawings

CONCEPTS AND CONVENTIONS (Not for Examination)			1
Importance of graphics in Engineering Applications–Use of drafting Instruments– BIS conventions and specifications– Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.			
UNIT-I	**PLANECURVES AND FREE HAND SKETCH**		**11**
Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method– Construction of cycloids, Construction of involutes of square and circle drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects			
UNIT-II	**PROJECTION OFPOINTS, LINESAND PLANESURFACE**		**12**
Orthographic projection- Principles-Principal planes- projection of points. First angle projection - Projection of straight lines inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method- Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.			
UNIT-III	**PROJECTIONOFSOLIDS**		**12**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.			
UNIT-IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENTOF SURFACES**		**12**
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of the section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.			
UNIT-V	**ISOMETRIC AND PERSPECTIVEPROJECTIONS**		**12**
Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.			
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
●	Construct different plane curves and free hand sketching of multiple views from pictorial objects.
●	Comprehend the theory of projection and to draw the basic views related to projection of points, lines and planes
●	Draw the projection of solids in different views
●	Draw the projection of Sectioned solids and development of surfaces of solids
●	Visualize and prepare Isometric and Perspective view of simple solids

Text Book (s):	
1	Bhatt N.D. and Panchal V.M., Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2	Natrajan K.V., A Text Book of Engineering Graphics, DhanalakshmiPublishers, Chennai, 2017.

Reference Books(s):	
1	Varghese P I., Engineering Graphics, McGraw Hill Education (I) Pvt.Ltd. 2013.
2	Venugopal K. and PrabhuRaja V., Engineering Graphics, New Age International (P) Limited, 2008.
3	Gopalakrishna K.R., Engineering Drawing, (Vol. I&II combined), Subhas Stores, Bangalore, 2017.
4	Basant Agarwal and Agarwal C.M., Engineering Drawing, McGraw Hill, New Delhi, 2018.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19101.1	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.2	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.3	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.4	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.5	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
Average	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.0**	**-**	**2.0**	**-**	**-**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
PH19241	PHYSICS FOR INFORMATION SCIENCE	BS	3	0	2	4

Objectives:	
•	To understand the principles of laser and fibre optics in engineering and technology.
•	To understand the advanced concept of quantum theory and applications.
•	To study the properties and applications of semiconducting, magnetic, superconducting and optical materials.

UNIT-I	QUANTUM PHYSICS	9
Introduction- Quantum free electron theory-De Broglie‟s concept-Schrodinger wave equation-Time independent and time dependent equations-Physical significance of wave function - Particle in a one dimensional box – electrons in metals -degenerate states – Fermi- Dirac statistics – Density of energy states – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials.		
UNIT-II	**SEMICONDUCTOR PHYSICS**	**9**
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap - semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type and P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect.		
UNIT-III	**OPTICAL PROPERTIES OF MATERIALS**	**9**
Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – Photo transistor-solar cell - LED – Organic LED- Optical data storage techniques-Non Linear Optical materials-properties and applications.		
UNIT-IV	**LASERS AND FIBRE OPTICS**	**9**
Lasers: Population of energy levels, Einstein‟s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction- Applications. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, and mode) –Double crucible method-splicing technique- losses associated with optical fibers -Fiber optic communication system - fiber optic sensors: pressure and displacement.		
UNIT-V	**MAGNETIC AND SUPERCONDUCTING MATERIALS**	**9**
Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility -Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses-– Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor). Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative), Type-I and Type II Superconductors -Magnetic Levitation-SQUIDS- An overview of High temperature superconductors.		
	Contact Hours :	**45**

	List of Experiments (Any 10 experiments)			
1	Determine the wavelength and angle of divergence of laser beam and numerical aperture using fiber cable.			
2	Determine the wavelength of spectrum by using spectrometer.			
3	Determine of refractive index of a given prism by using spectrometer.			
4	Determine specific resistance of the material of given wires using metre bridge.			
5	Verify Ohm's law - series and parallel.			
6	Determine the value of Planck's constant using photo electric effect.			
7	Determine the band gap of given semiconductor.			
8	Determination of Hall coefficient of semiconducting materials.			
9	Study the magnetic field produced by current carrying coils by using Helmoltz coil.			
10	Study the resonance frequency in series connected LCR circuits.			
11	Determine the wavelength of given source by using Newton's ring Experiment.			
12	Determine the thickness of the given specimen by using air wedge method.			
		Contact Hours	:	**30**
		Total Contact Hours	:	**75**

Course Outcomes: On completion of the course, the students will be able to:	
●	Apply the concepts of electron transport in nanodevices.
●	Analyze the physics of semiconductor devices
●	Analyze the properties of optical materials for optoelectronic applications.
●	Use the concepts of Laser and Fiber optics in communication.
●	Use the properties of magnetic and superconducting materials in data storage devices.

Text Book(s):	
1	Bhattacharya, D.K. & Poonam, T. Engineering Physics, Oxford University Press, 2015.
2	Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012.
3	Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
4	Kittel, C. Introduction to Solid State Physics, Wiley, 2005.

Reference Books(s):	
1	Garcia, N. & Damask, A.,Physics for Computer Science Students, Springer Verlag, 2012.
2	Hanson, G.W. Fundamentals of Nanoelectronics, Pearson Education, 2009.
3	Rogers, B., Adams, J. &Pennathur, S. Nanotechnology: Understanding Small Systems, CRC Press, 2014.
4	S. O. Pillai, Solid state physics, New Age International, 2015.
5	Serway, R.A. & Jewett, J.W,Physicsfor Scientists and Engineers,Cengage Learning.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
PH19241.1	3	3	2	2	2	1	-	1	1	2	1	2	1	1	2
PH19241 .2	3	3	3	2	3	1	1	-	1	2	1	2	1	1	2
PH19241 .3	3	3	3	2	3	1	1	-	1	2	1	2	1	1	1
PH19241 .4	3	3	2	2	3	1	1	-	1	2	1	2	1	-	1
PH19241 .5	3	3	2	2	3	1	1	-	1	2	1	2	1	1	1
Average	**3.0**	**3.0**	**2.4**	**2.0**	**2.8**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**1.0**	**2.0**	**1.0**	**1.0**	**1.4**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EE19242	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4

Objectives:	
●	To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
●	To impart knowledge on the phenomenon of resonance in RC, RL and RLC series and parallel circuits.
●	To provide knowledge on the principles of electrical machines and electronic devices.
●	To learn the concepts of different types of electrical measuring instruments and transducers.
●	To teach methods of experimentally analyzing electrical circuits, electrical machines, electronic devices and transducers.

UNIT-I	**DC CIRCUITS**	**9**
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff,,s current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.		
UNIT-II	**AC CIRCUITS**	**9**
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections		
UNIT-III	**ELECTRICAL MACHINES**	**9**
Construction, Principles of operation and characteristics of; DC machines, Transformers (single and three phase), Synchronous machines, three phase and single-phase induction motors.		
UNIT-IV	**ELECTRONIC DEVICES & CIRCUITS**	**9**
Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias – Semiconductor Diodes –Bipolar Junction Transistor – Characteristics –Field Effect Transistors – Transistor Biasing – Introduction to operational Amplifier –Inverting Amplifier –Non-Inverting Amplifier.		
UNIT-V	**MEASUREMENTS & INSTRUMENTATION**	**9**
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect - Classification of instruments - PMMC and MI Ammeters and Voltmeters – Multimeter -Digital Storage Oscilloscope.		
	Contact Hours : 45	

	List of Experiments			
1	Verification of Kirchhoff‘s Laws.			
2	Load test on DC Shunt Motor.			
3	Load test on Single phase Transformer.			
4	Load test on Single phase Induction motor.			
5	Characteristics of P-N junction Diode.			
6	Half wave and Full wave Rectifiers.			
7	Characteristics of CE based NPN Transistor.			
8	Inverting and Non- Inverting Op-Amp circuits.			
9	Characteristics of LVDT, RTD and Thermistor.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Analyse DC and AC circuits and apply circuit theorems.
●	Realize series and parallel resonant circuits.
●	Understand the principles of electrical machines.
●	Understand the principles of different types of electronic devices, electrical measuring instruments and transducers.
●	Experimentally analyze the electric circuits, electrical machines, electronic devices, and transducers.

Text Book(s):	
1	J.B.Gupta, Fundamentals of Electrical Engineering and Electronics,S.K.Kataria& Sons Publications, 2002.
2	D P Kothari and I.J Nagarath, Basic Electrical and Electronics Engineering, McGraw Hill Education(India) Private Limited, Third Reprint,2016
3	Thereja .B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand & Co. Ltd., 2008

Reference Books(s):	
1	Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, 2007
2	John Bird,Electrical Circuit Theory and Technology, Elsevier, First Indian Edition, 2006
3	Allan S Moris, Measurement and Instrumentation Principles, Elsevier, First Indian Edition, 2006
4	Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall of India, 2006
5	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, Basic Electrical Engineering, McGraw Hill Education(India) Private Limited, 2009

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EE19242.1	2	2	2	3	3	2	1	-	-	-	-	3	2	2	2
EE19242.2	1	2	2	3	2	2	3	-	-	-	-	-	1	-	1
EE19242.3	2	3	2	1	2	2	2	-	2	-	-	1	2	2	2
EE19242.4	3	3	2	3	1	2	2	-	-	-	2	2	2	1	2
EE19242.5	3	3	2	2	2	1	2	1	2	1	2	1	2	3	2
Average	**2.2**	**2.6**	**2.0**	**2.4**	**2.0**	**1.8**	**2.0**	**1.0**	**2.0**	**1.0**	**2.0**	**1.75**	**1.8**	**2.0**	**1.8**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CS19241	DATA STRUCTURES	PC	3	0	4	5

Objectives:	
●	To apply the concepts of List ADT in the applications of various linear and nonlinear data structures.
●	To demonstrate the understanding of stacks, queues and their applications.
●	To analyze the concepts of tree data structure.
●	To understand the implementation of graphs and their applications.
●	To be able to incorporate various searching and sorting techniques in real time scenarios.

UNIT-I	LINEAR DATA STRUCTURES – LIST	9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).		
UNIT-II	**LINEAR DATA STRUCTURES – STACKS, QUEUES**	**9**
Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue –DEQUE –applications of queues.		
UNIT-III	**NON-LINEAR DATA STRUCTURES – TREES**	**9**
Tree Terminologies- Binary Tree–Representation-Tree traversals – Expression trees – Binary Search Tree–AVL Trees – Splay Trees - Binary Heap – Applications.		
UNIT-IV	**NON-LINEAR DATA STRUCTURES – GRAPHS**	**9**
Graph Terminologies – Representation of Graph – Types of graphs - Breadth-first traversal - Depth-first traversal – Topological Sort - Shortest path - Dijkstra's Algorithm - Minimum Spanning Tree- Prim's Algorithm.		
UNIT-V	**SEARCHING, SORTING AND HASHING TECHNIQUES**	**9**
Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort – Shell sort – Quick sort - Merge Sort. Hashing- Hash Functions –Collision resolution strategies- Separate Chaining – Open Addressing – Rehashing.		
	Contact Hours : 45	

	List of Experiments			
1	Array implementation of Stack and Queue ADTs			
2	Array implementation of List ADT			
3	Linked list implementation of List, Stack and Queue ADTs			
4	Applications of List, Stack and Queue ADTs			
5	Implementation of Binary Trees and operations of Binary Trees			
6	Implementation of Binary Search Trees			
7	Implementation of AVL Trees			
8	Implementation of Heaps using Priority Queues			
9	Graph representation and Traversal algorithms			
10	Applications of Graphs			
11	Implementation of searching and sorting algorithms			
12	Hashing –any two collision techniques			
	Contact Hours	**:**	**60**	
	Total Contact Hours	**:**	**105**	

Course Outcomes: On completion of the course, the students will be able to	
●	Analyze the various data structure concepts.
●	Implement Stacks and Queue concepts for solving real-world problems.
●	Analyze and structure the linear data structure using tree concepts.
●	Critically Analyze various non-linear data structures algorithms.
●	Apply different Sorting, Searching and Hashing algorithms.

Text Books:	
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2002.
2	ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.

Reference Books:	
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, McGraw Hill, 2002.
2	Aho, Hopcroft and Ullman,Data Structures and Algorithms, Pearson Education, 1983.
3	Stephen G. Kochan, Programming in C, 3rd edition, Pearson Education.
4	Ellis Horowitz, SartajSahni and Susan Anderson Freed,Fundamentals of Data Structures in C, 2nd Edition, University Press, 2008.

Web links for virtual lab (if any)	
1	http://vlabs.iitb.ac.in/vlab/labscse.html

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19241.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19241.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	**1.0**	**1.2**	**1.8**	**1.2**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**1.6**	**1.6**	**2.0**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE19121	ENGINEERING PRACTICES – CIVIL AND MECHANICAL	ES	0	0	2	1

Objectives:	
•	To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

List of Experiments				
CIVIL ENGINEERING PRACTICE				
1.	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.			
2.	Preparation of basic plumbing line sketches for wash basins, water heaters, etc.			
3.	Hands-on-exercise: Basic pipe connections –Pipe connections with different joining components.			
Carpentry Works:				
4.	Study of joints in roofs, doors, windows and furniture.			
5.	Hands-on-exercise: Woodwork, joints by sawing, planning and chiseling.			
MECHANICAL ENGINEERING PRACTICE				
6.	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.			
7.	Gas welding practice.			
Basic Machining:				
8.	Simple Turning and Taper turning			
9.	Drilling Practice			
Sheet Metal Work:				
10.	Forming & Bending:			
11.	Model making – Trays and funnels			
12.	Different type of joints.			
Machine Assembly Practice:				
13.	Study of centrifugal pump			
14.	Study of air conditioner			
		Total Contact Hours	**:**	**30**

Course Outcomes: On completion of the course, the students will be able to	
•	Perform plumbing activities for residential and industrial buildings considering safety aspects while gaining clear understanding on pipeline location and functions of joints like valves, taps, couplings, unions, reducers, elbows, etc.
•	Perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of the joints in roofs, doors, windows and furniture.
•	Produce joints like L joint, T joint, Lap joint, Butt joint, etc. through arc welding process while acquiring in depth knowledge in the principle of operation of welding and other accessories
•	Perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
•	Perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19121.1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.2	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.3	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.4	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	**1.0**	**1.0**	-	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
CS19211	PYTHON PROGRAMMING LAB	PC	0	0	4	2

Objectives:	
●	Learn the Python Environment using interactive and script mode
●	Implement Python programs with conditionals and loops.
●	Use functions for structuring Python programs.
●	Represent compound data using Python lists, tuples and dictionaries.
●	Lay the foundation for mathematical and statistical data packages.

	List of Experiments			
1	Implement simple python programs using interactive and script mode.			
2	Develop python programs using id() and type() functions			
3	Implement range() function in python			
4	Implement various control statements in python.			
5	Develop python programs to perform various string operations like concatenation, slicing, Indexing.			
6	Demonstrate string functions using python.			
7	Implement user defined functions using python.			
8	Develop python programs to perform operations on list			
9	Implement dictionary and set in python			
10	Develop programs to work with Tuples.			
11	Implement python programs using modules and packages. (Basics of Numpy – Arrays and vectorized computation)			
12	Getting started with Pandas			
	Total Contact Hours	**:**	**60**	

Course Outcomes: On completion of the course, the students will be able to	
●	Run Python Programs at interactive and script mode.
●	Implement Python programs with conditionals and loops.
●	Develop Python programs stepwise by defining functions and calling them.
●	Use Python lists, tuples and dictionaries for representing compound data.
●	Apply Numpy and Pandas for numerical and statistical data.

Web links for virtual lab	
1	https://www.python.org/shell/
2	https://www.tutorialspoint.com/execute_python_online.php
3	https://www.onlinegdb.com/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19211.1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CS19211.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.3	2	2	3	2	1	-	-	-	1	-	2	1	2	2	-
CS19211.4	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	-
Average	**1.5**	**1.5**	**2.25**	**1.5**	**1.0**	**-**	**-**	**-**	**1.0**	**-**	**1.5**	**1.0**	**1.8**	**1.8**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19101	ENVIROMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0

Objectives:	
●	To understand the importance of natural resources, pollution control and waste management.
●	To provide the students awareness on the current social issues and environmental legislations.

UNIT-I	**NATURAL RESOURCES**	**9**
Environment -definition - scope and importance - forest resources -use and overexploitation -water resources -use and over utilization - dams - benefits and problems - water conservation -energy resources - growing energy needs - renewable and non-renewable energy sources - use of alternate energy sources -land resources -land degradation - role of an individual in conservation of natural resources		
UNIT-II	**ENVIRONMENTAL POLLUTION**	**9**
Definition - causes, effects and control measures of air pollution -chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, and ozone depletion- noise pollution -mitigation procedures - control of particulate and gaseous emission (Control of SO2, NOX, CO and HC). Water pollution - definition-causes-effects of water pollutants–marine pollution-thermal pollution-radioactive pollution-control of water pollution by physical, chemical and biological processes–waste water treatment-primary, secondary and tertiary treatment. Soil pollution: definition-causes-effects and control of soil pollution.		
UNIT-III	**SOLID WASTE MANAGEMENT**	**9**
Solid wastes - sources and classification of solid wastes -solid waste management options - sanitary landfill, recycling, composting, incineration, energy recovery options from wastes. Hazardous waste -definition -sources of hazardous waste-classification (biomedical waste, radioactive waste, chemical waste, household hazardous waste)-characteristics of hazardous waste ignitability (flammable) reactivity, corrosivity, toxicity -effects of hazardous waste -case study- Bhopal gas tragedy - disposal of hazardous waste-recycling, neutralization, incineration, pyrolysis, secured landfill - E- waste management -definition-sources-effects -electronic waste recycling technology.		
UNIT-IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**9**
Sustainable development -concept, components and strategies - social impact of growing human population and affluence, food security, hunger, poverty, malnutrition, famine - consumerism and waste products - environment and human health - role of information technology in environment and human health -disaster management– floods, earthquake, cyclone and landslide.		
UNIT-V	**TOOLS FOR ENVIRONMENTAL MANAGEMENT**	**9**
Environmental impact assessment (EIA) structure -strategies for risk assessment–EIS-environmental audit-ISO 14000-precautionary principle and polluter pays principle- constitutional provisions- - pollution control boards and pollution control acts- environmental protection act1986- role of non-government organizations- international conventions and protocols.		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Be conversant to utilize resources in a sustainable manner.
●	Find ways to protect the environment and play proactive roles.
●	Apply the strategies to handle different wastes
●	Develop and improve the standard of better living.
●	Be conversant with tools of EIA and environmental legislation.

Text Book(s):	
1	Benny Joseph, "Environmental Science and Engineering", 2nd edition, Tata McGraw-Hill, New Delhi, 2008.
2	Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2ndedition, Pearson Education, 2004.

Reference Books(s):	
1	Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd, New Delhi, 2007.
2	ErachBharucha, "Textbook of Environmental Studies", 3rd edition, Universities Press, 2015.
3	G. Tyler Miller and Scott E. Spoolman, "Environmental Science", 15thedition,CengageLearning India, 2014.
4	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", 3rdedition, Oxford UniversityPress, 2015.
5	De. A.K., "Environmental Chemistry", New Age International, New Delhi, 1996.
6	K. D. Wager, "Environmental Management", W. B. Saunders Co., USA, 1998.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC19101.1	3	2	3	2	1	3	3	2	1	1	1	1	1	1	1
MC19101.2	3	3	3	2	2	3	3	3	2	1	2	2	1	2	2
MC19101.3	3	3	3	2	2	3	3	3	2	1	2	1	1	2	1
MC19101.4	3	3	3	2	2	3	3	2	2	1	2	2	1	2	2
MC19101.5	2	2	3	1	1	3	3	1	1	2	1	1	1	1	1
Average	**2.8**	**2.6**	**3.0**	**1.8**	**1.6**	**3.0**	**3.0**	**2.2**	**1.6**	**1.2**	**1.6**	**1.4**	**1.0**	**1.6**	**1.4**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
MA19354	TRANSFORMS AND DISCRETE MATHEMATICS Common to III sem. B.E. Computer Science and Engineering and B.Tech. Information Technology	BS	3	1	0	4

Objectives:	
●	To introduce Fourier series and Z transforms to solve problems that arise in the field of Engineering.
●	To introduce the basic terminologies used in courses of computer science and to solve practical problems.

UNIT-I	**FOURIER SERIES**	**12**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Parseval's identity – Harmonic analysis.		
UNIT-II	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS**	**12**
Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) –Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.		
UNIT-III	**MATHEMATICAL LOGIC**	**12**
Propositional Logic – Propositional equivalences – Rules of inference – normal forms - introduction to Proofs-Proof Methods and strategy.		
UNIT-IV	**COMBINATORICS**	**12**
Mathematical induction-The basic principles of counting-The pigeonhole principle –Permutations and combinations-Recurrence Relations-Solving Linear recurrence relations using generating function-inclusion and exclusion principle and applications.		
UNIT-V	**GROUPS AND BOOLEAN ALGEBRA**	**12**
Algebraic systems-Groups: Semi Groups, Subgroups - Posets -Lattices-Boolean Algebra - simplification of Boolean expression (with examples from small circuits).		
	Total Contact Hours : 60	

Course Outcomes: On completion of the course, the students will be able to	
●	Develop skills to construct Fourier series for different periodic functions and to evaluate infinite series.
●	Solve difference equations using Z – transforms that arise in discrete time systems.
●	Apply the concepts of logic to test the validity of a program.
●	Use the counting principles in implementing various programs.
●	Apply the concepts and properties of different algebraic structures.

Text Books:	
1	Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
2	Veerarajan T, "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
3	Kenneth H.Rosen, "Discrete Mathematics and its Applications, Special Indian edition", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, (2007).

Reference Books	
1	Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
2	Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.
3	Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, Wiley India, 2015.
4	Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2019.
5	Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006.
6	Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, 2nd edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2017.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA19354.1	3	3	2	2	1	-	-	-	-	-	-	2	2	2	2
MA19354.2	3	3	2	2	1	-	-	-	-	-	-	2	2	2	2
MA19354.3	3	3	3	3	3	-	-	-	-	-	2	2	3	3	3
MA19354.4	3	3	3	3	1	-	-	-	-	-	2	2	3	2	3
MA19354.5	3	3	3	3	3	-	-	-	-	-	2	2	3	3	3
Average	**3**	**3**	**2.6**	**2.6**	**1.8**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2.6**	**2.4**	**2.6**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS19301	COMPUTER ARCHITECTURE	PC	3	0	0	3

Objectives:	
•	To learn the basic structure and operation of digital computer.
•	To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
•	To make the students quantitatively evaluate simple computer designs and their sub-modules.
•	To make the students to understand about the Pipelining and Hazards.
•	To expose and make the students to learn about the memory system design and different ways of communicating with I/O devices and standard I/O interfaces.

UNIT-I	INTRODUCTION & INSTRUCTIONS		9
Introduction –RISC – CISC, Eight ideas – Components of a computer system – Technology – Performance – Power wall –Instructions – Operations & Operands, Representing instructions, Logical operations – Instructions for decision making- Addressing Modes. Case Study: Evolution of Intel x86 architecture.			
UNIT-II	**ARITHMETIC AND LOGIC UNIT**		**9**
Design of ALU, Integer Arithmetic: Addition, Subtraction, Multiplication and Division – Floating Point Arithmetic: Representation, Addition, subtraction, Multiplication.			
UNIT-III	**PROCESSOR AND CONTROL UNIT**		**9**
MIPS implementation – Building data path – Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.			
UNIT-IV	**PARALLELISM**		**9**
Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors- Case Study: Key Elements of ARM 11 MPCORE.			
UNIT-V	**MEMORY AND I/O SYSTEMS**		**9**
Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory – TLBs, Input/output system, programmed I/O, DMA and interrupts, I/O processors. Case Study: RAID.			
	Contact Hours	**:**	**45**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the impact of instruction set architecture on cost-performance of computer design.
•	Perform computer arithmetic operations.
•	Design and analyze pipelined control units and hazards.
•	Develop the system skills in parallelism and multithreading.
•	Evaluate the performance of memory systems.

Text Books:	
1	David A. Patterson and John L. Hennessey, “Computer organization and design”, 5th edition, Elsevier, 2014.

Reference Books:	
1	V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organisation”, 6th edition, Mc Graw-Hill Inc, 2012.
2	William Stallings, “Computer Organization and Architecture Designing for performance”, 10th Edition, PHI Pvt. Ltd., Eastern Economy Edition2016.
3	Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, 2nd Edition, Pearson Education, 2005.
4	Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications”, 1st edition, Tata McGraw Hill, New Delhi, 2005.
5	John P Hayes, “Computer Architecture and Organization”,3rd edition, McGraw Hill, 2002.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19302.1	2	2	1	1	-	-	1	-	-	-	-	-	2	2	2
CS19302.2	3	3	1	2	-	-	-	-	2	-	1	-	2	2	2
CS19302.3	2	2	3	1	2	1	2	-	-	-	2	-	2	2	2
CS19302.4	2	2	2	1	2	2	2	-	-	-	2	1	2	2	2
CS19302.5	2	2	3	1	2	2	2	-	-	-	2	-	3	3	2
Average	**2.2**	**2.2**	**2.0**	**1.2**	**2.0**	**1.7**	**1.8**	**-**	**2.0**	**-**	**1.8**	**1.0**	**2.2**	**2.2**	**2.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
EC19306	COMMUNICATION ENGINEERING	ES	3	0	0	3

Objectives:	
●	To understand the need for modulation and various analog modulation techniques.
●	To acquire knowledge in digital modulation techniques.
●	To learn the necessity of data communication and pulse modulation techniques.
●	To be familiarized with source and Error control coding.
●	To gain knowledge on multi-user radio communication.

UNIT-I	ANALOG MODULATION	9
Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation- AM transmitter & receiver - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).		
UNIT-II	**DIGITAL MODULATION (Qualitative only)**	**9**
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).		
UNIT-III	**PULSE MODULATION AND DATA COMMUNICATION**	**9**
Pulse Modulation**:** Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication**:** Standards & Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces.		
UNIT-IV	**INFORMATION THEORY AND CODING**	**9**
Measure of Information, Entropy-properties, Source encoding theorem-Shannon-Fano coding, Huffman Coding-Channel capacity, Shannon's limit -Channel coding theorem- Error Control Coding, linear block codes, Cyclic codes, Convolution codes, Viterbi decoding.		
UNIT-V	**MULTI USER RADIO COMMUNICATION**	**9**
Global System for Mobile Communications (GSM) - Overview of Multiple Access Schemes-FDMA, TDMA, CDMA, and SDMA – Cellular Concept and Frequency Reuse - Channel Assignment and Handoff-Introduction to 3G,4G and 5G wireless systems.		
	Total Contact Hours : 45	

Course Outcomes: On completion of course, students will be able to	
●	Describe various analog modulation techniques
●	Explain various digital modulation techniques employed in communication systems
●	Differentiate data communication and pulse modulation techniques.
●	Analyze Source and Error control coding.
●	Demonstrate the multi-user radio communication.

Text Books:	
1	Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009.
2	SimonHaykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004.

Reference Books:	
1	B.Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition Pearson Education 2007.
2	H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
3	B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.
4	H P Hsu, "Schaum Outline Series –Analog and Digital Communications", TMH 2006.
5	Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, Prentice Hall of India, 2002.

Web Links:	
1	https://www.slideshare.net/vivekrana007/next-generation-5-g-mobile-wireless-technology
2	https://www.slideshare.net/sushilsudake/5-g-wireless-technology

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC19306.1	3	2	2	1	-	-	-	-	-	-	1	1	-	-	-
EC19306.2	3	2	2	1	2	-	1	1	1	1	2	1	2	2	-
EC19306.3	2	1	1	1	-	-	1	-	2	2	2	-	1	-	1
EC19306.4	3	3	3	2	2	-	1	-	1	1	2	2	-	-	-
EC19306.5	2	2	1	-	-	2	-	2	2	1	2	-	1	1	-
Average	**2.6**	**2.0**	**1.8**	**1.3**	**2.0**	**2.0**	**1.0**	**1.5**	**1.5**	**1.3**	**1.8**	**1.3**	**1.3**	**1.5**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CS19341	DESIGN AND ANALYSIS OF ALGORITHMS	PC	3	0	2	4

Objectives:	
●	Learn and understand the algorithm analysis techniques and complexity notations.
●	Become familiar with the different algorithm design techniques for effective problem solving in computing.
●	Learn to apply the design techniques in solving various kinds of problems in an efficient way.
●	Understand the limitations of Algorithm power.
●	Solve variety of problems using different design techniques.

UNIT-I	**INTRODUCTION AND ANALYSIS OF ALGORITHMS**	**9**
Introduction –Algorithm Specification –Important Problem types- Performance Analysis: Space Complexity - Time Complexity - Asymptotic Notations - Using Limits for Comparing Orders of Growth – Basic Efficiency Classes- Solving Recurrence Relations: Substitution methods and Master Theorem Method.		
UNIT-II	**BRUTE FORCE AND DIVIDE-AND-CONQUER**	**9**
Brute Force: Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem - Divide and Conquer Method: Analysis of Binary Search, Merge sort and Quick sort Algorithms, Integer Multiplication- Finding Minimum and Maximum.		
UNIT-III	**GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING**	**9**
Greedy Method – Minimum Spanning Trees: Kruskal's Algorithm– Fractional Knapsack - Huffman Codes - Dynamic Programming: General Method - String Editing - 0/1 Knapsack - Travelling Salesman Problem.		
UNIT-IV	**BACKTRACKING AND BRANCH & BOUND**	**9**
Backtracking: General Method - 8 Queen's Problem - Sum of Subsets Problem - Graph Coloring - Hamiltonian Circuit Problem - Branch and Bound: LC branch and bound - 0/1 Knapsack - Travelling Salesman Problem.		
UNIT-V	**STRING MATCHING AND NP COMPLETE & NP HARD**	**9**
String Matching: Naive String Matching - Rabin Karp - Knuth Morris Pratt - NP Complete and NP Hard Problems: Basic Concepts - Non-Deterministic Algorithms - Class of NP Complete and NP Hard – Approximation Algorithms: Travelling Salesman problem.		
	Contact Hours : 45	

List of Experiments			
1	Finding Time Complexity of algorithms.		
2	Design and implement algorithms using Brute Force Technique.		
3	Design and implement algorithms using Divide and Conquer Technique.		
4	Design and implement algorithms using **G**reedy Technique.		
5	Design and implement algorithms using Dynamic Programming.		
6	Design and implement algorithms using Backtracking.		
7	Design and implement algorithms using Branch and Bound.		
8	Implement String Matching algorithms.		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Analyze the time and space complexity of various algorithms and compare algorithms with respect to complexities.
●	Decide and apply Brute Force and Divide and Conquer design strategies to Synthesize algorithms for appropriate computing problems.
●	Apply Greedy and Dynamic Programming techniques to Synthesize algorithms for appropriate computing problems.
●	Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing problems.
●	Apply string matching algorithms in vital applications.

Text Books:	
1	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2012.
2	Ellis Horowitz, Shani, SanguthevarRajasekaran, “Computer Algorithms”, 2nd Edition Universities Press, 2008.

Reference Books	
1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd Edition, PHI Learning Private Limited, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
3	Donald E. Knuth, “The Art of Computer Programming”, Volumes 1& 3 Pearson Education, 2009.
4	Sara Baase Allen Van Gelder, “Computer Algorithms - Introduction to Analysis”, Pearson Education Asia, 2010.
5	Droomey R. G, “How to solve it by Computer”, Pearson Education, 2006.

Web links for Theory & Lab:	
1	https://www.geeksforgeeks.org/fundamentals-of-algorithms/
2	https://www.hackerrank.com/domains/algorithms

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19341.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
CS19341.2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.5	1	2	2	2	-	-	-	-	-	-	-	1	3	3	1
Average	**2.0**	**2.8**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.0**	**3.0**	**2.8**	**1.2**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
EC19341	DIGITAL LOGIC AND MICROPROCESSOR	ES	3	0	4	5

Objectives:	
●	To learn basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions.
●	To illustrate the formal procedures for the analysis and design of Combinational and Sequential circuits.
●	To understand the concept by illustrating and elucidating the basic functionalities of 8085.
●	To understand the concept by illustrating and elucidating the basic functionalities of 8051.
●	To peruse the knowledge of programming, peripherals and interface various devices with the processor.

UNIT-I	MINIMIZATION TECHNIQUES AND LOGIC GATES	9
Number systems and Complements. **Fundamentals:** Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Sum of Products (SOP), Product of Sums (POS). **Minimization Techniques:** Minimization of Boolean expressions using Boolean laws, Karnaugh map, Quine McCluskey method of minimization, don't care conditions. **Logic Gates:** Implementations of Logic Functions using gates, NAND–NOR implementations, Tristate gates.		
UNIT-II	**COMBINATIONAL AND SEQUENTIAL CIRCUITS**	**9**
Combinational Circuits: Full Adder, Full Subtractor, Code converters, Magnitude Comparator, Multiplexer-Logic function implementation, Demultiplexer, Decoder, Encoder, Parallel Binary Adder/Subtractor. **Sequential Circuits: Memory element:** Latches, Flip-flops: RS, JK, D, T, Shift Registers - SISO, SIPO, PISO, PIPO, **Design:** Synchronous &Asynchronous counters - Up/Down counter, Modulo–N counter.		
UNIT-III	**THE 8085 MICROPROCESSORS**	**9**
8085 Architecture - Pin configuration - Instruction Set - Addressing modes – Interrupts- Timing diagram, Assembly Language Programming.		
UNIT-IV	**THE 8051 MICROCONTROLLERS**	**9**
8051 Architecture - SFR - Instruction Set - Addressing modes – Programming 8051 Timers, Serial Port, Assembly Language Programming.		
UNIT-V	**8085 PROGRAMMING, INTERFACING & APPLICATIONS**	**9**
Programmable Peripheral Interface (8255), Programmable Interval Timer (8253), DAC, ADC, Stepper Motor Control, Traffic Light Control.		
	Total Contact Hours :	**45**

List of Experiments			
1	Design and Implementation of adder, subtractor using logic gates.		
2	Design and Implementation of Parallel Binary adder/subtractor using IC 7483.		
3	Design and Implementation of Multiplexer and De-multiplexer using logic gates.		
4	Design and Implementation of BCD Synchronous counters.		
5	Design and Implementation of Mod-10Asynchronous counters.		
6	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- Flop.		
7	8-bit Arithmetic, Logical and Decimal Arithmetic Operations using 8085.		
8	Searching an array of numbers using 8085.		
9	8-bit Arithmetic, Logical operations using 8051.		
10	8255 - Parallel interface.		
11	8253– Timer interface.		
12	Analog to Digital Converter, Digital to Analog Converter.		
13	Stepper Motor Control.		
	Contact Hours	:	**60**
	Total Contact Hours	:	**105**

Course Outcomes: On completion of the course students will be able to:	
●	Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization techniques.
●	Apply the procedure to design and implement combinational and sequential circuits.
●	Pertain the concepts of 8085 and to infer the basic functionalities.
●	Analyze the concepts of 8051 and to infer the basic functionalities.
●	Explore the knowledge of programming, interfacing and use it for different applications.

Text Book(s):	
1	M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085",6thEdition, Penram International Publishing, 2012.

Reference Books(s):	
1	Charles H.Roth, "Fundamentals of Logic Design", 7th Edition, Thomson Learning, 2014.
2	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
3	Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Revised 2nd Edition 2006, eleventh reprint 2010.Tata McGraw Hill.
4	Barry B. Brey, "The Intel Microprocessors Architecture", Programming and Interfacing, 8thEdition, Pearson.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC 19341.1	3	3	3	3	3	2	2	2	3	2	3	3	3	3	2
EC 19341.2	3	3	3	3	3	2	1	1	3	2	2	3	3	3	2
EC 19341.3	3	3	2	3	3	2	2	2	2	1	2	2	3	3	1
EC 19341.4	3	3	3	3	3	2	1	1	3	2	3	3	3	3	1
EC 19341.5	3	3	3	3	3	2	2	1	3	2	3	3	3	3	1
Average	**3.0**	**3.0**	**2.8**	**3.0**	**3.0**	**2.0**	**1.6**	**1.4**	**2.8**	**1.8**	**2.6**	**2.8**	**3.0**	**3.0**	**1.4**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19342	OBJECT ORIENTED PROGRAMMING PARADIGM	PC	3	0	4	5

.

Objectives:	
●	To understand Object Oriented Programming concepts and characteristics of Java
●	To know the principles of classes, abstraction and inheritance
●	To create packages, define exceptions and use strings
●	To use I/O streams and collections in applications
●	To design and build simple GUI programs using generics, AWT, Swings and JDBC

UNIT-I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9
Introduction to Object Oriented Programming – Basic concepts of OOP - An overview of Java - Java Architecture - Data Types - Variables- Arrays- Operators - Control Statements - Command Line Arguments.		
UNIT-II	**CLASSES AND INHERITANCE**	**9**
Defining Classes in Java: Methods, Constructors, Garbage Collection - Access Specifiers - Method Overloading – Inheritance: Super keyword, this keyword, Method Overriding, Abstract Classes – Static Members -Final Method and Class.		
UNIT-III	**PACKAGES, EXCEPTION HANDLING AND STRINGS**	**9**
Packages – Interfaces - Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions, User defined Exceptions, Stack Trace Elements – Strings - String Buffer.		
UNIT-IV	**I/O AND COLLECTIONS**	**9**
Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files – Collection Interfaces – Collection Classes.		
UNIT-V	**GENERIC PROGRAMMING, MULTITHREADING AND EVENT DRIVEN PROGRAMMING**	**9**
Generic Programming – Generic Classes – Generic Methods - Multithreading: Thread Life Cycle, Thread Creation, Thread Synchronization- Swings – Layout Management - Accessing Databases with JDBC.		
	Total Contact Hours :	**45**

	List of Experiments
1	Simple programs using command line arguments
2	Programs using control structures
3	Programs using arrays
4	Programs using classes and objects.
5	Programs using inheritance and interfaces
6	Programs using packages and abstract class
7	Programs to handle different types of exceptions
8	Programs using strings and string buffer
9	Programs using I/O streams
10	Programs using files
11	Programs using collections
12	Programs using multithreading
13	Programs using Generics
14	Programs using swings
15	Simple applications using database connectivity

Contact Hours	:	**60**
Total Contact Hours	:	**105**

Course Outcomes: On completion of the course, the students will be able to	
●	Develop Java programs using OOP principles.
●	Develop Java programs with the concept's inheritance.
●	Build Java applications using exceptions and strings.
●	Develop Java applications using I/O and collections.
●	Develop interactive Java applications using GUI components.

Text Book (s):	
1	Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2	Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

Reference Books(s):	
1	Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2	Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3	Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.
4	SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill.

Web links for Theory & Lab:	
1	https://www.javatpoint.com/java-tutorial

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19342.1	3	2	1	-	1	-	-	-	1	-	-	1	1	1	1
CS19342.2	3	1	1	-	1	-	-	-	1	-	-	1	2	1	1
CS19342.3	3	1	1	-	1	-	-	-	2	-	-	1	2	2	2
CS19342.4	3	2	1	-	1	-	-	-	2	-	-	2	3	2	2
CS19342.5	3	2	2	2	1	-	-	-	3	1	3	2	3	2	3
Average	**3.0**	**1.6**	**1.2**	**2.0**	**1.0**	**-**	**-**	**-**	**1.8**	**1.0**	**3.0**	**1.4**	**2.2**	**1.6**	**1.8**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19301	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	3	0	0	0

Objectives:	
●	To impart basic principles of thought process, reasoning and inference.
●	To acquire knowledge in holistic life style of yoga science and wisdom in modern society with rapid technological advancements and societal disruptions.
●	To gain knowledge in Indian perspective of modern science.
●	Be familiarized with Indian philosophical, linguistic and artistic traditions.

UNIT-I	**INTRODUCTION TO INDIAN KNOWLEDGE SYSTEM**	**9**
Basic structure of the Indian Knowledge System –Veda – Upaveda - Ayurveda, Dhanurveda - Gandharvaveda, Sthapathyaveda and Arthasasthra. Vedanga (Six forms of Veda) – Shiksha, Kalpa, Nirukta, Vyakarana, Jyothisha and Chandas- Four Shasthras - Dharmashastra, Mimamsa, Purana and Tharkashastra.		
UNIT-II	**MODERN SCIENCE AND YOGA**	**9**
Modern Science and the Indian Knowledge System – a comparison - Merits and demerits of Modern Science and the Indian Knowledge System - the science of Yoga-different styles of Yoga – types of Yogaasana, Pranayam, Mudras, Meditation techniques and their health benefits – Yoga and holistic healthcare – Case studies		
UNIT-III	**INDIAN PHILOSOPHICAL TRADITION**	**9**
Sarvadharshan/Sadhdharshan – Six systems (dharshans) of Indian philosophy - Nyaya, Vaisheshika, Sankhya, Yoga, Vedanta-Other systems- Chavarka, Jain (Jainism), Boudh (Buddhism) – Case Studies.		
UNIT-IV	**. INDIAN LINGUISTIC TRADITION**	**9**
Introduction to Linguistics in ancient India – history – Phonetics and Phonology – Morphology –Syntax and Semantics-Case Studies		
UNIT-V	**INDIAN ARTISTIC TRADITION**	**9**
Introduction to traditional Indian art forms – Chitrakala (Painting), Murthikala / Shilpakala (Sculptures), Vaasthukala, Sthaapathya kala (Architecture), Sangeeth (Music), Nruthya (Dance) and Sahithya (Literature) – Case Studies.		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Understand basic structure of the Indian Knowledge System.
●	Apply the basic knowledge of modern science and Indian knowledge system in practice.
●	Understand the importance Indian Philosophical tradition.
●	Appreciate the Indian Linguistic Tradition.
●	Understand the concepts of traditional Indian art forms.
Text Book (s):	
1	V. Sivaramakrishnan (Ed.), "Cultural Heritage of India-course material", BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014.
2	Swami Jitatmanand, "Modern Physics and Vedant", BharatiyaVidyaBhavan.
3	Swami Jitatmanand, "Holistic Science and Vedant", BharatiyaVidyaBhavan.
4	Fritzof Capra, "Tao of Physics".
5	Fritzof Capra, "The Wave of life".

Reference Books(s) :	
1	VN Jha (Eng. Trans.), "Tarkasangraha of Annam Bhatta", International ChinmayFoundation,Velliarnad, Arnakulam.
2	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
3	GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya,VidyanidhiPrakashan, Delhi 2016.
4	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakashan, Delhi 2016.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC19301.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19301.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19301.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19301.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19301.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
Average	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19454	PROBABILITY, STATISTICS AND QUEUING THEORY Common to IV sem. B.E. Computer Science Engineering and B.Tech. Information Technology	BS	3	1	0	4

Objectives:	
●	To provide the required mathematical support in real life problems.
●	To develop probabilistic models that can be used in several areas of Science and Engineering.

UNIT-I	ONE – DIMENSIONAL RANDOM VARIABLE	12
Discrete and continuous random variables – Moments – Moment generating function –Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions.		
UNIT-II	**TWO - DIMENSIONAL RANDOM VARIABLES**	**12**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Applications of Central Limit Theorem.		
UNIT-III	**TESTING OF HYPOTHESIS**	**12**
Statistical hypothesis - large sample test based on Normal distribution for single mean and difference of means -Tests based on t, F and Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit.		
UNIT-IV	**RANDOM PROCESSES**	**12**
Classification – Stationary process – Markov process - Poisson process and its properties – Discrete parameter Markov chain – Chapman Kolmogorov Theorem (without proof)– Limiting distributions.		
UNIT-V	**QUEUEING MODELS**	**12**
Markovian queues – Birth and Death processes – Queueing Models - (M/M/1) :(GD/∞/∞), (M/M/1) :(GD/k/∞), (M/M/c) :(GD/∞/∞), (M/M/c) :(GD/k/∞), - (M/G/1) :(GD/∞/∞).		
	Total Contact Hours : 60	

Course Outcomes: On completion of the course, the students will be able to:	
●	Apply the basic concepts of probability, one dimensional and two-dimensional Random Variables.
●	Apply the concept of correlation and regression in real life situation.
●	Use the concepts of Testing of Hypothesis for industrial problems.
●	Characterize phenomena which evolve with respect to time in a probabilistic manner.
●	Characterize features of a queuing system and analyze different queuing models.

Text Books:	
1	Veerarajan T, "Probability, Statistics and Random Processes with Queueing Theory", Mc Graw Hill, 1st Edition, 2018.
2	Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition, 5th Edition, 2018.
3	Oliver Cibe, "Fundamentals of Applied Probability and Random Processes", 2nd edition, Academic Press, June 2014.

Reference Books:	
1	Robertazzi, "Computer Networks and Systems: Queueing Theory and performance evaluation", Springer, 3rd Edition, 2013.
2	Taha H.A, "Operations Research", 9th Edition, Pearson Education, Asia, 2014.
3	Trivedi.K.S, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, 2008.
4	Hwei Hsu, "Schaums Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2017.
5	Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19454.1	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA19454.2	3	3	2	2	1	-	-	-	-	-	-	2	2	1	2
MA19454.3	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
MA19454.4	3	3	3	3	3	-	-	-	-	-	1	2	3	1	2
MA19454.5	3	3	3	3	2	-	-	-	-	-	2	2	3	1	2
Average	**3.0**	**3.0**	**2.6**	**2.6**	**1.8**	**-**	**-**	**-**	**-**	**-**	**1.7**	**2.0**	**2.6**	**1.0**	**2.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE19301	LIFE SCIENCE FOR ENGINEERS	BS	3	0	0	3

Objectives:	
•	Broad objective of this course is to give an introduction of life science to engineering students.
•	The course helps students to familiarize with human physiology, life style diseases and their management and basic diagnostic aspects.

UNIT-I	**OVERVIEW OF CELLS AND TISSUES**	**9**
Introduction to Bacteria, virus, fungi and animal cells. Organization of cells into tissues and organs. Functions of vital organs.		
UNIT-II	**HEALTH AND NUTRITION**	**9**
Balanced diet, Importance of RDA, BMR, and diet related diseases. Role of antioxidants PUFA, DHA, Essential amino acids, Essential fatty acids in diet. Water and its significance for human health. Physical and Mental health – Significance of exercise and yoga.		
UNIT-III	**UNHEALTHY PRACTICES AND THEIR IMPACT ON HEALTH**	**9**
Drug induced toxicity, Unhealthy practices - Drug abuse/Narcotics/Smoking/Alcohol/Self-medication/Undue usage of electronic gadgets.		
UNIT-IV	**COMMON DISEASES AND LIFESTYLE DISORDERS**	**9**
Prevention and management of food, water and airborne illness (Common cold, dehydration, food poisoning etc). Lifestyle disorders – obesity, diabetes, stroke, heart attack, ulcer, renal calculi, cancer, AIDS, hepatitis- prevention and management.		
UNIT-V	**DIAGNOSTIC TESTS AND THEIR RELEVENCE**	**9**
Normal range of biochemical parameters, significance of organ function tests, organ donation.		
	Total Contact Hours :	**45**

Course Outcomes:	
On completion of the course, the students will be able to	
•	Classify the living organisms and relate the functions of vital organs.
•	Demonstrate the importance of balanced diet and plan methods for healthy living.
•	Analyze the hazards of unhealthy practices and take preventive measures.
•	Categorize the various life style disorders and recommend ways to manage the common diseases.
•	Evaluate and interpret biochemical parameters and their significance.

Text Books:	
1	Carol D. Tamparo PhD CMA-A (AAMA), Marcia (Marti) A. Lewis EdD RN CMA-AC (AAMA), “Diseases of human body , F.A Davis Company, 2011
2	Textbook of Medical Biochemistry, Chatterjea and Rana shindae Jaypee Brothers Medical Publishers, 2011.

Reference Books	
1	ArthurT.Johnson, “Biology for Engineers”, CRC Press, Taylor and Francis, 2011.
2	Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, “Cell Biology and Genetics”, Cengage Learning, 2008.

Web links for Theory & Lab:	
1	https://nptel.ac.in/courses/122103039/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19301.1	3	1	2	2	2	3	1	1	1	2	1	3	-	-	-
GE19301.2	3	1	2	2	2	3	1	1	1	2	1	3	-	-	-
GE19301.3	3	1	2	2	2	3	1	3	1	2	1	3	-	-	-
GE19301.4	3	1	2	2	2	3	1	1	1	2	1	3	-	-	-
GE19301.5	3	1	2	2	3	3	1	1	1	2	1	3	-	-	-
Average	**3.0**	**1.0**	**2.0**	**2.0**	**2.2**	**3.0**	**1.0**	**1.4**	**1.0**	**2.0**	**1.0**	**3.0**	**-**	**-**	**-**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19441	OPERATING SYSTEMS	PC	3	0	4	5

Objectives:	
●	To study the basic concepts and functions of operating systems.
●	To learn about Processes, Threads, Scheduling algorithms and Deadlocks.
●	To study various Memory Management schemes.
●	To learn I/O Management and File Systems.
●	To learn the basics on Linux, Windows and Android OS.

UNIT-I	INTRODUCTION	9
Operating Systems Overview — OS Structure and Operations –Virtualization - System Calls – Types of System Calls- System Programs-System Boot Process – BIOS – POST- Bootstrap Loader.		
UNIT-II	**PROCESS MANAGEMENT**	**10**
Process Concepts– Process Scheduling - Operations - Interprocess Communication- Threads Overview - CPU Scheduling – FCFS – SJF – Priority – RR – Multilevel Queue Scheduling - Multilevel Feedback Queue - Process Synchronization – Critical Section Problem – Peterson‟s Solution – Synchronization Hardware –Semaphores- Classic Problems of Synchronization – Monitors – Deadlocks –Characterization-Prevention – Avoidance – Detection – Recovery.		
UNIT-III	**MEMORY MANAGEMENT**	**9**
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of a page table – Segmentation - Virtual Memory – Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames – Thrashing.		
UNIT-IV	**I/O MANAGEMENT**	**9**
File System -Concepts - Access Methods- Directory Structure - Mounting - Protection - File System Implementation – Directory Implementation – Allocation Methods – Free-Space Management - Mass Storage Structure - Disk Scheduling - Disk Management - Swap-Space Management.		
UNIT-V	**LINUX, WINDOWS & ANDROID OS**	**8**
The Linux System – Design Principles – Kernel Modules – Memory Management – Windows 10- Overview- Key Components- Android- Architecture - Security Model.		
	Contact Hours :	**45**

List of Experiments			
1	Installation and Configuration of Linux in a Virtual Machine		
2	System monitoring using shell script		
3	Text processing using Awk script		
4	User-defined Signal Handler		
5	Trace system calls with systrace tool		
6	Inter-process Communication using Shared Memory		
7	Scheduling algorithms – FCFS, SJF, Priority and RR		
8	Producer Consumer Problem Solution using Semaphore		
9	Bankers Deadlock Avoidance algorithm		
10	Contiguous Memory Allocation - First Fit and Best Fit		
11	Page Replacement Algorithms - FIFO & LRU		
12	Customization of Linux Kernel		
13	Develop a Simple LKM		
		Contact Hours	**60**
		Total Contact Hours	**105**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the concepts of Operating Systems and its structure.
•	Analyze the various Scheduling algorithms and methods to avoid Deadlock.
•	Compare and contrast various memory management schemes.
•	Mount file systems and evaluate various disk scheduling techniques.
•	Understand the basic principles of Linux, Windows and Android operating systems.

Text Books:	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2	Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android"s Security Architecture",No Starch Press, 2015.

Reference Books:	
1	William Stallings, "Operating Systems – Internals and Design Principles", 9thEdition, Pearson, 2018.
2	Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson, 2016.
3	AchyutGodbole and AtulKahate, "Operating System", 3rd Edition, Tata McGraw Hill, 2017.
4	Pavel Y., Alex I., Mark E., David A., "Windows Internal Part I - System Architecture, Processes, Memory Management and More", 7th Edition, Microsoft Press, 2017.

Web links:	
1	https://www.octawian.ro/fisiere/cursuri/asor/build/html/_downloads/Russinovich_M_WinInternals_part1_7th_ed.pdf
2	https://swayam.gov.in/
3	https://www.youtube.com/watch?time_continue=98&v=xwxgpCKo7c4
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Linux&search_language=English

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19441.1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
CS19441.2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
CS19441.3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
CS19441.4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
CS19441.5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Average	**2.0**	**2.0**	**1.7**	**1.0**	**2.2**	**-**	**1.0**	**1.0**	**1.4**	**2.0**	**2.0**	**2.0**	**2.6**	**2.7**	**1.6**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19442	SOFTWARE ENGINEERING CONCEPTS	PC	3	0	4	5

Objectives:	
•	To apply software engineering theory, principles, emerging tools and processes, to the development and maintenance of complex, scalable software systems.
•	To elicit, analyze and specify software requirements through a productive working relationship with project stakeholders.
•	To design and experiment with various software models and patterns.
•	To apply various testing techniques, skills, and testing tools to build robust software products.
•	To insist the development and sustained use of standards and software metrics for software engineering practices.

UNIT-I	INTRODUCTION	9
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models– The rational unified process-Agile methods- Extreme Programming.		
UNIT-II	**REQUIREMENTS ENGINEERING**	**9**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management.		
UNIT-III	**DESIGN AND CODING**	**9**
System Modeling – Context, Interaction, Structural, and Behavioral - Architectural patterns - Design patterns - Observer – Modeling Data – Data Flow Diagrams and ER Diagram.		
UNIT-IV	**TESTING AND MANAGEMENT**	**9**
Software testing fundamentals-Internal and external views of Testing-white box testing- basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques: Coding Practices-Refactoring.		
UNIT-V	**SOFTWARE MANAGEMENT AND ADVANCE ENGINEERING**	**9**
Software Project Management: Estimation – LOC and FP Based Estimation, Make/Buy Decision, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis– Advance Software Engineering Models.		
	Contact Hours : 45	

	List of Experiments
1	Writing Requirement Specification using IEEE SRS template.
2	Designing Project using AGILE-SCRUM Methodology.
3	Object Oriented design with UML using Argo UML/STAR UML/Rational Rose Modeling Concepts and Diagrams.
4	Use Case Diagrams - Class Diagrams.
5	Interaction Diagrams- State chart Diagrams.
6	Activity Diagrams.
7	Package Diagrams.
8	Component, Deployment.
9	Testing using Selenium/JMeter/Junit.
10	Mini Project-Documentation.
	Contact Hours : 60
	Total Contact Hours : 105

Course Outcomes: On completion of the course, the students will be able to:	
•	Understand the software development process models.
•	Determine the requirements to develop software
•	Apply modeling and modeling languages to design software products
•	Apply various testing techniques and to build a robust software product
•	Manage Software Projects and to understand advanced engineering concepts

Text Book(s):	
1	Ian Sommerville, "Software Engineering", 9th edition, Pearson Education, 2010.
2	Roger S.Pressman, "Software Engineering – A Practitioner"s Approach", 7th edition, 2010.

Reference Books(s) :	
1	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2005.
2	Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, PHI Learning Private Limited, 2009.
3	Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
4	Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
5	Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

Web Link for Virtual Lab	
1.	https://www.nptel.ac.in/courses/106101061/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19442.1	2	2	3	2	2	2	2	2	2	2	3	2	1	3	-
CS19442.2	2	3	1	2	2	1	-	1	1	1	2	-	1	2	-
CS19442.3	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1
CS19442.4	2	2	3	2	2	2	1	0	2	2	2	1	1	2	1
CS19442.5	2	2	2	1	1	1	1	0	2	1	1	1	2	1	-
Average	**2.0**	**2.2**	**2.0**	**1.6**	**1.6**	**1.4**	**1.3**	**1.3**	**1.6**	**1.4**	**1.8**	**1.3**	**1.4**	**2.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19443	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5

Objectives:	
•	To understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
•	To construct simple and moderately advanced database queries using Structured Query Language (SQL).
•	To know the importance of functional dependency and normalization, and what role it plays in the database design process.
•	To familiarize with the concepts of a database transaction including concurrency control, backup and recovery, and data object locking and handling deadlocks.
•	To work with the foundation for NoSQL technologies.

UNIT-I	INTRODUCTION TO DATABASE SYSTEMS	10
Introduction – Purpose of Database Systems - View of Data –Database Architecture - Relational Databases – Database Schema – Keys – Codd‟s Rule – Relational Algebra – Data Models – Entity Relationship Model – Constraints – Entity Relationship Diagram - Design Issues of ER Model – Extended ER Features – Mapping ER Model to Relational Model.		
UNIT-II	**SQL AND QUERY PROCESSING**	**10**
SQL: Data Definition – Domain types – Structure of SQL Queries - Modifications of the database – Set Operations – Aggregate Functions – Null Values – Nested Sub queries – Complex Queries – Views – Joined relations – Complex Queries – PL/SQL: Functions, Procedures, Triggers, Cursors -Embedded SQL – Query Processing – Heuristics for Query Optimization.		
UNIT-III	**DEPENDENCIES AND NORMALFORMS**	**8**
Motivation for Normal Forms – Functional dependencies – Armstrong‟s Axioms for Functional Dependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF.		
UNIT-IV	**TRANSACTIONS**	**7**
Transaction Concept – State – ACID Properties – Concurrency control - Serializability – Recoverability – Locking based protocols –Timestamp Based Protocol - Deadlock handling.		
UNIT-V	**NoSQL DATABASE**	**10**
Introduction to NoSQL - CAP Theorem – Data Models - Key-Value Databases - Document Databases- Column Family Stores – Graph Databases –Working of NoSQL Using MONGODB/CASSANDRA.		
	Contact Hours :	**45**

List of Experiments	
1	Introduction to SQL: DDL, DML, DCL, TCL.SQL clause: SELECT FROM WHERE GROUPBY, HAVING, ORDERBY Using SQLite/MySQL/Oracle SQL clause: SELECT FROM WHERE GROUPBY, HAVING, ORDERBY Using SQLite/MySQL/Oracle
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.
3	Creating an employee database to set various constraints and sub queries.
4	Optimize a SQL query construct considering time complexity.
5	Write a PL/SQL block to specify constraints by accepting input from the user.
6	Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
7	Implementation of PL/SQL Function.
8	Implementation of PL/SQL Cursor.
9	Implementation of PL/SQL Trigger, Packages.
10	Implementation of NoSQL basic commands using Cassandra/Mongo DB.
11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation, Indexes in NoSQL.

13	**MINI PROJECT** Database Connectivity with Front End Tools(Python/C/C++/JAVA)and Back End Tools(MySQL/SQLite/CASSANDRA/MONGO DB) For any problem selected, write the ER Diagram, apply ER mapping rules, normalize the relations, and follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include

	a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System i) Library Management System

	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**105**

Course Outcomes: On completion of the course, the students will be able to:	
•	Understand the use of the Relational model, ER diagrams.
•	Apply SQL Queries to define and manipulate the database.
•	Comprehend the concept of normalization and apply as a case study.
•	Know concurrency control and recovery mechanisms.
•	relate the different models of NoSQL databases.

Text Books:	
1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Seventh Edition, Mc Graw Hill, March 2019.
2	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2013.

Reference Books:	
1	RamezElmasri and Shamkant B. Navathe,Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016.
2	C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.
3	AtulKahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl,”Oracle PL/SQL Programming”, 6th edition, Publisher: O'Reilly, 2014.
5	Kristina Chodorow, Shannon Bradshaw, “MongoDB: The Definitive Guide”, 3rd Edition,O'Reilly Media,2019.

Web Link for Virtual Lab	
1.	https://livesql.oracle.com/apex
2.	https://www.jdoodle.com/online-mongodb-terminal/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19443.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS19443.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS19443.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS19443.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS19443.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	**2.0**	**2.0**	**2.2**	**2.8**	**2.3**	**-**	**-**	**-**	**1.6**	**1.0**	**2.0**	**1.3**	**1.4**	**1.8**	**1.7**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Employability Enhancement Course)	Category	L	T	P	C
GE19421	SOFT SKILLS-I	EEC	0	0	2	1

Description	
•	The course, **"VAP"** intends to enhance the students‟ confidence to communicate in front of an audience effectively.
•	The emphasis is on improving the spoken skills of the students so that they can communicate both, in the college and in the corporate setting to deliver their message successfully
•	In today‟s technology driven world, communicating with confidence is imperative.
•	Hence, this course aims at providing students with the necessary practice in the form of debates, discussions and role plays.

Program Learning Goals :	
•	This program will help our students to build confidence and improve their English communication in order to face the corporate world as well as providing them with opportunities to grow within an organization.

Objectives:	
•	To help students break out of shyness.
•	To build confidence.
•	To enhance English communication skills.
•	To encourage students‟ creative thinking to help them frame their own opinions.

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.
5	Debate	Is competition necessary in regards to the learning process?	The aim of this activity is to develop the student's ability to debate and think out of the box
6	Short Talks	Here the students are given topics for which they take one minute to prepare and two minutes to speak. They can write down points but can't read them out they can only use it as a reference.	The activity aims at breaking the students‟ shyness and encouraging them to standup in front of the class and speak. It also aims at creating awareness that they are restricted for time so they only speak points that are relevant and important.

7	Debate	Will posting students‟ grades on bulletin boards publicly motivate them to perform better or is it humiliating?	This activity aims at enhancing the students unbiased thought process when it comes to exams and grades as well as develop their skills to debate
8	The Art of diplomacy	The facilitator proceeds to share multiple concepts of conversation and helps the participants to identify the various methods of being diplomatic and how do deal with misinformation.	The aim of the lesson is to provide an opportunity for the participants to learn about body language and choosing the appropriate words for conversation.
9	Debate	Are humans too dependent on computers?	The aim of this activity is to test the students debating skills and thought process with a topic that affects everybody in daily life.
10	Story Completion	The teacher starts to tell a story but after 2 sentences he/she asks students to work in groups to create the rest of the story which includes the plot and the ending.	This activity aims at building their narrating skills as well as their creativity and ability to work in a team.
11	Role play debate	Students scrutinize different points of view or perspectives related to an issue. For example, a debate about the question “Should students be required to wear uniforms at school?” might yield a range of opinions. Those might include views expressed by a student (or perhaps two students – one representing each side of the issue), a parent, a school principal, a police officer, a teacher, the owner of a clothing store, and others.	The aim of this activity is to get students to speak based on other people‟s perspective instead of their own. The students take the role of various characters and debate accordingly.
12	I Couldn‟t Disagree More	This is a game where students practice rebuttal techniques where one student provides a thought or an idea and the other students starts with the phrase I couldn‟t disagree more and continues with his opinion	The aim of this activity is to improve general communication skills and confidence.
13	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.
			Total Contact Hours : 30

Course Outcomes: On completion of the course, the students will be able to:	
•	Be more confident.
•	Speak in front of a large audience.
•	Be better creative thinkers.
•	Be spontaneous.
•	Know the importance of communicating in English.

Reference Books(s):	
1.	Kings Learning work sheets.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19421.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
GE19421.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
GE19421.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
GE19421.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
GE19421.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	**2.0**	**2.0**	**2.2**	**2.8**	**2.3**	**-**	**-**	**-**	**1.6**	**1.0**	**2.0**	**1.3**	**1.4**	**1.8**	**1.7**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19501	THEORY OF COMPUTATION	PC	3	0	0	3

Objectives:	
•	To give an overview of the theoretical foundations of computer science from the perspective of formal languages
•	To understand basic concepts of formal languages of automata.
•	To illustrate finite state machines, pushdown automata and Turing machine to solve problems in computing.
•	To familiarize regular grammars and context frees grammars
•	To determine the decidability and intractability of computational problems

UNIT-I	INTRODUCTION TO FINITE AUTOAMTA	9
Introduction to formal proof – Deductive Proof, Reduction to Definitions - Additional forms of proof – Proving equivalence about sets, Contrapositive, Proof by Contradiction, Counterexamples -Inductive Proofs – Induction on Integers - Central Concepts of Finite Automata Theory - Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon transitions – Equivalence of NFA and DFA - Equivalence of NDFA‟s with and without Epsilon moves		
UNIT-II	**REGULAR EXPRESSION AND LANGUAGES**	**9**
Regular expressions - Finite Automata and Regular Expressions - Applications of Regular Expressions - Regular languages - Proving languages not to be regular languages - Closure properties of regular languages - Decision properties of regular languages - Equivalence of Regular Expressions and Finite Automata - Equivalence and minimization of automata - Case Study: JFLAP Tool.		
UNIT-III	**GRAMMARS AND PUSH DOWN AUTOMATA**	**9**
Context-free Grammars – Derivations: Leftmost, Rightmost – Ambiguity, Inherent Ambiguity - Parse Trees, Normal Forms: CNF, GNF - Pushdown Automata - PDA String Acceptance by Empty Stack, and Acceptance by Final State - Equivalence of the Two Methods of PDA Acceptance - Equivalence of PDAs and Context-free Grammars - Closure Properties of Context-free Languages - Pumping Lemma for Context-free Languages		
UNIT-IV	**TURING MACHINES**	**9**
Definition of Turing Machine - Church Turing Thesis – Programming Techniques for Turing Machine Construction - Modifications of the Basic Turing Machine Model - Multi Tape - Non-deterministic Turing Machines - Chomskian hierarchy of languages.		
UNIT-V	**RECURSIVELY ENUMERABLE LANGUAGES AND UNSOLVABLE PROBLEMS**	**9**
Recursive And Recursively Enumerable Languages -Diagonalization Language -Universal Turing Machine - Code for Turing Machine - Halting problem- Post‟s Correspondence Problem –The Classes of P and NP – Problems solvable in Polynomial Time with examples.		
	Total Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
•	Use basic concepts of formal languages of finite automata techniques
•	Design Finite Automata‟s for different Regular Expressions and Languages
•	Construct context free grammar for various languages
•	Solve various problems by applying normal form techniques, push down automata and Turing Machines
•	Determine the decidability and un-decidability problems

Text Books(s):	
1	John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Third Edition, Pearson Education, 2013.
2	John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

Reference Book(s) / Web link(s):	
1	Mishra K L P and Chandrasekaran N, "Theory of Computer Science – Automata, Languages and Computation", Third Edition, Prentice Hall of India, 2006.
2	K.V. N Sunitha and N.Kalyani, "Formal Languages and Automata Theory", Pearson Education India, 2015.
3	Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
4	Peter Linz, "An Introduction to Formal Language and Automata", Sixth Edition, Narosa Jones & Bartlett, 2016.
5	Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CS19501.01	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS19501.02	2	3	1	1	-	-	-	-	-	-	1	-	2	1	-
CS19501.03	2	2	1	-	-	-	-	-	-	-	-	-	2	2	-
CS19501.04	2	3	2	1	-	-	1	-	1	-	1	-	2	2	-
CS19501.05	2	2	2	-	-	1	-	-	-	1	-	-	2	1	2
Average Mapping	**2.0**	**2.4**	**1.5**	**1.0**	**-**	**1.0**	**1.0**	**-**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**1.5**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19541	COMPUTER NETWORKS	PC	3	0	4	5

Objectives:	
•	Understand the concepts of computer networks and error detection-correction of data.
•	Be exposed to various addressing schemes and routing protocols.
•	Learn the Transport Layer, flow control and congestion control algorithms
•	Be familiar with real time applications of networking devices and tools.
•	To configure different devices and trace the flow of information between nodes in the network using various tools

UNIT-I	FUNDAMENTALS AND DATA LINK LAYER	9
Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Application Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detection and Correction - Reliable transmission		
UNIT-II	**MEDIA ACCESS AND INTERNETWORKING**	**9**
Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels.		
UNIT-III	**ROUTING**	**9**
Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM.		
UNIT-IV	**TRANSPORT LAYER**	**9**
Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements.		
UNIT-V	**APPLICATION LAYER**	**9**
E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON.		
	Contact Hours : 45	

List of Experiments	
1	Configuration of Network in Linux Environment
2	Learning and Assignment of IP Address to computers
3	Implementation of Subnet mask in IP addressing
4	Write a socket PING program to test the server connectivity
5	Design, Build & Configure Networks using Cisco Packet Tracer tools
6	Study & implement the different types of Network Cables (RS 232C)
7	Implementation of setup of a Local Area Network (using Switches) – Minimum 3 nodes and Internet
8	Write a socket program Remote Procedure Call using connection oriented / connectionless protocols (programs like echo, chat, file transfer etc)
9	To Identify the various port & its usage using NMAP tool.
10	To capture, save, and analyze network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DNS using Wireshark Tool.
11	Write a code using Raw sockets to implement packet Sniffing
12	Perform a case study using OPNET / NS3 tools about the different routing algorithms to select the Network path with its optimum and economical during data transfer

13	Simulation of Link State routingalgorithm using OPNET or NS3 tool			
14	Simulation of Distance Vector Routingalgorithm OPNET or NS3 tool			
15	To Analyze the different types of servers using Webalizer tool			
		Contact Hours	**:**	**60**
		Total Contact Hours	**:**	**105**

Course Outcomes: On completion of the course, the students will be able to	
•	Choose the required functionality at each layer for given application
•	Trace the flow of information from one node to another node in the network
•	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
•	Monitor the traffic within the network and analyse the transfer of packets.
•	Develop real time applications of networks using different tools

Text Books(s):	
1	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
2	Behrouz A. Forouzan, "Data Communications and Networking", Fifth Edition, McGrawHill, 2017.

Reference Book(s) / Web links:	
1	William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Edition, 2009.
2	James F. Kurose, Keith W. Ross," Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2017.
3	Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall publisher, 2010.
4	William Stallings, "Data and Computer Communications", Eighth Edition, Pearson Education, 2011.
5	Website reference: https://realpython.com/python-sockets/

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CS19541.01	3	2	1	0	3	1	1	1	1	0	1	1	2	1	1
CS19541.02	2	2	1	0	2	1	1	0	0	0	2	2	1	1	1
CS19541.03	3	3	1	0	3	0	1	0	0	0	2	1	2	3	2
CS19541.04	2	3	0	0	3	1	1	1	0	0	2	2	1	2	3
CS19541.05	3	2	2	2	3	0	1	1	0	0	3	3	3	3	3
Average Mapping	**2.6**	**2.4**	**1.3**	**2.0**	**2.8**	**1.0**	**1.0**	**1.0**	**1.0**	**0.0**	**2.0**	**1.8**	**1.8**	**2.0**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19542	INTERNET PROGRAMMING	PC	3	0	4	5

Objectives:	
•	To understand and practice Embedded Dynamic Client-side Scripting
•	To understand Server-side Programming Language
•	To implement manipulation of DOM events.
•	To learn tools and components Bootstrap 4
•	To learn basic architecture of Angular and React

UNIT-I	WWW and JAVASCRIPT	9
WWW: Internet technologies Overview – Internet Standards & Protocols - HTTP. JAVASCRIPT: Introduction to Scripting - Data types and Variables - Operators, Expressions and Statements - Functions - Arrays - Objects - Document Object Model - Event Handling – JSON – AJAX.		
UNIT-II	**SERVLETS, JSP and PHP**	**10**
Servlets: Java Servlet Architecture - Servlet Life Cycle - Form GET and POST actions- Session Handling - Understanding Cookies - Database Connectivity - JDBC. JSP: Understanding Java Server Pages - JSP Standard Tag Library (JSTL) - Creating HTML forms by embedding JSP code – Database Connectivity. PHP: Variables – Conditions, Branches, Loops - Arrays & Strings - Regular Expressions - Date and Time Functions - Integer and Float Functions - User-Defined Functions - Program control - Form Processing - Cookies - Database Connectivity.		
UNIT-III	**JQUERY**	**8**
JQUERY: Introduction to jQuery – Selectors – Elements: Manipulations, Changing and Setting elements – Event Models: Event handlers – Animations & Effects – Functions – Plugins.		
UNIT-IV	**BOOTSTRAP 4**	**9**
Bootstrap Background and Features - Getting Started with Bootstrap - Demystifying Grids - Bootstrap Components – Menus and Navigations - Plugins – Flexbox & Layouts.		
UNIT-V	**ANGULAR 10 and REACT 16**	**9**
ANGULAR 10: TypeScript 3.8 – Node.js 14 - Angular Web Application - Components - Data Binding - Directives - Pipes - Service - Event Binding – Forms. REACT 16: Getting start with React – Working with React.		
	Contact Hours : 45	

List of Experiments	
1	Create a web page to embed a map along with hot spot, frames & links.
2	Create a web page using an embedded, external and inline CSS file.
3	Create an online job registration page along with java script validations.
4	Develop web page for Library Management System using Servlet /JSP and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.
5	Develop web page for Banking Management System using Servlet /JSP and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.
6	Create a program to change the content of the web page using AJAX.
7	Create a program to implement the concepts of AJAX for web page login process.
8	Develop a Simple game using jQuery.
9	Write a PHP program for Employee Details, which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.
10	Create an online application in any of the web application like PHP for Tourism management like the available trip details in season based. Type of mode, Concession details for passengers and Booking / Cancelling tickets.

11	Develop an Attractive web pages using Bootstrap.			
12	Design a Web page with Navigation menu, Inline editor, Order form, Instant Search & Switchable Grid using Bootstrap.			
13	Design a web page application using Angular 9			
14	Design a registration page along with event handling using Angular 9			
15	Design user interface using ReactJS			
16	MINI-PROJECT (Suggested Domains): a) Inventory Control System b) Railway Reservation System c) Library Management System d) Banking System e) Exam Registration f) Stock maintenance system. g) Online course reservation system h) E-ticketing i) Software personnel management system j) Credit card processing k) e-book management system l) Recruitment system m) Foreign trading system n) Student Information System			
		Contact Hours	**:**	**60**
		Total Contact Hours	**:**	**105**

Course Outcomes: On completion of the course, the students will be able to	
•	Design and implement dynamic web page with validation and event handling by applying Java Script.
•	Design and implement Server-side Programming using JSP and Servlet
•	Design and implement client-side webpage using jQuery.
•	Design and implement attractive web page using Bootstrap 4
•	Learn and design web application using Angular and React

Text Books(s):	
1	Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, Fifth Edition, Pearson Education, 2011.
2	Matt Lambert, Learning Bootstrap 4, Second Edition, Packt Publishing, 2016
3	Nate Murray, Felipe Coury, Ari Lerner, and Carlos, ng-book The Complete Guide to Angular, Fullstack.io, 2020
4	Adam Freeman, Pro React 16, Apress, 2019

Reference Book(s) / Web link(s):	
1	Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.
2	Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.
3	Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011
4	UttamK.Roy, “Web Technologies”, Oxford University Press, 2011

Web links for virtual lab:	
1	https://getbootstrap.com/
2	https://angular.io/
3	https://reactjs.org/

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19542.01	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CS19542.02	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CS19542.03	3	3	3	3	3	-	-	2	2	-	2	2	3	3	3
CS19542.04	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CS19542.05	3	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average Mapping	**3**	**3**	**3**	**3**	**3**	**2.0**	**2.0**	**2.0**	**2.3**	**2.0**	**1.8**	**2.4**	**3**	**3**	**2.6**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AI19341	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	PC	3	0	2	4

Objectives:	
•	Understand the various characteristics of a problem solving agent
•	Learn about the different strategies involved in problem solving
•	Learn about solving problems with various constraints.
•	Apply A.I to various applications like expert systems etc.
•	Understand the different models of learning

UNIT-I	Introduction to Artificial intelligence and Problem-Solving Agent	9
Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.		
UNIT-II	**Search techniques**	**9**
Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.		
UNIT-III	**Constraint satisfaction problems and Game Theory**	**9**
Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		
UNIT-IV	**Knowledge & reasoning**	**9**
Statistical Reasoning: Probability and Bays‟ Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.		
UNIT-V	**Introduction to Machine Learning**	**9**
Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.		
	Contact Hours :	**45**

List of Experiments				
1	**Programs on Problem Solving**			
a	Write a program to solve 8 Queens problem.			
b	Solve any problem using depth first search.			
c	Implement MINIMAX algorithm.			
d	Implement A* algorithm			
2	**Programs on Decision Making and Knowledge Representation**			
a	Introduction to PROLOG			
b	Implementation of Unification and Resolution Algorithm.			
c	Implementation of Backward Chaining			
d	Implementation of Forward Chaining			
3	**Programs on Planning and Learning**			
a	Implementation of Blocks World program			
b	Implementing a fuzzy inference system			
c	Implementing Artificial Neural Networks for an application using python			
d	Implementation of Decision Tree			
e	Implementation of K-mean algorithm			
		Contact Hours	:	**30**
		Total Contact Hours	:	**75**

Lab Specifications:

- The lab can be implemented using Python or C.
- Knowledge representation experiments can be performed using a PROLOG TOOL.

Course Outcomes: On completion of the course, the students will be able to	
•	Basic knowledge representation, problem solving, and learning methods of artificial intelligence.
•	Provide the apt agent strategy to solve a given problem
•	Represent a problem using first order and predicate logic
•	Design applications like expert systems and chat-bot.
•	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

Text Books(s):	
1	S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2015.
2	Nils J. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978- 1558605350.

Reference Book(s) / Web link(s):	
1	Elaine Rich, Kevin Knight, &Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2017.
2	Introduction to Artificial Intelligence & Expert Systems, Patterson, Pearson, 1st ed. 2015
3	Logic & Prolog Programming, Saroj Kaushik, New Age International, Ist edition, 2002.
4	Expert Systems: Principles and Programming,11 March 1998. Edition: 4th. ISBN: 9788131501672

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
AI19341.01	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.02	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.03	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.04	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.05	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average Mapping	**2.4**	**2.4**	**1.25**	**2.0**	**2.4**	**1.5**	**1.2**	**1.3**	**1.0**	**-**	**2.4**	**1.8**	**2.0**	**2.0**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Employability Enhancement Courses)	Category	L	T	P	C
GE19521	SOFT SKILLS - II	EEC	0	0	2	1

Objectives:	
•	To help students break out of shyness.
•	To build confidence.
•	To enhance English communication skills.
•	To encourage students‟ creative thinking to help them frame their own opinions.

Week	Activity Name	Description	Objective
1	The News hour	Students are made to read news articles from the English newspapers. The students also have to find words and their meaning from the article they have not come across before and share it with the group. They then use these words in sentences of their own	The aim of this activity is not only to get the students to read the newspaper but also aims at enhancing the students‟ vocabulary.
2	Court Case	The facilitator provides the participants the premise of a story and proceeds to convert the story into a court case. The students are required, department-wise to debate and provide their points to win the case for their clients.	The aim of the lesson is to encourage creative and out-of-the-box thinking to ensure a good debate and defense skills.
3	The ultimate weekend	The students design activities they are going to do over the weekend and they have to invite their classmates to join in the activity. The students move around the class and talk to other students and invite them.	The aim of this activity is to develop the art of conversation among students. It also aims at practicing the grammatical structures of “going to” “have to” and asking questions.
4	The Four Corners	This is a debate game that uses four corners of the classroom to get students moving. The following is written on the 4 corners of the room “Strongly Agree, Somewhat Agree, Somewhat Disagree and Strongly Disagree”. The topics are then given to the class and students move to the corner that they feel best explains their opinions	This activity aims at getting students to come up with their own opinions and stand by it instead of being overshadowed by others and forcing themselves to change based on others opinions.
5	Debate	Boarding school or day school? Which is more beneficial for a student?	The aim of this activity is to encourage students to draw up feasible points on the advantages and benefits of both. And enhance their debating ability
6	Grand Master	The facilitator starts the session by keeping an individual in mind, upon which the students guess it only through "Yes or No" questions. Post few trials the students are given same opportunity to do the same with the crowd.	The aim of the lesson is designed to teach the art of questioning. It also helps to enhance the students' speaking and listening skills.
7	Debate	Does violence on the TV and Video games influence children negatively?	This activity aims at encouraging the students to debate on real life scenarios that most students spend a lot of time on.
8	Turn Tables	This is a speaking activity where the students need to speak for and against the given topics when the facilitator shouts out 'Turn Table'.	The aim of this activity is to make the participants become spontaneous and have good presence of mind.
9	Debate	Do marks define the capabilities of a student?	This debate activity aims at allowing the students to argue on this worrisome adage of marks.

10	FictionAD	The Participants are asked to create an Ad for a challenging topic only using fictional characters.	The activity aims at developing their creativity and presentation skills.
11	Debate	Are social networking sites effective, or are they just a sophisticated means for stalking people?	This activity aims at refining the students debating skills on a very real life situation
12	Talent Hunt	Talent Hunt is a fun activity where the students are selected at random and supported to present any of their own skills.	The aim of this activity is designed to evoke their inner talents and break the shyness and the fear of participating in front of a crowd
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits.	The aim is to do both give feedback to students as well as obtain feedback on the course from them.
		Contact Hours :	**30**

Course Outcomes: On completion of the course, the students will be able to	
•	Be more confident
•	Speak in front of a large audience without hesitation
•	Think creatively
•	Speak impromptu
•	Communicate in English

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19521.1	-	-	-	-	-	-	-	-	2	3	1	1	-	-	2
GE19521.2	-	-	-	-	-	-	-	-	2	3	2	-	-	-	2
GE19521.3	-	1	-	-	-	-	-	-	2	3	1	1	-	1	2
GE19521.4	-	-	-	-	-	-	-	-	2	3	-	-	-	-	1
GE19521.5	-	1	-	-	-	-	-	-	2	3	1	1	-	1	3
Average Mapping	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1.25**	**1**	**-**	**1**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19601	FUNDAMENTALS OF MOBILE COMPUTING	PC	3	0	0	3

Objectives:	
•	To learn about the principles, characteristics, trends, latest development, systems issues in mobile technology
•	To understand the fundamentals of mobile computing
•	To infer knowledge about the various technologies used in mobile computing
•	To be familiar with wireless technologies and learn about development environment used in Mobile devices
•	To gain knowledge about different mobile platforms and application development

UNIT-I	INTRODUCTION	9
Mobility of bits and bytes - Beginning of wireless – Technology 1G to 5G- Mobile computing - Dialogue control, Networks - Middleware and Gateways - Application and services - Developing mobile computing applications - Security in mobile computing - Architecture for Mobile computing - Mobile computing through internet.		
UNIT-II	**WIRELESS TECHNOLOGIES**	**8**
Bluetooth – RFID – WIMAX – Mobile IP – IPV6 – GSM – Architecture – Call routing – Mobile Computing over SMS – GPRS – GPRS network architecture - Applications of GPRS – Introduction to WAP.		
UNIT-III	**WIRELESS LAN AND INTERNETWORKING**	**10**
Wireless LAN – Advantages - IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in Wireless LAN - Deploying Wireless LAN - Mobile Ad hoc and Sensor network – Wireless LAN security – WIFI versus 3G - Intelligence in the Networks – SS#7 Signaling – IN Conceptual model – softswitch – Programmable networks – Virtual Private Network(VPN).		
UNIT-IV	**CLIENT PROGRAMMING AND OS**	**9**
Client Programming – Introduction – Hardware Overview – Mobile Phones -PDA – Recent Developments in Client Technologies – Palm OS Architecture – Application Development – Symbian OS Architecture – Application for Symbian.		
UNIT-V	**APPLICATIONS**	**9**
Voice Over IP – H.323 framework – Session Initiation Protocol (SIP) – Real time protocols – Voice Over applications – IP Multimedia Systems (IMS) – Networked Multimedia Applications – Next generation networks		
	Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
•	Discover the characteristics of mobile computing applications including the major system components
•	To explore the working model and characteristics of mobile computing
•	To propose solutions with comparisons for problems related to mobile computing system through system investigations
•	To identify the use of wireless technologies in appropriate applications
•	Develop a mobile application using mobile technologies

Text Books(s):	
1	AsokeTalukder, Hasan Ahmed and Roopa R yavagal “Mobile computing Technology, Application and service creation”, Second edition, McGraw Hill, 2010
2	Jochen Schiller, “Mobile Communications”, Second Edition, Pearson, 2004

Reference Book(s) / Web link(s):	
1	Frank Adelstein, Sandeep KS Gupta, Golden Richard, Loren Schwiebert, “Fundamentals of Mobile and pervasive computing”, McGraw-Hill professional engineering,2005
2	Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi, 2012
3	“Beginning for Android 4 Application Development “, Wei Meng Lee, Wiley –India Edition, 2012

CO - PO – PSO matrices of course

PO/PSO / CO	P O1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19601.01	3	2	0	0	1	2	2	2	2	1	0	1	2	1	1
CS19601.02	2	2	0	0	1	1	2	1	2	0	0	2	1	1	1
CS19601.03	2	2	0	0	2	1	1	2	2	0	0	1	1	2	1
CS19601.04	1	1	0	0	1	1	3	2	3	1	0	1	2	2	2
CS19601.05	3	2	0	0	2	1	2	1	3	1	0	2	3	3	3
Average Mapping	**2.2**	**1.8**	**-**	**-**	**1.4**	**1.2**	**2.0**	**1.6**	**2.4**	**1.0**	**-**	**1.4**	**1.8**	**1.8**	**1.6**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
BA19602	FUNDAMENTALS OF ACCOUNTING	HS	3	0	0	3

Objectives:	
•	To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.
•	To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.
•	To create awareness about cost accounting, different types of costing and cost management.
•	Understand how financial statement information can help solve business problems and increase the ability to read and understand financial statements and related information

UNIT-I	ACCOUNTING CONCEPT		9
Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.			
UNIT-II	**ACCOUNTING PROCESS**		**9**
Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format- Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue			
UNIT-III	**FINANCIAL STATEMENTS**		**9**
Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam			
UNIT-IV	**CASH FLOW AND FUND FLOW TECHNIQUES**		**9**
Introduction, How to prepare – Cash flow and Fund flow, Difference between them.			
UNIT-V	**COSTING SYSTEMS**		**9**
Elements of Cost, Cost Behavior, Cost Allocation, Overhead Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis. Class Discussion: Application of costing concepts in the Service Sector.			
	Contact Hours	**:**	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Understand the theories, concept, and evolution of management.
●	Demonstrate the ability to employ the management way of thinking.
●	Understand how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc.
●	Understand the qualities of a leader in the managerial aspect in future terms.
●	Understand the managerial ethics and CSR and its importance.

Text Book (s):	
1	Robert N Anthony, David Hawkins, Kenneth Marchant, "Accounting: Texts and Cases", Thirteenth Edition, McGraw-Hill, 2017.
2	M.Y.Khan&P.K.Jain, "Management Accounting", Tata McGraw Hill, 2011.
3	R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi, 2011.

Reference Books(s) :	
1	Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", Fifteenth Edition, Tata McGraw Hill Publishers, 2010.
2	Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting", Sixteenth Edition, PHI Learning, 2014.
3	Stice&Stice," Financial Accounting Reporting and Analysis",Eight Edition, Cengage Learning, 2010.
4	SinghviBodhanwala, "Management Accounting -Text and cases", Third Edition, PHI Learning, 2018.
5	Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2009.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BA19602.01	2	1	2	1	2	3	2	2	-	-	2	2	-	-	-
BA19602.02	2	1	2	2	2	3	3	3	-	-	2	2	-	-	-
BA19602.03	2	1	2	3	2	3	2	2	-	-	2	2	-	-	-
BA19602.04	2	1	2	3	2	3	1	1	-	-	2	2	-	-	-
BA19602.05	2	1	2	3	2	3	2	2	-	-	2	2	-	-	-
Average Mapping	**2**	**1**	**2**	**2.4**	**2**	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CS19641	COMPILER DESIGN	PC	3	0	2	4

Objectives:	
•	Learn the various phases of a Compiler.
•	Demonstrate the compiler construction tools..
•	Analyze the various parsing techniques and different levels of translation.
•	Understand intermediate code generation and run-time environment.
•	Learn how to optimize and effectively incorporate in machine code generation.

UNIT-I	INTRODUCTION TO COMPILERS	5
Translators-Compilation and Interpretation-Language processors-The Structure of a Compiler-Compiler Construction Tools-Evolution of Programming Languages-Programming Language basics.		
UNIT-II	**LEXICAL ANALYSIS**	**9**
Role of the Lexical Analyzer-Input Buffering – Specification of Tokens – Recognition of Tokens - Finite Automata–NFA–DFA - Converting Regular Expression to Automata- Design of a Lexical Analyzer Generator-LEX..		
UNIT-III	**SYNTAX ANALYSIS**	**12**
Role of the Parser-Context Free Grammars–Ambiguity–Left Recursion-Left Factoring-Top Down Parsing–Recursive Descent Parsing-LL(1)Grammars-Non recursive Predictive Parsing-Error Recovery in Predictive Parsing-Bottom up Parsing-Shift Reduce Parsing-LR Parsing-SLR-Canonical LR-LALR Parser-YACC..		
UNIT-IV	**INTERMEDIATE CODE GENERATION**	**10**
Syntax directed Definitions-Construction of Syntax Tree- DAG - Three Address Code –Types and declarations–ControlFlow - Backpatching. Storage Organization-Stack allocation of space- Heap Management.		
UNIT-V	**CODE OPTIMIZATION AND CODE GENERATION**	**9**
Basic Blocks and Flow graphs- Optimization of Basic Blocks- Peephole Optimization-Principal sources of Optimization-Global Data Flow Analysis-Code Generation-Issues in Design of a Code Generator-A Simple Code Generator Algorithm.		
	Contact Hours : 45	

List of Experiments				
1	Develop a lexical analyzer to recognize tokens in C. (Ex. identifiers, constants, operators, keywords etc.).			
2	Design a Desk Calculator using LEX.			
3	Recognize an arithmetic expression using LEX and YACC.			
4	Evaluate expression that takes digits, *, + using YACC.			
5	Generate Three address codes for a given expression (arithmetic expression, flow of control).			
6	Implement Code Optimization Techniques like copy propagation, dead code elimination, Common sub expression elimination..			
7	Generate Target Code (Assembly language) for the given set of Three Address Code.			
	Contact Hours	**:**	**30**	
	Total Contact Hours	**:**	**75**	

Course Outcomes: On completion of the course, the students will be able to	
•	Demonstrate the functioning of a Compiler.
•	Analyse the local and global impact of translators.
•	Develop language specifications using context free grammars (CFG).
•	Apply the various optimization techniques.
•	Generate a target code.

Text Book(s):	
1	Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, Second Edition, Pearson Education, 2007.

Reference Book(s) / Web link(s):	
1	Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", First Edition, Morgan Kaufmann Publishers, 2002.
2	Steven S. Muchnick, "Advanced Compiler Design and Implementation", First Edition, Morgan Kaufmann publishers, 2003.
3	D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, "Modern Compiler Design", Wiley, 2008
4	Allen I. Holub, "Compiler Design in C", Prentice Hall of India, 2003.

CO - PO – PSO matrices of course

PO/PSO / CO	P O1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19641.01	-	-	1	-	1	-	-	-	-	-	-	-	1	-	-
CS19641.02	-	-	2	-	2	-	-	-	-	-	-	-	2	-	-
CS19641.03	-	-	2	-	2	-	-	-	-	-	-	-	2	-	-
CS19641.04	-	-	2	-	2	-	-	-	-	-	-	-	2	-	-
CS19641.05	-	-	3	-	2	-	-	-	-	-	-	-	2	-	-
Average Mapping	-	-	2.0	-	1.8	-	-	-	-	-	-	-	1.8	-	-

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19642	CRYPTOGRAPHY AND NETWORK SECURITY	PC	2	0	2	3

Objectives:	
•	Learn basics of encryption and Number Theory.
•	Understand the methods of public key encryption.
•	Acquire knowledge of hash functions and digital signatures.
•	Apply techniques of system level securities.
•	Know the current trends in e-mail, IP and web security

UNIT-I	INTRODUCTION & NUMBER THEORY	6
OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography)-Number Theory: Modular arithmetic- Euclid‟s algorithm-Fermat‟s and Euler‟s theorem -The Chinese Remainder theorem		
UNIT-II	**BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY**	**6**
Data Encryption Standard (DES)-Advanced Encryption Standard (AES)-Triple DES. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key Management-Attacks on RSA - Diffie-Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography		
UNIT-III	**HASH FUNCTIONS AND DIGITAL SIGNATURES**	**6**
Authentication requirement – MAC – Hash function – MD5 - SHA - HMAC - Merkle Hash Tree–-Digital signature and authentication protocols – DSS		
UNIT-IV	**SECURITY PRACTICE & SYSTEM SECURITY**	**6**
Kerberos – Firewall types and design - Intrusion detection system – Malicious software - Antivirus: introduction - signatures Case Study: - 3D-Secure		
UNIT-V	**E-MAIL, IP & WEB SECURITY**	**6**
E-mail Security: Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP) Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication. Case Study: Privacy and Security of Aadhar		
	Contact Hours :	**30**

LIST OF EXPERIMENTS				
1.	Implement the following substitution and transposition techniques: a) Caesar Cipher b) Playfair Cipher c) Rail Fence – Row & Column Transformation			
2.	Implement the following algorithms: a) RSA Algorithm b) Diffie-Hellman Key Exchange			
3.	Implement the Digital Signature Algorithm (DSA).			
4.	Implement a Keylogger to record the keystrokes.			
5.	Perform Code injection in running processes using ptrace.			
6.	Perform wireless audit on an access point or a router and decrypt WPA keys (aircrack-ng)			
7.	Demonstrate Intrusion Detection System using any tool (snort or any other equivalent s/w)			
8.	Demonstrate various exploits of Windows OS using Metasploit framework.			
9.	Install and Configure Firewalls for a variety of options (iptables or pfsense)			
10.	Demonstrate a simple MITM attack (ettercap)			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Grasp concepts in classical encryption techniques and number theory
•	Thoroughly understand Public Key Encryption and apply to real-world applications
•	Apply hashing algorithms and digital signatures.
•	Comprehend system level securities.
•	Perceiving the best in email, IP and Web Security.

Text Books(s):	
1	William Stallings, “Cryptography and Network Security-Principles and Practices”, Seventh Edition, Pearson Education, 2017
2	Christo Paar and Jan Pelzl, “Understanding Cryptography: A Textbook for Students and Practitioners”, First Edition, Springer, 2010

Reference Books(s) / Web links:	
1	JoxeanKoret and Elias Bachaalany,” The Antivirus Hackers Handbook”, First Edition, Wiley, 2015
2	Douglas R. Stinson,” Cryptography: Theory and Practice”, Third Edition, by, CRC Press, Taylor and Francis Group (Indian Edition),2006
3	https://blockonomi.com/merkle-tree/
4	https://www.educba.com/md5-alogrithm/
5	https://www.iusmentis.com/technology/hashfunctions/md5/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19642.01	3	3	1	2	0	2	0	0	1	0	0	3	2	2	2
CS19642.02	3	3	2	1	0	0	0	0	1	0	0	3	2	2	2
CS19642.03	3	3	2	2	2	0	0	2	0	0	0	3	1	1	2
CS19642.04	0	1	2	2	2	0	0	0	2	0	0	3	1	1	2
CS19642.05	0	2	2	2	2	0	0	0	2	1	0	3	1	1	2
Average Mapping	**3.0**	**2.4**	**1.8**	**1.8**	**2.0**	**2.0**	**-**	**2.0**	**1.5**	**1.0**	**-**	**3.0**	**1.4**	**1.4**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19643	FOUNDATIONS OF MACHINE LEARNING	PC	3	0	2	4

Objectives:	
•	Have a thorough understanding of the Supervised learning techniques
•	Study the various probability-based learning techniques
•	Know the basic concepts of decision tree and unsupervised models
•	Familiarize the basic concepts of neural networks.
•	Understand the working of graphical models of machine learning algorithms.

UNIT-I	INTRODUCTION AND REGRESSION MODELS	9
The Machine Learning Landscape – Types of Machine Learning – Main Challenges of Machine Learning – Testing and Validating – End to End Machine Learning Project – Regression: Linear Regression – Training Models - Polynomial Regression – Other Regression Models: Lasso, Ridge regression, ElasticNet - Logistic Regression.		
UNIT-II	**LINEAR MODELS**	**9**
Revisiting Core ML concept: Bias-variance trade-off. Classification using support vectors: – Linear SVM classification – Nonlinear SVM classification. Probabilistic classifier: Classification using Naïve Bayes. Decision trees: Training and Visualizing a Decision Tree - Making Predictions - Estimating Class Probabilities - The CART Training Algorithm - Computational Complexity - Gini Impurity or Entropy - Regularization Hyperparameters.		
UNIT-III	**UNSUPERVISED LEARNING AND TREE MODELS**	**9**
Unsupervised Learning Techniques: Clustering: K-Means - Limits of K-Means - Using Clustering for Image Segmentation - Using Clustering for Pre-processing - Using Clustering for Semi-Supervised Learning - DBSCAN - Other Clustering Algorithms. Ensemble learning and Random Forests: Voting Classifiers - Bagging and Pasting - Random Forests - Extra-Trees - Feature Importance – Boosting AdaBoost - Gradient Boosting		
UNIT-IV	**INTRODUCTION TO NEURAL NETWORKS**	**11**
Introduction to Artificial Neural Networks with Keras - Biological Neurons - Logical Computations with Neurons - The Perceptron - The Multilayer Perceptron and Backpropagation Regression MLPs - Classification MLPs - Fine-Tuning Neural Network Hyperparameters - Number of Hidden Layers - Number of Neurons per Hidden Layer - Learning Rate, Batch Size, and Other Hyperparameters		
UNIT-V	**FEATURE TRANSFORMATION**	**7**
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis		
	Contact Hours : 45	

List of Experiments				
1	A python program to perform pre-processing on tabular, text and Image data.			
2	A python program to do a data exploratory analysis to develop deep insights from a dataset.			
3	A python program to implement linear and polynomial regression.			
4	A python program to implement logistic regression algorithm.			
5	A python program to implement decision tree and Random forest algorithms.			
6	A python program to implement Naïve Bayes classification algorithm.			
7	A python program to analyze the difference in accuracy between perceptron vs logistic Regression.			
8	A python program perform Face Recognition using Support Vector Machines.			
9	A python program to implement neural networks.			
10	A mini project implementing the techniques learnt for a socially relevant problem statement.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**75**

Course Outcomes: On completion of the course, the students will be able to	
•	Distinguish between, supervised, unsupervised and semi-supervised learning.
•	Modify existing machine learning algorithms to improve classification efficiency.
•	Use unsupervised models for clustering data.
•	Build a basic neural network for real-time data.
•	Design systems that uses the appropriate graph models of machine learning.

Text Book(s):	
1	AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition. September 2019, O'Reilly Media, Inc., ISBN: 9781492032649.
2	Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3	Richard O.Duda, Peter E. Hard, David G. Stork, Pattern Recognition, 2ed, An Indian Adaptation, Wiley, May 2021

Reference Book(s)/Web link(s)	
1	Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
2	Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.
3	Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning (ESL)", 2nd edition, Springer, 2016. ISBN 978-0387848570.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19643.01	3	3	1	0	2	1	1	1	1	0	2	1	2	1	1
CS19643.02	2	2	1	0	2	1	2	0	0	0	2	2	1	1	1
CS19643.03	3	3	1	0	3	0	1	0	0	0	3	1	2	3	2
CS19643.04	2	3	0	0	2	1	1	1	0	0	2	2	2	2	3
CS19643.05	2	2	2	2	3	0	1	2	0	0	3	3	3	3	3
Average Mapping	**2.4**	**2.6**	**1.25**	**2.0**	**2.4**	**1.0**	**1.2**	**1.3**	**1.0**	**0.0**	**2.4**	**1.8**	**2.0**	**2.0**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
CS19611	MOBILE APPLICATION DEVELOPMENT LABORA TORY	PC	0	0	4	2

Objectives:	
•	To know the components and structure of mobile application development frameworks for android and windows OS-based mobiles.
•	To understand how to work with various mobile application development frameworks.
•	To learn the basic and important design concepts and issues of development of mobile applications.
•	To understand the capabilities and limitations of mobile devices.
•	To understand the working principle of Internal and External storage.

List of Experiments	
1	Develop an application to change the font and color of the text and display toast message when the user presses the button
2	Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [Your scientific calculator should contain +, *, /, =, cos, sin, tan, pow, sqrt, log, lan and mod].
3	Develop an android application to draw the circle, ellipse, rectangle and some text using Android Graphical primitives.
4	Develop an android application to create Two activity named as Student Basic Details (name, age, address) and Student Mark (Marks, Total, Grade, Status). Write an android code to combine these two activities in single screen using android fragment
5	Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop an android application to perform the following operation using SQLite developer classes. 1. Insert student Details 2. Update the student Record 3. Delete a specified record. View the details.
6	Design an android activity with two text boxes where the user can enter (username and ID) and a button (validate). Validate the entered username and ID field for the following using android code. i) Both the fields should not be empty, ii) Name field should have alphabets, iii) ID field should have numeric values (only 4-digit).
7	Develop an application to get the Latitude, Longitudes of the current location using android Location Manager and also convert the Latitude/Longitude to address format using Geocoder Class.
8	Implement an application to write the name and marks to SD card in text file format.
9	Implement an application to display the alert box message when your application receives the SMS.
10	Write a mobile application to set the alarm using android Alarm Manager class and also snooze the alarm after every 10 minutes.
11	Develop an android application to display the information of the telephony services after 30s after a button click using Thread.
12	Develop an application to display the cricket scores of the ICC world cup match. Your application should update the scores automatically. Use RSS feed to implement this application.
13	Develop an application to send/receive SMS and Email.
14	Develop an android application to perform the following i). Text to Speech ii). Speech to Text
15	Develop an android application to capture image using camera and displaying the image using imageview.
	Contact Hours : 60

Course Outcomes: On completion of the course, the students will be able to	
•	Learn the components of mobile application development.
•	Gain the knowledge of how to work with various mobile application development frameworks.
•	Acquire the basic and important design concepts and issues of development of mobile applications.
•	Deploy applications to the hand held devices.
•	Develop the mobile applications using Internal and External databases.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:	
1	**Hardware**: Standalone desktops with windows or Android or iOS or Equivalent Mobile Application Development.
2	**Software**: Tools with appropriate emulators and debuggers.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19611.01	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CS19611.02	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CS19611.03	3	3	3	3	3	-	-	2	2	-	2	2	3	2	3
CS19611.04	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CS19611.05	2	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average Mapping	**2.8**	**3**	**3**	**3**	**3**	**3.0**	**2.0**	**2.0**	**2.3**	**2.0**	**1.8**	**2.4**	**3**	**2.8**	**2.6**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
GE19612	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	PE	0	0	6	3

Objectives:	
•	To empower students with overall Professional and Technical skills required to solve a real world problem.
•	To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
•	To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

This course is a four months immersive program to keep up with the industry demand and to have critical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. **This is an EEC category course offered as an elective, under the type, "Experiential Project Based Learning".**

Highlights of this course:

1. Students undergo training on emerging technologies
2. Students develop solutions for real-world use cases
3. Students work with mentors to learn and use industry best practices
4. Students access and use Self-Learning courses on various technologies, approaches and methodologies.
5. Collaborate in teams with other students working on the same topic
6. Have a dedicated mentor to guide
7.

The course will involve 40-50 hours of technical training, and 40-50 hours of project development.

Course Outcomes: On completion of the course, the students will be able to	
•	Upskill in emerging technologies and apply to real industry-level use cases
•	Understand agile development proces
•	Develop career readiness competencies, Team Skills / Leadership qualities
•	Develop Time management, Project management skills and Communication Skills
•	Use Critical Thinking for Innovative Problem Solving and develop entrepreneurship skills

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP			
Technical Skills		Soft Skills	
Criteria	Weightage	Criteria	Weightage
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10

Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solution	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	70	Total	30
Total Weightage			100
Passing Requirement			50
Continuous Assessment Only			

The passing requirement for the courses of the type „Experiential Project Based Learning" falling under the category of EEC is 50% of the continuous assessment marks only.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19612.1	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
GE19612.2	3.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
GE19612.3	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
GE19612.4	3.00	3.00	3.00	3.00	3.00	3.00	1.00	1.00	1.00	2.00	2.00	3.00	3.00	3.00	3.00
GE19612.5	3.00	3.00	3.00	3.00	3.00	3.00	1.00	1.00	1.00	3.00	3.00	3.00	3.00	3.00	3.00
Average Mapping	3.00	3.00	3.00	3.00	2.80	2.80	2.00	2.00	2.00	2.60	2.60	2.80	2.80	2.80	2.80

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Employability Enhancement Courses)	Category	L	T	P	C
GE19621	PROBLEM SOLVING TECHNIQUES	EEC	0	0	2	1

Objectives:	
•	To improve the numerical ability
•	To improve problem-solving skills.

Topics				
1	Numbers system			
2	Reading comprehension			
3	Data arrangements and Blood relations			
4	Time and Work			
5	Sentence correction			
6	Coding & Decoding, Series, Analogy, Odd man out and Visual reasoning			
7	Percentages, Simple interest and Compound interest			
8	Sentence completion and Para-jumbles			
9	Profit and Loss, Partnerships and Averages			
10	Permutation, Combination and Probability			
11	Data interpretation and Data sufficiency			
12	Logarithms, Progressions, Geometry and Quadratic equations.			
13	Time, Speed and Distance			
		Total Contact Hours	**:**	**30**

Course Outcomes: On completion of the course, the students will be able to	
•	Have mental alertness
•	Have numerical ability
•	Solve quantitative aptitude problems with more confident

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE19621.1	2	2	2	2	1	1	-	-	-	-	1	1	2	2	2
GE19621.2	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
GE19621.3	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
Average Mapping	**2.67**	**2.67**	**2**	**2.67**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19721	BLOCK CHAIN FUNDAMENTALS	PC	1	0	0	1

Objectives:	
•	To study about the structure of blockchain and create simple blockchain
•	To learn about the various types of blockchain
•	To study various consensus mechanisms used in blockchain
•	To get insight into the major cryptocurrencies that are based on blockchain
•	To know about industry use case for blockchain in various domains

UNIT-I	INTRODUCTION	3
Structure of a Block – Block Header – The Genesis Block – Linking Blocks in the Blockchain – Merkle Trees – Simple Blockchain		
UNIT-II	**BLOCK CHAIN TYPES**	**3**
Public Blockchain – Private Blockchain – Semi-private Blockchain – Sidechains – Permissioned ledger – Distributed ledger – Shared ledger – Fully private and proprietary Blockchains – Tokenized Blockchains – TokenlessBlockchain.		
UNIT-III	**CONSENSUS IN BLOCK CHAIN**	**3**
Proof of Work – Proof of Stake – Delegated Proof of Stake – Proof of Elapsed Time – Deposit-based consensus – Proof of importance – Federated consensus – Reputation-based mechanisms – Practical Byzantine Fault Tolerance		
UNIT-IV	**CRYPTOCURRENCIES**	**3**
Bitcoin - Overview- Transactions- Mining – Ethereum - Overview -Transactions – Ethereum Virtual Machine		
UNIT-V	**BLOCK CHAIN USE CASE**	**3**
Supply Chain Management – Healthcare Record Management – Digital Identity– Finance and Insurance		
	Contact Hours : 15	

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the blockchain concepts and create a simple application of blockchain
•	Analyze different types of blockchain
•	Compare and contrast the various consensus mechanism
•	Analyze and choose the best cryptocurrency for their use case
•	Understand and apply the various industry use cases of blockchain

Text Books(s):	
1	Imran Bashir," Mastering Blockchain", Second Edition, Packt, 2018.

Reference Book(s)/Web link(s):	
1	Manas Gupta, "Blockchain for Dummies", Limited Edition, IBM, 2017.
2	Andreas M. Antonopoulos, "Mastering Bitcoin", Second Edition, O"Reilly, 2017
3	Chris Dannen," Introducing Ethereum and Solidity", First Edition, Apress, 2017
4	https://www.blockchain-council.org/wp-content/uploads/2020/02/Blockchain-For-Beginners-Study-Guide-1.pdf
5	https://www.ibm.com/blockchain/use-cases/
6	https://consensys.net/blockchain-use-cases/

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19721.01	2	1	1	-	2	-	-	-	2	2	2	2	2	1	1
CS19721.02	2	1	1	1	2	-	-	-	2	1	2	2	3	2	2
CS19721.03	2	2	1	1	2	-	-	-	2	1	2	2	2	2	2
CS19721.04	2	2	1	-	2	-	-	-	2	1	2	2	3	2	1
CS19721.05	2	1	2	2	1	-	-	-	3	2	2	2	3	3	1
Average Mapping	**2**	**1.4**	**1.2**	**1.3**	**1.8**	**-**	**-**	**-**	**2.2**	**1.4**	**2**	**2**	**2.6**	**2**	**1.4**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19741	CLOUD COMPUTING	PC	2	0	2	3

Objectives:	
•	To learn the fundamentals of Cloud Computing and designing Private Cloud and Public Cloud Environment.
•	To learn the basic ideas and principles of Virtualization Technology.
•	To learn the dynamic programming models for Cloud.
•	To gain knowledge on various cloud components mechanism for data center design and management.
•	To learn the security and Advanced Cloud Concepts.

UNIT-I	INTRODUCTION		6
Basic Concepts and Terminology-Roles and Boundaries-Cloud Characteristics-Cloud Delivery Model and Deployment Model. Case study design and implementation of public and private cloud- Open stack, AWS/Google/Oracle			
UNIT-II	**VIRTUALIZATION TECHNOLOGY**		**6**
Broadband Networks and Internet Architecture-Data Center Technology-Virtualization Technology. Case Study: VMware, Xen, KVM, Docker Container.			
UNIT-III	**DISTRIBUTED DYNAMIC PROGRAMMING MODEL**		**6**
Design of HDFS, Concepts and Java Interface, Dataflow of File read & File write, Map Reduce, Input splitting, map and reduce functions. Case Study: Design and Implementation of Hive, Pig, HBase.			
UNIT-IV	**CLOUD COMPONENTS MECHANISM**		**6**
Cloud Infrastructure Mechanism: Cloud Storage and Usage Monitor, Resource Replication-Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource cluster, Multi Device Broker, State Management Database.			
UNIT-V	**SECURITY AND ADVANCED CLOUD CONCEPTS**		**6**
Cloud Security Thread-Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Mobile Cloud Computing, Edge and Fog Computing.			
	Contact Hours	**:**	**30**

List of Experiments	
1.	**Virtualization**
a	Find procedure to run the virtual machine of different configuration using virt-manager.
b	Virtualize a machine and check how many virtual machine can be utilized at a particular time.
c	Create a VM clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.
2	**Public Cloud**
a	Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.
b	Test how a SaaS applications scales in response to demand.
c	Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.
3	**Private Cloud**
a	Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.
b	Perform Creation, Management and Termination of a CirrOS instance in OPENSTACK.
c	Show the virtual machine migration based on certain conditions from one node to the other.

4	**Hadoop - Map Reduce**			
a	Setup a Single Node Hadoop cluster and show all the process through WEB UI.			
b	Demonstrate the MAP REDUCE programming model by counting the number of words in a file. Implement the procedure to interact with Hadoop API for Accessing HDFS from local file system.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Demonstrate the cloud, its characteristics, various delivery and deployment models.
•	The strength of virtualization and outline its role in enabling the cloud computing system mode
•	Recognize the scope of distributed file systems in cloud and their applications in industry.
•	The fundamental cloud components mechanismwith which cloud data centers are managed and administered
•	Analyse the core issue of cloud such as security. Provide an insight into future prospects of computing in the cloud.

Text Book(s):	
1	Thomas Erl, ZaighamMahood, Ricardo Puttini- "Cloud Computing, Concept, Technology and Architecturel", Prentice Hall, First Edition, 2013.
2	Kai Hwang, Geoffery C, Fox and Jack J, Dongarra," Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Inprint of Elsevier, 2012.

Reference Book(s) / Web link(s):	
1	Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models(SaaS, PaaS, and IaaS)", First Edition, Wiley,2014.
2	Tom White, "Hadoop: The Definitive Guid". Yahoo Press, 2014.
3	RajkumarBuyya, ChristainVecchiola, and ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
4	John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19741.01	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS19741.02	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CS19741.03	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CS19741.04	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS19741.05	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average Mapping	3	2.8	2.8	2.6	2.6	2	2	1.8	2.4	1.8	3	2	2.8	2.4	2.8

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P01	GRAPH THEORY	PE	2	1	0	3

Objectives:	
•	To understand fundamentals of graph theory.
•	To study proof techniques related to various concepts in graphs.
•	To be able to formally understand and prove theorems/lemmas and relevant results in graph theory.
•	To integrate core theoretical knowledge of graph theory to solve problems.
•	To explore modern applications of graph theory.

UNIT-I	INTRODUCTION		9
Graphs - Introduction – Graph Terminologies – Types of Graphs – Sub Graph- Multi Graph – Regular Graph – Isomorphism –Walk – Path – Circuit – Euler graph – Hamiltonian Graph – Related Theorems.			
UNIT-II	**TREES AND CONNECTIVITY**		**9**
Trees – Properties - Distance and Centers – Rooted and Binary Trees – Spanning Tree – Fundamental Circuits- Cut Sets – Properties – Fundamental Circuit and Cut-set –Connectivity - Separability - 1-isomorphism – 2-isomorphism - Related Theorems.			
UNIT-III	**NETWORK FLOWS, PLANARITY AND DI-GRAPHS**		**9**
Network Flows – Planar Graph –Kuratowski's two graphs - Different Representations of Planar Graph – Detection – Dual Graph – Geometric and Combinatorial Dual – Related Theorems – Digraph – Properties – Euler Digraph.			
UNIT-IV	**MATRIX REPRESENTATION AND COLOURING**		**9**
Matrix Representation – Incidence matrix- Circuit matrix –Fundamental Circuit matrix - Cut-set matrix - Adjacency matrix - Graph Coloring – Chromatic Number - Chromatic Polynomial – Chromatic Partitioning – Matching – Covering – Related Theorems.			
UNIT-V	**APPLICATIONS AND GRAPH THEORITIC ALGORITHMS**		**9**
Applications – Trees - Hamiltonian Circuits – Planar Graphs – Coloring - Connectivity - Directed graphs – Network Flows – Shortest-path algorithms.			
	Contact Hours	**:**	**45**

Course Outcomes:	On completion of the course, the students will be able to
•	Apply the concepts of graphs and different types of graphs.
•	Be able to grasp concepts, features and properties of Trees and graphs.
•	Formulate and prove theorems about network flows, planar graphs and Digraphs.
•	Analyse the different matrix representations and solve Coloring, chromatic polynomial, chromatic partitioning, matching and covering.
•	Appreciate the applications of Trees, Hamiltonian circuits, digraphs, planar graphs, coloring, matching and algorithms.

Text Book(s):	
1	NarsinghDeo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2	Bondy, J. A. and Murty, U.S.R., “Graph Theory with Applications”, North Holland Publication, 2011.

Reference Book(s)/Web link(s)	
1	L.R.Foulds , "Graph Theory Applications", Springer ,2016.
2	West, D. B., “Introduction to Graph Theory”, Pearson Education, 2011.
3	Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc GrawHill , 2007.
4	Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5	John Clark, Derek Allan Holton, “A First Look at Graph Theory” World Scientific Publishing Company, 1991.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CS19P01.1	3	2	-	2	2	-	-	-	1	2	-	-	1	3	2
CS19P01.2	2	2	-	2	1	-	-	-	1	1	-	-	2	2	1
CS19P01.3	2	2	2	2	2	1	2	-	2	2	-	1	1	2	-
CS19P01.4	2	2	1	2	1	1	-	-	1	1	-	-	-	2	-
CS19P01.5	3	2	2	2	2	1	1	-	2	2	-	-	2	2	1
Average Mapping	**2.4**	**2.0**	**1.67**	**2.0**	**1.6**	**1.0**	**1.5**	**-**	**1.4**	**1.6**	**-**	**1.0**	**1.5**	**2.2**	**1.33**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P02	COMPUTATIONAL NUMBER THEORY	PE	2	1	0	3

Objectives:	
•	To learn about divisibility theorem
•	To gain knowledge about congruences
•	To understand and learn about cryptosystem
•	To study the basis of Quadratic forms and residue

UNIT-I	DIVISIBILITY AND PRIMES	9
Divisors,Bezout‟sidentity,Least common multiples, Linear Diophantine equations, Prime numbers and prime power factorization , Distribution of Primes, Fermat and Mersenne primes, Primality testing and factorization.		
UNIT-II	**CONGRUENCES**	**9**
Modular arithmetic, Linear congruences, Simultaneous linear congruences, Simultaneous non-linear congruences, An extension of Chinese Remainder Theorem (with non-coprime moduli), Arithmetic modulo p, Fermat‟s little theorem, Wilson‟s theorem, Pseudoprimes and Carmichael numbers, Solving congruences modulo prime powers.		
UNIT-III	**QUADRATIC RESIDUES AND QUADRATIC FORMS**	**9**
Quadratic residues, Legendre symbol, Euler‟s criterion, Gauss lemma, law of quadratic reciprocity, Quadratic residues for prime-power moduli and arbitrary moduli..		
UNIT-IV	**QUADRATIC FORMS**	**9**
Binary quadratic forms, equivalence and reduction of binary quadric forms, positive definite binary quadric forms, Representations by Quadratic Forms, Reduction of Positive definite forms, Indefinite forms , automorph, Gauss‟s Class Number Problem.		
UNIT-V	**EULER'S FUNCTION AND RSA CRYPTOSYSTEM, UNITS MODULO AN INTEGER**	**9**
Definition of Euler function, Application of Euler‟s properties, RSA cryptography, The group of units modulo an integer, primitive roots, Existence of primitive roots.		
	Contact Hours : 45	

Course Outcomes:On completion of the course, the students will be able to	
•	Apply number theory concepts to cryptography.
•	Solve some of the divisor problems.
•	Understand the importance of Euler‟s phi function in RSA crypto system
•	Understand the importance of larger primes in coding theory.
•	Apply the theory of congruences to derive some of powerful theorems in number theory.

Text Books(s):	
1	G.A. Jones, J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Reference Book(s) / Web link(s):	
1	Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley, 2000.
2	D. Burton, "Elementary Number Theory", McGraw-Hill, 2005
3	Franz Lemmermeyer "Binary Quadratic Forms An Elementary Approach to the Arithmetic of Elliptic and Hyperelliptic Curves", November 8, 2010.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P02.1	3	3	3	3	3	2	-	-	-	-	2	2	3	3	1
CS19P02.2	3	3	3	3	2	1	-	-	-	-	2	2	3	3	1
CS19P02.3	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
CS19P02.4	3	3	2	3	2	1	-	-	-	-	1	1	3	3	1
CS19P02.5	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
Average	**3.0**	**3.0**	**2.4**	**2.6**	**2.2**	**1.2**	**-**	**-**	**-**	**-**	**1.4**	**1.4**	**3.0**	**3.0**	**1.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS19P03	PARALLEL AND DISTRIBUTED ALGORITHMS	PE	2	1	0	3

Objectives:	
●	To acquire a knowledge and experience on different Architecture of systems and measurement
●	To Learn about synchronous linear and nonlinear algorithms
●	To write a programming in dynamic and network flow environment.
●	Developing the skills in Totally asynchronous algorithmic model
●	Developing the skills in partially asynchronous algorithmic model

UNIT–I	INTRODUCTION	9
Parallel and distributed architectures, Models, complexity measures, and some simple algorithms, Communication aspects of parallel and distributed systems, Synchronization issues in parallel and distributed algorithms		
UNIT-II	**LINEAR EQUATIONS AND PROBLEMS**	**9**
Algorithms for Systems of Linear Equations and Matrix Inversion: Parallel algorithms for linear systems structure, equations, algorithm, methods for systems of linear equations, implementation of classical iterative methods. **Iterative Methods for Nonlinear Problems:** Contraction mappings, Unconstrained optimization, Constrained convex optimization, Parallelization and decomposition of optimization problems, Algorithms for variational inequalities		
UNIT-III	**DYNAMIC PROGRAMMING**	**9**
Shortest Paths and Dynamic Programming- The shortest path problem, Markov chains with transition costs, Markovian decision problems **Network Flow Problems-** The linear network flow problem and its dual, The relaxation method, The epsilon-relaxation method, Complexity analysis of the epsilon-relaxation method and its scaled version, Network flow problems with strictly convex cost, Nonlinear multi commodity flow problems - Routing applications		
UNIT-IV	**TOTALLY ASYNCHRONOUS ITERATIVE METHODS**	**9**
A general convergence theorem, Applications to problems involving maximum norm contraction mappings, Applications to monotone mappings and the shortest path problem, Linear network flow problems, Nonlinear network flow problems, Asynchronous relaxation for ordinary differential equations and two--point boundary value problems.		
UNIT-V	**PARTIALLY ASYNCHRONOUS ITERATIVE METHODS**	**9**
Algorithms for fixed points of non-expansive mappings, Algorithms for agreement and for Markov chain problems, Load balancing in a computer network, Gradient-like optimization algorithms, Distributed asynchronous routing in data networks, A model in which several processors may update the same variables, Stochastic gradient algorithms.		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course students will be able to	
●	To acquire a knowledge and experience on different measurement systems.
●	Familiarized synchronous linear and nonlinear algorithms
●	Problem solving capabilities in dynamic and network flow programming environment.
●	Skills created in n totally asynchronous algorithmic model
●	Skills developed in the area of partially asynchronous algorithmic model

Text Book(s):	
1	Dimitri P. Bertsekas and John N. Tsitsiklis, “Parallel and Distributed Computation: Numerical Methods”, Prentice-Hall in 2015

Reference Book(s) / Web link(s):	
1	AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to Parallel Computing”, Second Edition, AddisionWeslloy, 2003

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P03.1	1	2	2	2	-	-	-	-	1	2	1	1	2	1	1
CS19P03.2	2	2	2	2	-	-	-	-	2	2	2	2	3	2	2
CS19P03.3	3	3	2	3	-	-	-	-	2	2	2	2	3	2	2
CS19P03.4	3	3	3	3	-	-	-	1	2	2	3	3	3	2	2
CS19P03.5	3	3	3	3	-	-	-	1	2	2	3	3	1	2	2
AVERAGE	**2.4**	**2.6**	**2.4**	**2.6**	**-**	**-**	**-**	**1**	**1.8**	**2**	**2.2**	**2.2**	**2.4**	**1.8**	**1.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P04	COMPUTATIONAL COMPLEXITY	PE	2	1	0	3

Objectives:	
•	To learn about Turing machines computation
•	To gain knowledge about time complexity
•	To understand and learn about NP problems
•	To learn the complexity and its approximation

UNIT-I	COMPUTATION OF TURING MACHINES	9
Introduction: Easy and hard problems. Algorithms and complexity. Turing machines: Models of computation. Multi-tape deterministic and non-deterministic Turing machines, Enumerator, Equivalence with Other Models		
UNIT-II	**UNDECIDABILTY & TIME COMPLEXITY**	**9**
The Halting Problem, The Diagonalization Method, Undecidability of halting. A Turing-Unrecognizable language. Time Complexity: Measuring Complexity, Analyzing Algorithms, Complexity relationship among Models		
UNIT-III	**NP & NP COMPLETENESS**	**9**
NP and NP-completeness: Non-deterministic Turing machines. NTIME[t]. NP. NP-completeness and Polynomial time Reducibility. Cook-Levin Theorem. Additional NP-complete Problems		
UNIT-IV	**SPACE COMPLEXITY**	**9**
DSPACE[s]. Linear Space Compression Theorem. PSPACE, NPSPACE. PSPACE = NPSPACE. PSPACE-completeness. Quantified Boolean Formula problem is PSPACE-complete. L, NL and NL- completeness. NL=coNL.		
UNIT-V	**RANDOMIZED COMPLEXITY & APPROXIMATION**	**9**
Randomized Complexity: The classes BPP, RP, ZPP, Interactive proof systems: IP = PSPACE. Approximation: Bin-packing problem, Vertex cover, traveling salesman problem, minimum partition.		
	Contact Hours : 45	

Course Outcomes:	On completion of the course, the students will be able to
•	Determine the characteristics of complexity classes and determine whether a problem is computable.
•	Complete understanding on the main computational complexity classes, their underlying models of computation, and relationships.
•	Classify problems by their computational complexity
•	Show that a problem is NP-complete using reductions. Get familiar with the concepts of randomized, approximation and parallel algorithms.
•	Analyse optimization problems using the concept of interactive proofs and classify them into appropriate approximation complexity classes

Text Books(s):	
1	Michael Sipser," Introduction to the Theory of Computation", second edition - Thomson Course Technology, 2005.
2	Sanjeev Arora and Boaz Barak, "Computational Complexity: A Modern Approach", Cambridge University
	Press,2009.
3	Vijay Vazirani, "Approximation Algorithms", Springer--Verlag, 2001

Reference Books:	
1	Christos H Papadimitriou, Computational Complexity, Addison-Wesley, 1994.
2	M R Garey and D S Johnson, Computers and Intractability: A Guide to the Theory of NP Completeness, Freeman, 1979.
3	OdedGoldreich, Computational Complexity, Cambridge University press, 2008.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P04.1	1	1	3	2	3	-	-	-	-	2	1	2	3	3	2
CS19P04.2	1	1	3	2	3	-	-	-	-	2	1	2	3	3	2
CS19P04.3	2	2	3	2	2	-	-	-	-	2	1	2	3	2	1
CS19P04.4	1	1	3	1	3		-	-	-	2	1	3	2	1	2
CS19P04.5	1	1	3	2	2	1	2	1	2	2	1	2	3	1	2
Average	**1.2**	**1.2**	**3**	**1.8**	**2.6**	**1**	**2**	**1**	**2**	**2**	**1**	**2.2**	**2.8**	**2**	**1.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P05	QUANTUM COMPUTING	PE	2	1	0	3

Objectives:	
•	To know the fundamentals of Quantum computing and its Applications.
•	To understand the efficient quantum algorithms for several basic promise problems
•	To gain knowledge about quantum computers and their principles
•	To understand the principles, quantum information and limitation of quantum operations formalizing
•	To gain knowledge about different quantum error and its correction techniques.

UNIT-I	FUNDAMENTALS OF QUANTUM COMPUTING		9
Fundamental Concepts: Introduction and Overview – Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information. Problems on Qubits			
UNIT-II	**QUANTUM COMPUTATION**		**9**
Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. Problems on Boolean functions and Quantum gates			
UNIT-III	**QUANTUM COMPUTERS**		**9**
Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.			
UNIT-IV	**QUANTUM INFORMATIONS**		**9**
Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. Problems on Measurement			
UNIT-V	**QUANTUM ERROR CORRECTION AND CRYPTOGRAPHY**		**9**
Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation. Quantum Cryptography-Private Key Cryptography, Privacy Amplification and Information Reconciliation, Quantum Key Distribution, Privacy and Coherent Information, The Security of Quantum Key Distribution. Problems on Quantum error correction and cryptography.			
	Contact Hours	**:**	**45**

Course Outcomes: On completion of the course, the students will be able to	
•	Basics of Quantum computing and its Applications.
•	Solve various problems using quantum algorithms.
•	Methodology for quantum computers and their principles
•	Comprehend quantum noise and operations.
•	Gain knowledge about different quantum error correction techniques.

Text Books(s):	
1	Chris Bernhardt ,"Quantum Computing for Everyone", (The MIT Press) Hardcover – Illustrate ,September 2020,
2	Willi-Hans Steeb; "Problems and Solutions in Quantum Computing and Quantum Information", Yorick Hardy Academic Consulting and Editorial Services (ACES) Private Limited, January 2020.
3	M.A. Nielsen and I.Chuang,"Quantum Computation and Quantum Information", Cambridge University Press 2010.
Reference Book(s)/Web link(s):	
1	Parag K. Lala ,Quantum Computing: A Beginner's Introduction Paperback" , McGraw Hill November 2020.
2	V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing company,2007.
3	Nayak, Chetan; Simon, Steven; Stern, Ady; Das Sarma, Sankar, "NonabelianAnyons and Quantum Computation", 2008.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P05.1	3	2	1	1	0	1	0	0	1	0	0	3	2	2	2
CS19P05.2	3	3	2	2	1	0	0	0	1	0	0	3	2	2	2
CS19P05.3	3	3	2	1	2	0	0	2	0	0	0	3	1	1	2
CS19P05.4	-	1	2	1	2	0	0	0	0	0	0	3	1	1	2
CS19P05.5	-	2	2	2	2	0	0	0	0	0	0	3	1	1	2
Average	**3.0**	**2.2**	**1.8**	**1.4**	**1.75**	**1.0**	**-**	**2.0**	**1.0**	**-**	**-**	**3.0**	**1.4**	**1.4**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P17	COMPREHENSION STUDY	PE	3	0	0	3

Objectives:	
•	To revive Computer organization concepts
•	To solve and analyze algorithms
•	To familiarize operating system concepts
•	To design Software Engineering Concepts
•	To apply database management systems

UNIT-I	DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION	11
Number System – conversion of number systems – Complement of a number – Negative number representation - Boolean Logic – Duality and Consensus Theorem - Digital circuits – Combinational and sequential – Computer architecture – register set – machine instructions and addressing mode – Arithmetic logic unit - Arithmetic and logic micro-operations – CPU control Design – Instruction execution – CISC Vs. RISC – Interrupt and DMA modes – Instruction Pipelining – Memory Hierarchy		
UNIT-II	**DATA STRUCTURES AND ALGORITHMS**	**10**
Programming Basics - Stack – Queue – Linked List – Tree – Tree traversal – binary tree – Binary search tree - Graph – Graph Traversal - Algorithms Analysis – Asymptotic notation – hashing – binary heap – Searching and Sorting – Greedy approach – Dynamic Programming – shortest path problems – complexity classes		
UNIT-III	**OPERATING SYSTEM**	**8**
Types of Operating System – Process Management – CPU Scheduling – Process Synchronization – Threads- Dead locks – Memory Management – File and I/O System.		
UNIT-IV	**SOFTWARRE ENGINEERING**	**8**
Software Engineering Introduction – Conventional and Evolutionary Process Models – Measurement of Metrics – Software Development Life Cycle – Risk Analysis – Designing UML Diagrams – Software Testing		
UNIT-V	**DATABASE MANAGEMENT SYSTEMS**	**8**
DBMS Architecture- DBMS Models – Database Design – Structured Query Language – PL/SQL – Transitions and concurrency Control – Normalization – Creating a Database system for a project		
	Total Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
•	Regain knowledge of computer organization
•	Solve and analyze problems and algorithms
•	Revive Operating system Concepts
•	Design a software project
•	Develop and integrate Database for a project

Text Books(s):	
1	M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003. (Unit – 1)
2	William Stallings, "Computer Organization and Architecture Designing for performance", 10th Edition, PHI Pvt. Ltd., Eastern Economy Edition,2016(Unit -1).
3	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2002. (Unit – 2)
4	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John Wiley and Sons Inc., 2012(unit 3)
5	Ian Sommerville, Software Engineering, Ninth edition, 2010, Pearson Education. (Unit – 4)
6	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011. (Unit -5)

Reference Book(s) / Web Link(s):	
1	Gate Computer Science and Information Technology, 2021, Pearson Education
2	Acing the gate Computer sciene and information technology , 2ed, 2021, Wiley

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P17.1	3	2	2	3	3	3	3	2	3	3	3	2	3	3	3
CS19P17.2	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3
CS19P17.3	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3
CS19P17.4	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CS19P17.5	3	2	2	2	3	3	3	3	3	3	3	2	3	3	3
Average	**3**	**2.6**	**2.6**	**2.8**	**3**	**3**	**3**	**2.4**	**3**	**3**	**3**	**2**	**3**	**3**	**3**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
EC19P66	DIGITAL IMAGE AND VIDEO PROCESSING	PE	3	0	0	3

Objectives:	
•	To learn digital image fundamentals.
•	To be exposed to simple image enhancement and restoration techniques.
•	To learn image segmentation and representation techniques.
•	To be familiar with image compression techniques.
•	To acquire the knowledge on video surveillance and Human activity recognition.

UNIT-I	DIGITAL IMAGE FUNDAMENTALS AND IMAGE ENHANCEMENT	9
Introduction - Steps in digital image processing, Components of digital image processing systems, brightness, contrast, hue, saturation, Image sensing and acquisition, Image sampling and quantization, Relationships between pixels.		
UNIT-II	**IMAGE ENHANCEMENT AND RESTORATION**	**9**
Image enhancement - Gray level transformations, Homomorphic filtering, Color image enhancement. Reasons for image degradation, Image restoration model, Restoration filters - Arithmetic mean, Geometric mean, Harmonic mean, Contra harmonic mean, median, midpoint, alpha trimmed, min and max filters, Inverse filter, Wiener filter.		
UNIT-III	**IMAGE SEGMENTATION AND REPRESENTATION**	**9**
Detection of discontinuities - Point detection, Line detection, Edge detection, Region based segmentation – Region growing, Region splitting and Merging. Image representation - Chain Code – Polygonal approximation, Boundary segments, Boundary descriptors – Simple boundary descriptors, Shape numbers.		
UNIT-IV	**IMAGE COMPRESSION**	**9**
Need for data compression, Lossy and Lossless compression, Huffman coding, Run length codes, Shift codes, Arithmetic coding, Transform coding, JPEG and MPEG compression standards.		
UNIT-V	**VIDEO ANALYTICS AND HUMAN ACTIVITY RECOGNITION**	**9**
Introduction – Fundamentals for Video Surveillance, Object Detection and Tracking: Adaptive Background Modelling and Subtraction – Pedestrian Detection and Tracking, Vehicle Detection and Tracking. The framework for activity inference - Human Activity Recognition – Video summarization.		
	Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
•	Describe digital image fundamentals.
•	Exhibit various image enhancement and restoration techniques.
•	Explain various image segmentation and representation techniques.
•	Apply various image compression techniques.
•	Describe video surveillance and human activity recognition.

Text Book(s):	
1	Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing', Pearson” , Second Edition, 2004.
2	Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson 2002.

Reference Book(s)/Web link(s)	
1	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
2	Michael Berthold, David J.Hand, “Intelligent Data Analysis”, Springer, 2007.
3	AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4	Yunqian Ma, Gang Qian, “Intelligent Video Surveillance: Systems and Technology”, CRC Press (Taylor and Francis Group), 2009.
	Rama Chellappa, Amit K.Roy– Chowdhury, Kevin Zhou.S, “Recognition of Humans and their Activities using Video”, Morgan & Claypool Publishers, 2005.

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC19P66.01	3	2	2	2	2	1	1	2	2	2	1	1	1	1	2
EC19P66.02	3	2	2	2	3	2	1	2	2	2	2	2	2	3	3
EC19P66.03	3	2	2	2	3	2	1	2	2	2	2	2	3	3	3
EC19P66.04	3	3	3	3	3	2	1	2	2	2	2	3	3	3	3
EC19P66.05	3	2	2	2	2	3	1	2	2	2	2	3	2	2	3
Average	**3**	**2.2**	**2**	**2.2**	**2.6**	**2**	**1**	**2**	**2**	**2**	**1.8**	**2.2**	**2.2**	**2.4**	**2.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
EC19P01	PRINCIPLES OF DIGITAL SIGNAL PROCESSING	PE	3	0	0	3

Objectives:	
•	To understand the basics of discrete time signals, systems and their classifications.
•	To analyze the discrete time signals in both time and frequency domain.
•	To design low pass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
•	To design Linear phase digital FIR filters using Fourier method, window technique
•	To realize the concept of finite word length effects.

UNIT-I	DISCRETE TIME SIGNALS AND SYSTEMS	9
Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals–Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems–Discrete Convolution: Linear and Circular–Correlation.		
UNIT-II	**ANALYSIS OF LTI DISCRETE TIME SYSTEMS**	**9**
Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.		
UNIT-III	**INFINITE IMPULSE RESPONSE**	**9**
Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques.		
UNIT-IV	**FINITE IMPULSE RESPONSE**	**9**
Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.		
UNIT-V	**FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS**	**9**
Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band-Overflow error-signal scaling.		
	Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
•	Perform mathematical operations on signals.
•	Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
•	Transform the time domain signal into frequency domain signal and vice-versa.
•	Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.
•	Analyse finite word length effects in digital filter

Text Book(s):	
1	John G. Proakis& Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007

Reference Book(s)/Web link(s)	
1	Richard G. Lyons, “Understanding Digital Signal Processing”. Second Edition, Pearson Education.
2	A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, 8th Indian Reprint, Pearson, 2004.
3	Emmanuel C.Ifeachor, &Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
4	William D. Stanley, “Digital Signal Processing”, Second Edition, Reston Publications.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC19P01.01	3	3	3	3	2	2	1	1	1	2	1	2	1	3	2
EC19P01.02	3	3	3	3	2	2	1	1	1	2	1	2	1	3	2
EC19P01.03	3	3	3	3	2	2	1	1	1	2	1	2	1	3	2
EC19P01.04	3	3	3	3	2	2	1	1	1	2	1	2	1	3	2
EC19P01.05	3	3	3	3	2	2	1	1	1	2	1	2	1	3	2
Average	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P06	HUMAN COMPUTER INTERACTION	PE	2	0	2	3

Objectives:	
•	Learn the foundations of Human Computer Interaction.
•	Be familiar with the design technologies and software process.
•	Learn human interaction models and theories
•	Be aware of Design thinking concepts.
•	Learn the guidelines of design thinking and apply it.

UNIT-I	FOUNDATIONS OF HCI		6
The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – Processing and networks; Interaction: Models – Frameworks – Ergonomics – Styles – Elements – Interactivity – Paradigms.			
UNIT-II	**DESIGN & SOFTWARE PROCESS**		**6**
Interactive Design basics – Process – Scenarios – Navigation – Screen design – Iteration and prototyping. HCI in software process – Software life cycle – Usability engineering – Prototyping in practice – Design rationale - Design rules – Principles, Standards, Guidelines, Rules – Universal Design.			
UNIT-III	**MODELS AND THEORIES**		**6**
Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models - Task Analysis.			
UNIT-IV	**MOBILE HCI**		**6**
Mobile Ecosystem: Platforms–Application frameworks– Types of Mobile Applications: Widgets– Applications– Games– Mobile Information Architecture–Mobile 2.0.			
UNIT-V	**WEB INTERFACE DESIGN**		**6**
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages.			
	Contact Hours	**:**	**30**

List of Experiments			
1	Design a user interface for Welcome screen.		
2	Design a user interface by applying design rules for assigning a grade to students based on the subject marks.		
3	Design a user interface with Layouts for printing the numbers in ascending order and descending order.		
4	Design a user interface by using task analysis for calculator.		
5	Design a user interface with direct selection for registration of a student for admissions.		
6	Design a user interface by using colours for displaying and changing of picture on the form.		
7	Design a user interface with widgets for end semester exam registrations.		
8	Design a user interface by using drag and drop for creating forms.		
9	Design a user interface with Overlays and Inlays for menu-based program.		
10	Mini Project.		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Describe the foundations of Human Computer Interaction.

•	Demonstrate with the design technologies and software process.
•	Apply the concepts of human interaction models and theories .
•	Design effective HCI for individuals and persons with disabilities.
•	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
Text Book(s):	
1	Jeff Johnson, "Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines", Morgan Kaufmann, 2014.
2	Brian Fling, "Mobile Design and Development", First Edition, O„Reilly Media Inc., 2009.
3	Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O„Reilly, 2009.
Reference Book(s)/Web link(s)	
1	Jeff Johnson, "Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines", Morgan Kaufmann, 2014.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P06.01	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS19P06.02	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS19P06.03	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS19P06.04	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS19P06.05	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	**2.4**	**3.0**	**3.0**	**2.75**	**2.6**	**2.25**	**2.8**	**2.75**	**3.0**	**3.0**	**2.67**	**3.0**	**2.67**	**3.0**	**3.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P07	ELECTRONIC DESIGN AUTOMATION	PE	2	0	2	3

Objectives:	
●	To acquire a knowledge and experience on different Digital Electronic circuit design
●	To empathize the different types of Design Automation tools
●	To Apply Circuit Design technology for manufacture area
●	To learn about VERILOG Tools
●	To explore technology about the VHDL

UNIT I	Combinational-Circuit Building Blocks	6
Multiplexers, Synthesis of Logic Functions Using Multiplexers, Multiplexer Synthesis Using Shannon‟s Expansion, Decoders, De-multiplexers, Encoders, Arithmetic Comparison Circuits, The Case Statement		
UNIT II	**VERILOG-1**	**6**
Introduction, Structural Specification of Logic Circuits, Behavioral Specification of Logic Circuits, Hierarchical Verilog Code, Minimization and Karnaugh Maps, Strategy for Minimization, Minimization Procedure, Incompletely Specified Functions		
UNIT III	**VERILOG-2**	**6**
Design of Arithmetic Circuits Using Verilog, Using Vectored Signals, Using a Generic Specification, Nets and Variables, Arithmetic Assignment Statements, Module Hierarchy, Representation of Numbers, Multiplication, Floating-Point Numbers.		
UNIT IV	**VHDL**	**6**
Introduction, Basic terminology, Entity declaration, Architecture Body, Configuration Declaration, Package Declaration, Package Body, Model Analysis, Basic Language Elements, Data Types, Operators		
UNIT V	**VHDL Modeling**	**6**
Behavioral Modeling- Variable Assignment Statement, Signal Assignment Statement, Multiple Processes, Dataflow Modeling - Concurrent Assertion Statement, Structural Modeling- Component Declaration and Instantiation.		
	Contact Hours : 30	

List of Experiments			
	Study and Experiments based on EDA environment. Using simulation tools Verilog/VHDL.		
1	Half Adder		
2	Full Adder		
3	Subtractor		
4	Flip-Flop‟s		
5	4-bit Comparators		
6	Multiplexers - 2:1, 4:1 and 8:1		
7	Parity Generator		
8	4 Bit Up/Down Counter with Loadable Count		
9	Decoders - 6. 2:4, 3:8 and 4:16.		
10	8-bit Shift Resistors		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course students will be able to	
●	Construct different types of digital electronic circuits
●	Apply digital circuit design in different tools
●	To Apply Circuit Design technology for manufacturing area
●	To learn about VERILOG Tools
●	To explore technology about the VHDL

Text Book(s):	
1	Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", Third Edition, Tata McGraw-Hill Education, 2017
2	JayaramBhasker, "A VHDL Primer", P T R Prentice Hall, 1999

Reference Book(s)/Web link(s):	
1	Stephen Brown and ZvonkoVranesic "Fundamentals of Digital Logic with VHDL Design", Third Edition, McGraw-Hill Education, 2017
2	Volnei A. Pedroni ,"Circuit Design with VHDL", MIT Press, 2004
3	David Pellerin Douglas Taylor," VHDL", Made easy Prentice Hall PTR, 1997

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P07.1	2	2	2	-	-	-	-	-	-	-	1	1	2	2	2
CS19P07.2	2	2	2	2	2	1	-	-	2	-	1	1	1	2	2
CS19P07.3	2	2	2	1	2	1	-	-	1	-	2	1	2	2	1
CS19P07.4	2	2	2	2	2	1	-	-	1	-	2	1	2	2	2
CS19P07.5	2	2	3	1	2	1	-	-	-	-	2	1	2	3	2
Average	**2**	**2**	**2.2**	**1.5**	**2.0**	**1.0**	**-**	**-**	**1.33**	**-**	**1.6**	**1**	**1.8**	**2.2**	**1.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P08	COMPUTER GRAPHICS	PE	2	0	2	3

Objectives:	
•	To Gain knowledge about graphics hardware devices and software used.
•	To understand the two dimensional graphics and their transformations, familiar with clipping techniques.
•	To understand the three dimensional graphics and their transformations, familiar with clipping techniques.
•	To understand and Appreciate illumination and color models.
•	To understand the basic of animation techniques.

UNIT-I	INTRODUCTION	6
Application areas of Computer Graphics, overview of graphics systems, Video -display devices, Raster - scan systems, random scan systems, graphics monitors and work stations. Output primitives: Points and lines, line drawing algorithms, mid – point circle and ellipse algorithms.		
UNIT-II	**2 - D GEOMETRICAL TRANSFORMS**	**6**
Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms. 2-D Viewing: The viewing pipeline, window to view - port coordinate transformation, point clipping, Text Clipping, Cohen-Sutherland, NLN and Liang basky line clipping algorithms, Sutherland –Hodgeman and Weiler Atherton polygon clipping algorithm.		
UNIT-III	**3-D OBJECT REPRESENTATION**	**6**
Polygon surfaces, quadric surfaces, spline representation, Bezier curve and surfaces, 3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D viewing: Viewing pipeline, viewing coordinates, view volume, projection and clipping.		
UNIT-IV	**ILLUMINATION AND COLOR MODELS**	**6**
Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive color concepts – RGB color model – YIQ color model – CMY color model – HSV color model – HLS color model; Color selection.		
UNIT-V	**COMPUTER ANIMATION AND REALISM**	**6**
Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications, Morphing and Tweening – Fractals – Grammar based models.		
	Contact Hours : 30	

List of Experiments	
1	Implementation of Bresenham‟s Line drawing Algorithm
2	Implementation of Mid point Circle drawing Algorithm
3	Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear
4	Composite 2D Transformations
5	Implementation of Cohen Sutherland 2D line clipping Algorithm
6	Window to viewport Mapping
7	Three dimensional transformations - Translation, Rotation, Scaling
8	Parallel and Perspective Projections
9	Generation of fractal images
10	Creating Animation using any tool
	Contact Hours : 30
	Total Contact Hours : 60

Course Outcomes: On completion of the course, the students will be able to	
•	Understand overview of graphics system and various output primitives algorithms.
•	Design two dimensional graphics, apply two dimensional transformations and clipping
•	Design three dimensional graphics, apply three dimensional transformation and clipping.
•	Apply Illumination and color models in real time.
•	Design animation sequences.

Text Books(s):	
1	Donald Hearn and M. Pauline Baker, "Computer Graphics C version", Pearson education, Second edition,2002.

Reference Book(s) / Web link(s):	
1	Zhigangxiang, Roy Plastock, "Computer Graphics Second edition", Schaum"s outlines, Tata Mc Graw hill edition,2003
2	John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, AddisonWesley Professional,2013
3	Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
4	William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", Mc Graw Hill 1978.
5	http://nptel.ac.in/

CO - PO – PSO matrices of course

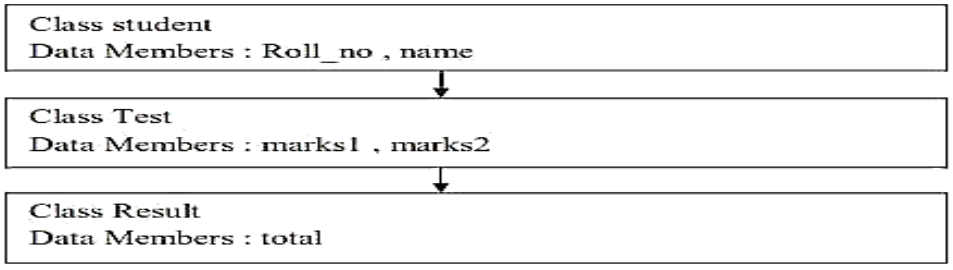
PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P08.1	1	1	3	2	3	-	1	1	-	2	1	2	3	3	2
CS19P08.2	1	1	3	2	3	-	1	1	-	2	1	2	3	3	2
CS19P08.3	1	1	2	2	3	-	1	1	-	2	2	2	3	3	2
CS19P08.4	2	1	2	2	3	-	1	1	-	3	2	1	3	3	2
CS19P08.5	3	1	3	2	3	-	1	1	-	2	2	1	3	3	2
Average	1.6	1	2.6	2	3	-	1	1	-	2.2	1.6	1.6	3	3	2

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P09	C# AND .NET PROGRAMMING	PE	2	0	2	3

Objectives:	
•	To learn basic programming in C# and the object-oriented programming concepts.
•	To study the advance programming concepts in C#.
•	To understand the working of base class libraries, their operations and manipulation of data using XML.
•	To update and enhance skills in writing Windows application, WPF, WCF and WWF with C# and .NET.
•	To implement mobile applications using .Net compact framework.

UNIT-I	C# LANGUAGE BASICS	6
.Net Architecture – Core C#– Objects and Types- – Inheritance- Generics – Arrays and Tuples – Operators and Casts.		
UNIT-II	**C# ADVANCED FEATURES**	**6**
Delegates – Lambdas – Events– Strings and Regular Expressions – Collections –Asynchronous Programming- Memory Management and Pointers – Errors and Exceptions – Reflection.		
UNIT-III	**BASE CLASS LIBRARIES AND DATA MANIPULATION**	**6**
Diagnostics -Tasks, Threads and Synchronization – Manipulating XML–ADO.NET- Peer-to-Peer Networking –Core Windows Presentation Foundation (WPF).		
UNIT-IV	**WINDOW BASED APPLICATIONS, WCF AND WWF**	**6**
Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)– Introduction to Web Services – .Net Remoting -Windows Service – Windows Workflow Foundation (WWF)		
UNIT-V	**.NET FRAMEWORK AND COMPACT FRAMEWORK**	**6**
Assemblies – Custom Hosting with CLR Objects – Core XAML – .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance.		
	Contact Hours : 30	

List of Experiments	
1	Write a console application that obtains four int values from the user and displays the product. Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a double; the equivalent command to convert from a string to an int is Convert.ToInt32().
2	Write an application that receives the following information from a set of students: Student Id: Student Name: Course Name: Date of Birth: The application should also display the information of all the students once the data is Entered. Implement this using an Array of Structures.
3	Write a program to declare a class “staff” having data members as name and post. Accept this data 5 for 5 staffs and display names of staff who are HOD.
4	Write a program to implement multilevel inheritance from following figure. Accept and display data for one student. 

5	Write a program to create a delegate called TrafficDel and a class called TrafficSignal with the following delegate methods.
	Public static void Yellow(){
	Console.WriteLine("Yellow Light Signal To Get Ready");
	}
	Public static void Green(){
	Console.WriteLine("Green Light Signal To Go");
	}
	Public static void Red(){
	Console.WriteLine("Red Light Signal To Stop");
	}
	Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array.

6	Write a program to accept a number from the user and throw an exception if the number is not an even number.
7	Create an application that allows the user to enter a number in the textbox named "getnum". Check whether the number in the textbox "getnum" is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button "check".
8	Create a project that calculates the total of fat, carbohydrate and protein. Allow the user to enter into text boxes. The grams of fat, grams of carbohydrate and grams of protein. Each gram of fat is 9 calories and protein or carbohydrate is 4 calories. Display the total calories of the current food item in a label. Use to other labels to display and accumulated some of calories and the count of items entered. The form food have 3 text boxes for the user to enter the grams for each category include label next to each text box indicating what the user is enter.
9	Database programs with ASP.NET and ADO.NET. Create a Web App to display all the Empname and Deptid of the employee from the database using SQL source control and bind it to GridView . Database fields are(DeptId, DeptName, EmpName, Salary).
10	Programs using ASP.NET Server controls. Create the application that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within 21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters.
11	For the web page created for the display OF Employee data change the authentication mode to Windows.

	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Write various applications using C# Language.
•	Write various applications using advanced C# concepts.
•	Create window services, libraries and manipulating data using XML.
•	Develop distributed applications using .NET Framework.
•	Create mobile applications using .NET compact Framework.

Text Books(s):	
1	Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4", Wiley, 2012.
2	Andy Wigley, Daniel Moth, Peter Foot, "Mobile Development Handbook", Microsoft Press, 2007.

Reference Books:	
1	Ian Gariffiths, Mathew Adams, Jesse Liberty, "Programming C# 4.0‖:,OReilly, Fourth Edition, 2010.
2	D Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Apress publication, 2012.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P09.1	2	2	1	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.2	2	2	1	2	1	-	-	-	1	-	2	2	2	2	-
CS19P09.3	2	2	2	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.4	2	2	2	2	2	-	-	-	2	-	2	2	2	2	2
CS19P09.5	3	2	2	2	3	-	-	-	3	-	2	2	2	2	2
Average	**2.2**	**2.0**	**1.6**	**1.6**	**1.6**	**-**	**-**	**-**	**1.6**	**-**	**2.0**	**1.6**	**2.0**	**1.6**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS19P25	**Immersive Experience in AR/VR**	PE	1	0	3	4

OBJECTIVES:
• To learn basics of AR/VR
• To create 3D Modeling
• To create AR Application
• To create VR Application
• To develop a Real-Time Project in AR/VR

UNIT-I	**TECHNOLOGY FOUNDATIONS, AR DEVELOPMENT**	3
Definition and key concepts of Augmented Reality (AR) and Virtual Reality (VR),Historical context and evolution,Current trends and applications. Hardware components (sensors, displays, etc.),Software components (SDKs, engines),Platforms (ARKit, AR Core, Oculus, Etc.),Understanding 3D space and spatial computing, Choosing Development tools (Unity, Blender),Introduction to AR Development Frameworks,Hands-on experience with a simple Project.		
UNIT-II	**3D MODELLING**	3
3D modelling basics,Textures, materials, lighting ,Rigging ,Animation.		
UNIT-III	**AR DEVELOPMENT AND INTEGRATION**	3
Vuforia Engine and its AR Functionalities,Marker-based vs Marker less Tracking, Common issues in AR development,Image Detection Applications. Common issues in AR development, Common issues in AR development, Common issues in AR development, Common issues in AR development.		
UNIT-IV	**VR DEVELOPMENT**	3
Overview of VR development tools (Unity), Introduction to VR development frameworks,Hands-on experience with a simple VR project,VR user interfaces (UI),Implementing Basic VR Integration,User experience considerations in VR, Advanced VR Interactions,Implementing in VR,VR Optimization technique. Motion sickness Mitigation,Performance Optimization in VR		
UNIT-V	**PROJECT DEVELOPMENT IN AR/VR**	3
Design Principles for immersive experiences,User testing in AR/VR,Iterative design process. Emerging trends in AR/VR. Project Development with AR/VR. Real Time Use Cases in AR/VR		
	Contact Hours :	15

List of Experiments

1. Marker-Based AR Experiments

Objective: Develop and test AR applications using fiducial markers.

Activities:

- Identify markers using AR libraries (e.g., ARToolkit, Vuforia).
- Experiment with marker designs and recognition under varying conditions (lighting, angle, distance).
- Overlay virtual 3D objects on detected markers.
- Measure marker tracking accuracy.

2. Markerless AR Experiments
Objective: Create AR experiences using environmental tracking instead of markers.
Activities:

- Implement SLAM (Simultaneous Localization and Mapping) for real-world recognition.
- Place virtual objects in real-world spaces using AR SDKs (e.g., ARCore, ARKit).
- Evaluate object stability and precision in different environments.

3. Object Recognition and AR Overlays
Objective: Use machine learning for real-time object recognition in AR.
Activities:

- Train a neural network to detect and recognize objects.
- Overlay AR content dynamically based on object recognition.
- Experiment with speed and accuracy across diverse datasets.

4. Gesture Recognition in AR
Objective: Integrate AR applications with hand gestures or body movements.
Activities:

- Use a depth-sensing camera (e.g., Leap Motion, Microsoft Kinect).
- Implement hand-tracking SDKs and algorithms to manipulate AR objects.
- Test usability and responsiveness.

5. AR Navigation and Wayfinding
Objective: Implement AR-based navigation systems.
Activities:

- Develop a path-guidance system overlaying routes on real-world environments.
- Experiment with indoor and outdoor environments using ARCore/ARKit or similar tools.
- Evaluate accuracy and user experience under different lighting and terrain conditions.

6. Motion Tracking and Locomotion Techniques
Objective: Test and compare different VR locomotion methods.
Activities:

- Implement teleportation, joystick-based movement, and natural walking.
- Measure user performance and susceptibility to motion sickness.
- Evaluate how each technique affects task efficiency and user comfort.

7.VR-Based Simulation Training
Objective: Develop and test training modules in a VR environment.
Activities:

- Simulate scenarios like flight training, surgery, or disaster response.
- Assess the effectiveness of VR training compared to traditional methods.

8. Interaction Methods in VR
Objective: Compare various interaction techniques for manipulating virtual objects.
Activities:

- Experiment with hand tracking, controllers, and gesture-based interactions.
- Measure task completion times, accuracy, and user preference.

9. Visual Perception and Depth Cues in VR
Objective: Explore how depth perception influences interaction and navigation.
Activities:

- Study the effects of stereoscopy, occlusion, shadows, and motion parallax on depth perception.
- Evaluate user performance in spatial tasks under varying visual conditions.

10. VR and Cognitive Load
Objective: Measure the impact of VR tasks on cognitive load and mental effort.
Activities:

- Use VR environments to test multitasking capabilities.
- Monitor physiological responses (e.g., EEG, heart rate) alongside subjective feedback.

	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**75**

Hardware Requirements:
1.Quest 3Development Tool Kit 2.System with GTX/RTX Graphic Card Required
Software Requirements:
1.Unity 2.Blender

Course Outcomes: On completion of the course, the students will be able to
• Understand the Foundational Concepts of AR and VR
• Designing 3D Model
• Familiarize in AR Application development
• Familiarize in VR Application Development
• Experiencing Real Time Projects

Textbooks:	
1.	"Augmented Reality and Virtual Reality: Empowering Human, Place and Business" by M. Claudia tom Dieck and Patrick M. T. Griffin
2.	"Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web" by Tony Parisi
3.	"Understanding Virtual Reality: Interface, Application, and Design" by William R. Sherman and Alan B. Craig.

Reference Books(s):	
1	"Augmented Reality: Principles and Practice" by Dieter Schmalstieg and Tobias Hollerer
2	"Unity Virtual Reality Projects" by Jonathan Linowes

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P25.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
CS19P25.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
CS19P25.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
CS19P25.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
CS19P25.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	**1.0**	**1.7**	**1.0**	**1.3**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**2.8**	**1.0**	**1.8**	**2.0**	**2.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P10	ADVANCED COMPUTER ARCHITECTURE	PE	3	0	0	3

Objectives:	
•	To familiarize the students with theory of Parallelism in architecture design
•	To make the students to understand about the various hardware technologies
•	To know about the parallel and scalable architecture
•	To apply the software techniques for parallel programming
•	To expose the students to study about the Instruction and System Level Parallelism

UNIT-I	THEORY OF PARALLELISM	9
Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws.		
UNIT-II	**HARDWARE TECHNOLOGIES**	**9**
Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design.		
UNIT-III	**PARALLEL AND SCALABLE ARCHITECTURES**	**9**
Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms, MultivectorComputers,Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable, Multithreaded and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.		
UNIT-IV	**SOFTWARE FOR PARALLEL PROGRAMMING**	**9**
Parallel Models, Languages, and Compilers, Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Code optimization and scheduling, Loop parallelism and pipelining, Parallel Program Development and Environments, Synchronization and Multiprocessing Modes		
UNIT-V	**INSTRUCTION AND SYSTEM LEVEL PARALLELISM**	**9**
Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism, Operand Forwarding, Reorder Buffer, Register Renaming, Tomasulo‟s Algorithm, Branch Prediction, Limitations in Exploiting Instruction Level Parallelism, Thread Level Parallelism.		
	Contact Hours : 45	

Course Outcomes:	
On completion of the course, the students will be able to	
✍	Understand the impact of Parallelism in architecture design
✍	Identification of the specific hardware technology.
✍	Understand the impact of parallel and scalable architecture
✍	Ability to implement parallel programming in software
✍	Analyze performance of Instruction and System Level Parallelism

Text Books(s):	
1	Kai Hwang and Naresh Jotwani, “Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability”, McGraw Hill Education third edition, 2015

Reference Books:	
1	John L. Hennessy and David A. Patterson, "Computer Architecture: A quantitative approach", 5th edition, Morgan Kaufmann Elseveir, 2013.
2	David A. Patterson and John L. Hennessy, "Computer Organization and Design RISC-V Edition: The Hardware/Software Interface", First edition, Morgan Kaufmann Elseveir, 2018.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P10.1	2	2	2	1	1	-	1	-	-	-	1	1	2	2	2
CS19P10.2	2	2	3	2	2	2	-	-	2	-	1	1	1	2	2
CS19P10.3	2	2	3	1	2	1	2	-	1	-	2	1	2	2	1
CS19P10.4	2	2	2	2	2	2	1	-	1	-	2	1	2	2	2
CS19P10.5	2	2	3	1	2	2	2	-	-	-	2	1	2	3	2
Average	**2**	**2**	**2.6**	**1.4**	**1.8**	**1.75**	**1.5**	**-**	**1.33**	**-**	**1.6**	**1**	**1.8**	**2.2**	**1.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P11	INTERNET OF THINGS ESSENTIALS	PE	2	0	2	3

Objectives:	
•	To learn the fundamentals of IoT
•	To know the various architectural and design methodology of IOT
•	To know about various devices of IOT
•	To know and use the various IoT devices and cloud services
•	To build a small, low-cost embedded system using present day embedded platforms

UNIT-I	INTRODUCTION TO INTERNET OF THINGS	6
Introduction – Definition and characteristics of IoT – Physical design of IoT: Things in IoT – IoT Protocols – Logical Design of IoT: IoT Functional blocks – IoT Communication Models – IoT Communication APIs.		
UNIT-II	**IOT DESIGN METHODOLOGY**	**6**
IoT Architecture – IoT Reference Architecture – IOT Design Methodology – Domain Specification- Functional View, Information View, Deployment View and Operational View, Device and Component Integration, Application development.		
UNIT-III	**IOT ELEMENTS AND CHALLENGES**	**6**
Building blocks of an IoT Device – Raspberry Pi, Arduino – Sensing devices, Communication Modules: Bluetooth, Zigbee, RFID, Wi-Fi - Power Sources –Data Management, Business Processes in IoT — Challenges in IoT: Design Challenges, Development Challenges, Security Challenges and Other Challenges.		
UNIT-IV	**IoT PHYSICAL SERVERS CLOUD OFFERINGS**	**6**
XaaS, M2M, WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django – Designing a RESTful Web API – Amazon Web Services for IoT.		
UNIT-V	**APPLICATIONS**	**6**
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home		
	Contact Hours : 30	

List of Experiments	
1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
3	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
4	To interface Bluetooth/Wifi with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth/Wifi.
5	Mini Projects (any one for each group) i. Home Automation system with mobile Integration. ii. Weather Monitoring system using Raspberry Pi/Arduino iii. Automatic plant watering/irrigation system using Raspberry Pi/Arduino. iv. Vehicle Tracking System using Raspberry Pi/Arduino. v. Intrusion detection System using Raspberry Pi/Arduino. vi. Smart Parking System using Raspberry Pi/Arduino

	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand internet of Things and its hardware and software components
•	Understand the architecture of a basic IoT system
•	Interface I/O devices, sensors & communication modules
•	Develop web services to access and control IoT devices
•	Develop real life IoT based projects

Text Books(s):	
1	Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach", 2014, www.internet-of-things-book.com
2	Perry Lea, "Internet of Things for Architects", Packt Publishers ,2018.
3	Martin Bauer Mathieu Boussard Nicola Bui Jourik De Loof et.al," IoT Reference Architecture", DOI: 10.1007/978-3-642-40403-0_8 Springer.
4	Jan Holler, VlasiosTsiatis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Reference Book(s)/Web link(s):	
1	Dr.OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers,2013.
2	Peter Waher, "Learning Internet of Things", Packt Publishing, Birminghan – Mumbai,2015
3	Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156, e-ISBN 978-3-642-19157-2, Springer,2011.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P11.1	1	2	-	-	-	-	-	-	-	-	-	1	1	1	1
CS19P11.2	1	2	-	1	-	-	-	-	-	-	-	1	-	1	-
CS19P11.3	1	1	-	1	-	-	-	-	-	-	-	2	3	2	2
CS19P11.4	1	2	2	2	2	-	-	1	-	-	-	2	3	2	2
CS19P11.5	1	3	3	2	2	3	2	2	2	2	2	3	3	3	3
Average	**1**	**2**	**2.5**	**1.5**	**2.0**	**3.0**	**2.0**	**1.5**	**2.0**	**2.0**	**2.0**	**1.8**	**2.5**	**1.8**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P12	DISTRIBUTED SYSTEMS	PE	2	0	2	3

Objectives:	
•	To explain the goals and types of Distributed Systems.
•	To describe Communications and distributed web based system.
•	To learn about Distributed objects and File System.
•	To emphasize the benefits of using Distributed Transactions and Concurrency.
•	To learn issues related to process and Security.

UNIT-I	INTRODUCTION TO DISTRIBUTED SYSTEMS	6
Introduction to Distributed systems – Design Goals-Challenges - Types of Distributed Systems - Architectural Styles – Middleware - System Architecture – Centralized and Decentralized organizations – Peer-to-Peer System –Focus on resource sharing -Case Study: Skype, Bittorrent.		
UNIT-II	**COMMUNICATIONS AND DISTRIBUTED WEB BASED SYSTEM**	**6**
Fundamentals - Remote Procedure Call – Stream oriented communication – Message oriented communication – Multicast communication -Web based system architecture-Web services-Case Study: Apache Web server, HTTP, SOAP		
UNIT-III	**DISTRIBUTED OBJECTS AND FILE SYSTEM**	**6**
Remote Invocation – Request Reply Protocol - Java RMI - Distributed Objects - CORBA -Object to component - Enterprise java Bean- Introduction to Distributed File System - File Service architecture – Andrew File System, Sun Network File System - Case Study: Google File System		
UNIT-IV	**SYNCHRONIZATION AND DISTRIBUTED TRANSACTIONS**	**6**
Clock Synchronization – Physical Clocks– Clock Synchronization Algorithms– Logical Clocks-Lamport's Logical Clocks-Vector Clocks-Election Algorithms-Ring based Algorithm -Bully Algorithm– Distributed Transactions- Nested Transaction- Locks- Concurrency Control- Timestamp Ordering - Atomic Commit-Distributed Deadlock.		
UNIT-V	**SECURITY AND PROCESS**	**6**
Introduction to Security – Security Threats, Policies, and Mechanisms-Design Issues-Cryptography-Secure Channels – Authentication-Message Integrity and Confidentiality-Secure Group Communication-Example: Kerberos- Process-Threads-Virtualization.		
	Contact Hours : 30	

List of Experiments	
1	Install Skype and initiate a chat between users.
2	Write a program to add two numbers in Java RMI.
3	Write a program in java for creating a simple chat application with TCP.
4	Write a program to illustrate UDP sockets.
5	Write a program to Distributed Deadlock Detection using Chandy Haas Misra.
6	Create a SOAP based web service for a simple Java calculator class with operations add and subtract. Also create web service client which consumes web service and displays the result of invoked web service.
7	Write a java program to illustrate multithreaded server where the client send a number to the server and in response to each client, the server should send back the square of the received number.
	Contact Hours : 30
	Total Contact Hours : 60

Course Outcomes: On completion of the course, the students will be able to	
•	Gain knowledge about goals and types of Distributed Systems.
•	Ability to describe Communications and distributed web-based system.
•	Clear knowledge about Distributed objects and File System.
•	Emphasize the benefits of using Distributed Transactions and Concurrency.
•	Gain knowledge about process and Security.

Text Books(s):	
1	Tanenbaum, A. and van Steen, M., "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2007.
2	Coulouris, G, Dollimore, J., and Kindberg, "Distributed Systems: Concepts and Design", Fourth Edition, Addison-Wesley, 2006.

Reference Books:	
1	Pradeep K Sinha," Distributed Operating Systems", Prentice-Hall of India, First Edition, New Delhi, 2001.
2	Jean Dollimore, Tim Kindberg, George Coulouris, "Distributed Systems -Concepts and Design", Pearson Education, Fourth edition, 2005.
3	M.L. Liu," Distributed Computing Principles and Applications", Pearson Education, First edition, 2004.
4	HagitAttiya and Jennifer Welch,"Distributed Computing: Fundamentals, Simulations and Advanced Topics", Wiley, First edition, 2004.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P12.1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS19P12.2	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CS19P12.3	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CS19P12.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS19P12.5	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average	**3**	**2.8**	**2.8**	**2.6**	**2.6**	**2**	**2**	**1.8**	**2.4**	**1.8**	**3**	**2**	**2.8**	**2.4**	**2.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P13	ROBOTICS AND EMBEDDED PROGRAMMING	PE	2	0	2	3

Objectives:	
•	To understand the fundamentals of embedded system.-
•	To understand the fundamentals of robotics
•	To understand the implementation of kinematics in robot
•	To demonstrate the understanding of actuators and sensors and their working principles
•	To demonstrate the concepts of robot with various real time applications

UNIT-I	FUNDAMENTALS OF EMBEDDED SYSTEM	6
Introduction to Embedded System - Embedded Processors - Microcontrollers - Data Processors - INTEL Series Processors - RISC Processors - Digital Signal Processors - UART implementations - DMA Controllers - Real time Operating Systems		
UNIT-II	**FUNDAMENTALS OF ROBOTICS**	**6**
Introduction - Classification - History - Components - Degree of freedom - Joints - Coordinates - Reference frames - Programming modes - Characteristics - work place - language - applications - other robots and applications - social issues		
UNIT-III	**KINEMATICS OF ROBOT**	**6**
Introduction - Robots as mechanisms - Forward and Inverse Kinematics of Robots - Forward and Inverse Kinematic - Equations: Position - Forward and Inverse Kinematic Equations: Orientation - Degeneracy and Dexterity		
UNIT-IV	**ACTUATORS AND SENSORS**	**6**
Introduction - Characteristics - Comparison - Hydraulic actuators - pneumatic devices - Electric Motors Microprocessor control of electric motors - speed reduction - sensor characteristics - sensor utilization - position sensors - velocity sensors - force and pressure sensors - torque sensors - Micro-switches - visible light and infrared sensors - touch and tactile sensors - proximity sensors - range finders - vision sensors - Remote center compliance device		
UNIT-V	**CASE STUDIES**	**6**
Industrial robots - Domestic robots - Medical robots - Entertainment robots - Military robots - Service robots - Space robots - Mobile robots		
	Total Contact Hours : 30	

List of Experiments			
1	Embedded System Based Air Pollution Detector		
2	Automatic College Gate Controller with high-speed Alert		
3	Automatic Bell System for Institutions		
4	Automatic Room Light Controller by sensing visitor counter		
5	Automated irrigation System by detecting soil moisture content		
6	Automated Waste Separator		
7	Materials detection in Exam Hall for Institutions		
8	Pick N Place for materials in laboratories		
9	Programmable Energy Meter for Electrical Load Survey		
10	Attendance System		
11	Spy Robot with Night Vision Wireless Camera for institutions		
12	Smoke and Gas detection Robots in laboratories		
13	Automatic Car Parking System		
14	Password Based Door Lock System for institutions		
15	Head Movement count in buses for Institutions		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes:	
•	Apply the concepts of embedded system for solving real world applications
•	Learn the concepts of robotics fundamentals
•	Analyze the concept of kinematics in robot
•	Implement actuators and sensors for solving real world applications
•	Creation of robot for solving real world applications

Text Book (s):	
1	Steve Heath, "Embedded System Design 2nd Edition", EDN Series for Design Engineers, 2003
2	Saeed Benjamin Niku, "Introduction to Robotics - Analysis, Control, Applications", John Wiley & sons, 2011.

Reference Books(s) / Web links:	
1	Thomas Braunl, "Embedded Robotics", 3rd Edition, Springer, 2008.
2	Ramachandran Nagarajan, "Introduction to Industrial Robotics", Pearson, 2016
3	A.K. Gupta,S.K.Arora, J.R.Westcott, "Industrial Automation and Robotics",3rd Edition, Mercury, 2013
4	Le, Chung Van_ Le, Dac-Nhuong_ Nguyen, Nhu Gia_ Tromp, Jolanda G ," Emerging technologies for health and medicine", John Wiley & sons, 2018.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P13.1	3	2	3	2	2	2	2	2	3	2	2	3	2	3	2
CS19P13.2	3	2	3	3	3	2	3	2	2	1	2	2	2	3	2
CS19P13.3	3	3	3	3	2	2	3	2	2	2	3	3	2	3	2
CS19P13.4	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3
CS19P13.5	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3
Average	**3**	**2.4**	**3**	**2.6**	**2.4**	**2.4**	**2.8**	**2.4**	**2.6**	**2**	**2.6**	**2.8**	**2.4**	**3**	**2.4**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P14	INFORMATION SECURITY AND MANAGEMENT	PE	2	0	2	3

Objectives:	
•	To understand the basics of Information Security and legal and ethical issues in Information Security.
•	To understand the information security policy and concepts of access control.
•	To learn about intrusion detection and prevention techniques and tools.
•	To learn about auditing techniques and tools.
•	To Learn to analyze and validate forensics data

UNIT-I	INTRODUCTION	6
Security Trends, OSI security architecture, Security attacks, security services, security mechanisms, Security System Development Life cycle – Legal, Ethical and Professional issues.		
UNIT-II	**SECURITY ANALYSIS**	**6**
Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk. Blueprint for Information Security - Information Security Policy.		
UNIT-III	**SECURITY TECHNOLOGY**	**6**
Intrusion Detection and Prevention Systems(IDPS)-Terminology-Types-Detection methods.Honeypots,Honeynets and padded cell systems.Scanning and Analysis Tools-Port scanners-Firewall analysis tools,Operating system detection tools-Vulnerability scanners-Packet sniffers-Wireless security tools.		
UNIT-IV	**AUDITING**	**6**
Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment-Case study: Wireshark, FAW		
UNIT-V	**ANALYSIS AND VALIDATION**	**6**
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics. -Case Study: Toolsley		
	Contact Hours : 30	

List of Experiments				
1	Implementation to gather information from any PC‟s connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.			
2	Implementation of Steganography			
3	Implementation of Mobile Audit and generate the report of the existing Artifacts.			
4	Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.			
5	Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.			
6	Perform mobile analysis in the form of retrieving call logs ,SMS log ,all contacts list using the forensics tool like SAFT			
7	Implementation to identify web vulnerabilities, using OWASP project.			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Discuss the basics of information security and legal and ethical issues in Information Security.
•	Analyse the risk management and information security policy.
•	Implement intrusion detection and prevention techniques using different tools.
•	Perform auditing of logs.
•	Analyze and validate forensics data

Text Book(s):	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, Fourth Edition 2011.
2	Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

Reference Book(s)/Web link(s):	
1	Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", CRC Press; 6th Edition, 2007.
2	John R.Vacca, "Computer Forensics", Cengage Learning, 2005
3	MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3 rd Edition, Prentice Hall, 2013.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P14.1	3	2	2	1	1	3	-	3	-	-	-	2	2	1	1
CS19P14.2	3	2	2	2	1	2	2	2	-	-	-	-	2	1	1
CS19P14.3	3	2	2	2	2	2	2	1	-	-	-	2	3	3	3
CS19P14.4	3	2	2	2	3	2	2	2	-	-	-	2	3	3	2
CS19P14.5	3	3	2	2	3	2	2	1	-	-	-	2	3	3	3
Average	**3**	**2.2**	**2**	**1.8**	**2**	**2.2**	**2.0**	**1.8**	-	-	-	**2.0**	**2.6**	**2.2**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Course Code	Course Name (Laboratory Course)	Category	L	T	P	C
CS19P22	Linux System Administration	PE	1	0	4	3

Objectives:	
•	To introduce the key role of an Linux Operating system
•	To understand the File system Management of a Linux Operating system
•	To emphasize the importance of Server Management concepts of an Enterprise Linux Operating system
•	Realize the significance of Software repositories & management and explore the Containerized platform offered by the Linux Operating system
•	Comprehend the need of Security vulnerability in Linux Operating system

List of Experiments		
1	**Introduction** -Introduction to Red Hat Enterprise Linux - 9.x - -RHEl - 9 Installation Procedure	
2	**Accessing Systems and Obtaining Support: -** Edit Text Files from the Shell Prompt - Configuring SSH Key-based Authentication - Getting Help from Red Hat Customer Portal	
3	**Navigating File Systems -** Managing Files Using Command-line Tools - Making Links Between Files	
4	**Managing Local Users and Groups -** Describing User and Group Concepts - Gaining Superuser Access - Managing Local User Accounts - Managing Local Group Accounts - Managing User Passwords	
4	**Controlling Access to Files -** Managing File System Permissions from the Command Line - Managing Default Permissions and File Access	
5	**Managing SELinux Security -** Changing the SELinux Enforcement Mode - Controlling SELinux File Contexts - Adjusting SELinux Policy with Booleans - Investigating and Resolving SELinux Issues	
6	**Tuning System Performance -** Killing Processes - Monitoring Process Activity - Adjusting Tuning Profiles - Influencing Process Scheduling	
7	**Scheduling Future Tasks -** Scheduling Recurring System Jobs - Managing Temporary Files	
8	**Installing and Updating Software Packages -** Installing and Updating Software Packages with DNF - Enabling DNF Software Repositories	
9	**Managing Basic Storage -** Managing Package Module Streams - Adding Partitions, File Systems, and Persistent Mounts - Managing Swap Space	
10	**Controlling Services and the Boot Process -** Identifying Automatically Started System Processes - Controlling System Services	
11	Controlling Services and the Boot Process - Root Password Break - Selecting the Boot Target - Resetting the Root Password - Repairing File System Issues at Boot	
12	Analyzing and Storing Logs - Reviewing Syslog Files- Reviewing System Journal Entries - Preserving the System Journal - Maintaining Accurate Time	
13	**Managing Networking -** Validating Network Configuration - Configuring Networking from the Command Line - Editing Network Configuration Files - Configuring Host Names and Name Resolution	
14	**Accessing Network-Attached Storage -** Managing Network-Attached Storage with NFS - Automounting Network-Attached Storage	
15	**Running containers -** Deploy Containers - Manage Container Storage and Network Manage Container Storage and Network Resources - Managing Containers as System Services	
16	**Managing Network Security -** Managing Server Firewalls	
	Total Hours:	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Identify the need of a Linux Operating system
●	Know the Process management functions of a Linux Operating system
●	Understand the need of Users and Group Management in Linux Operating system
●	Find the significance of Software repositories and management
●	Recognize the essentials of File Management part of a Linux Operating system

	Text Books:
1.	Kenneth Hitchcock, "Linux System Administration for the 2020s: The Modern Sysadmin Leaving Behind the Culture of Build and Maintain", Apress, 2022
Reference Books:	
1.	Scott Alan Miller, "Linux Administration Best Practices: Practical solutions to approaching the design and management of Linux systems", Packt, 2022
2.	Adam K. Dean, "Linux Administration Cookbook: Insightful recipes to work with system administration tasks on Linux", Packt, 2018.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P22.1	3	2	-	-	3	-	-	-	-	-	-	2	3	2	-
CS19P22.2	3	3	2	2	3	-	-	-	-	-	-	2	3	3	-
CS19P22.3	3	2	2	2	3	-	-	2	2	2	-	3	3	2	2
CS19P22.4	3	3	3	2	3	-	2	-	-	-	-	2	3	3	2
CS19P22.5	3	2	2	2	3	2	2	-	-	-	-	2	3	3	2
Average	**3**	**2.4**	**2.3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**-**	**2.2**	**3**	**2.6**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS19P26	IoT: Concepts and Hands-On Applications	PE	1	0	4	3

This course will enable students
• To introduce the terminology, technology and its applications
• To introduce the concept of M2M (machine to machine) with necessary protocols
• To introduce the Python Scripting Language which is used in many IoT devices
• To introduce the Raspberry PI platform, that is widely used in IoT applications
• To introduce the implementation of web-based services on IoT devices

UNIT-I	**Introduction**	**3**
Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.		
UNIT-II	**IoT and M2M**	**3**
Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER		
UNIT-III	**IoT Physical Devices and Controlling Hardware**	**3**
IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C) Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors		
UNIT-IV	**Sensors**	**3**
Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor		
UNIT-V	**IoT Physical Servers and Cloud Offerings**	**3**
Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API		
	Total Contact Hours : 15	

	List of Experiments		
1	Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light.		
2	Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds		
3	Switch on and switch of a DC motor based on the position of a switch.		
4	Convert an analog voltage to digital value and show it on the screen.		
5	Create a door lock application using a reed switch and magnet and give a beep when the door is opened.		
6	Control a 230V device (Bulb) with Raspberry Pi using a relay.		
7	Control a 230V device using a threshold temperature, using a temperature sensor.		
8	Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor).		
9	Create a web application for the above applications wherever possible with suitable modifications to get input and to send output.		
	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**75**

Hardware Requirements:
1. Arduino board, ultrasonic sensor, IR sensor, breadboard, jumper wires. 2. Raspberry Pi
Software Requirements:
1. Jupyter Notebook (Python), Anaconda. 2. Arduino IDE. **3.** MATLAB

Course Outcomes: On completion of the course, the students will be able to
• Understand IoT value chain structure (device, data cloud), application areas and technologies involved.
• Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
• Market forecast for IoT devices with a focus on sensors
• Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi
• Design and analyze IoT servers and application needs.

Textbooks:	
1.	Arshdeep Bahga and Vijay Madisetti, Universities Press, " Internet of Things - A Hands-on Approach", 2015, ISBN: 9788173719547
2.	Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014, ISBN: 9789350239759
3.	Simon Monk, Raspberry Pi Cookbook," Software and Hardware Problems and solutions", O'Reilly (SPD), 2016, ISBN 7989352133895

Reference Books(s):	
1	Peter Waher, "Learning Internet of Things", Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2	Peter Friess,"Internet of Things – From Research and Innovation to Market Deployment", River Publishers, 2014

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P26.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
CS19P26.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
CS19P26.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
CS19P26.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
CS19P26.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	**1.0**	**1.7**	**1.0**	**1.3**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**2.8**	**1.0**	**1.8**	**2.0**	**2.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P15	DATA MINING	PE	2	0	2	3

Objectives:	
•	Introduce the basic concepts of pattern discovery and data preparation
•	Understand the importance of Association and Correlations Algorithms.
•	Understand and apply the concept of various Classifiers.
•	Work with the foundation for Clustering and Outlier Analysis
•	Explore a data mining tool

UNIT-I	DATA MINING INTRODUCTION	7
Introduction: Kinds of Data- Kinds of Patterns-Data Objects and Attribute Type- Data Visualization -Data Preprocessing: Data cleaning, Data Integration, Data Reduction: Attribute Subset Selection-Histograms, Clustering, Sampling, Data Transformation and Data Discretization		
UNIT-II	**ASSOCIATIONS AND CORRELATIONS**	**6**
Basic Concepts- Frequent Item set Mining Methods: Finding Frequent Itemsets by Confined Candidate Generation, Growth Approach for Mining Frequent Item sets, Mining Frequent Itemsets Using Vertical Data Format, Mining Closed and Max Patterns - Pattern Evaluation Methods: Association Analysis to Correlation Analysis		
UNIT-III	**CLASSIFICATION**	**6**
Basic Concepts- Decision Tree Induction-Attribute selection Measures-ID3 and CART algorithms, Tree Pruning-Bayes Classification Methods: Bayes‟ Theorem, Naive Bayesian Classification		
UNIT-IV	**ADVANCED CLASSIFICATION METHODS AND PREDICTION**	**6**
Classification by Back propagation- Support Vector Machines-Lazy learners: kNN-Metrics for evaluating classifier performance-Techniques to improve classification accuracy-Prediction: Regression Analysis		
UNIT-V	**CLUSTER ANALYSIS**	**5**
Cluster Analysis: Partitioning Methods- Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering-Probabilistic Model based Clustering - Outlier Detection.		
	Contact Hours : 30	

List of Experiments				
	WEKA TOOL			
1	Installing Weka and Exploring a dataset.			
2	Loading a Dataset and Visualize the Data			
3	Building a classifier- Run Decision Tree, Naïve Bayesian Classifier, NN classifier and SVM			
4	Forming clusters: Run Clustering algorithms			
5	Mining Association Rules- Run Apriori Algorithm			
	BASIC DATA ANALYSIS USING PYTHON			
1	Exploring Numpy and Pandas packages			
2	Data Wrangling using Pandas			
3	Data manipulation using Pandas			
4	Linear Regression Implementation			
5	K-Means Implementation			
		Contact Hours	**:**	**30**
		Total Contact Hours	**:**	**60**

Course Outcomes:	
On completion of the course, the students will be able to	
⍉	Do the preprocessing of data before mining of data.
⍉	Make use of Association and Correlations Algorithms to perform association mining
⍉	Apply as well as Compare and Contrast the various classifiers.
⍉	Apply Clustering and outlier Analysis and to solve simple Data Mining Problems
⍉	Use the tool to solve various data Mining problems by applying different algorithms

Text Book(s):	
1	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2	Ian H. Witten, Eibe Frank and Mark A. Hall "Data Mining: Practical Machine Learning Tools and Techniques", Fourth Edition, Elsevier,2017.

Reference Book(s)/Web link(s):	
1	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
2	K.P. Soman, ShyamDiwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
3	G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
4	Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.
5	Jason Brownlee "Machine Learning Mastery with Weka"

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P15.01	2	2	2	2	1	-	-	2	-	-	1	2	2	2	1
CS19P15.02	3	2	3	2	1	1	1	-	-	-	1	2	3	3	2
CS19P15.03	3	2	3	2	1	1	1	-	-	-	1	2	3	3	2
CS19P15.04	3	2	3	2	1	1	1	-	-	-	1	2	3	3	2
CS19P15.05	3	2	3	2	3	1	2	2	-	-	1	2	3	3	3
Average	**2.8**	**2**	**2.8**	**2**	**1.4**	**1.0**	**1.25**	**2.0**	**-**	**-**	**1**	**2**	**2.8**	**2.8**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P16	DATA ANALYTICS	PE	2	0	2	3

Objectives:	
•	To introduce Big Data Analytics
•	To brief Hadoop framework
•	To realize storage of big data using Hive and MongoDB
•	To describe the data stream analytics methodologies
•	To narrate various data analytics techniques using R

UNIT-I	INTRODUCTION TO BIG DATA ANALYTICS	4
Introduction to Big Data, Types of Digital Data, Challenges of conventional systems - Analysis Vs reporting - Big Data Analytics – Predictive Analytics – Prescriptive Analytics		
UNIT-II	**HADOOP AND MAP REDUCE**	**7**
Introduction to Hadoop - Distributed Computing Challenges - History of Hadoop, Hadoop Eco System. Hadoop Overview – Use case of Hadoop – Hadoop Distributors – HDFS – Processing Data with Hadoop – Map Reduce - Managing Resources and Applications with Hadoop YARN – Interacting with Hadoop Ecosystem.		
UNIT-III	**NOSQL DATABASES**	**7**
NoSQL - Pig - Introduction to Pig, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators - Hive - Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying – MongoDB - Needs-Terms-Data Types- Query Language – Cassandra -Introduction-Features-Querying Commands		
UNIT-IV	**MINING DATA STREAMS**	**5**
Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real time Analytics Platform(RTAP) applications - case studies – real time sentiment analysis, stock market predictions.		
UNIT-V	**DATA ANALYTICS USING R**	**7**
Regression modelling, Multivariate analysis, Neural networks: learning and generalization, competitive learning, principal component analysis; Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – Frequent pattern based clustering methods – Clustering in Non-Euclidean space – Clustering for streams and Parallelism-Time series analysis- Visualization.		
	Contact Hours : 30	

List of Experiments				
1	Install, configure and run Hadoop and HDFS			
2	Implement word count/frequency programs using MapReduce			
3	Implement a MapReduce program to process a weather dataset			
4	Create UDF (User Defined Functions) in Apache Pig and execute it in MapReduce/HDFS mode			
5	Create tables in Hive and write queries to access the data in the table			
6	Import a JASON file from the command line. Apply the following actions with the data present in the JASON file where, projection, aggregation, remove, count, limit, skip and sort			
7	Implement Linear and Logistic Regression			
8	Implement SVM/Decision tree classification techniques			
9	Implement clustering techniques – Hierarchical and K-Means			
10	Visualize data using any plotting framework			
	Contact Hours	**:**	**30**	
	Total Contact Hours	**:**	**60**	

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the usage scenarios of Big Data Analytics
•	Understand Hadoop framework
•	Store data using Hive and MongoDB
•	Apply Stream Data Model
•	Use various data analytics techniques using R

Text Book(s):	
1	Seema Acharya, SubhashiniChellappan, "Big Data and Analytics" Wiley India; Second Edition, ISBN:978-8126579518
2	Jure Leskovec, AnandRajaraman and Jeff Ullman, “Mining of Massive Datasets”, Cambridge University Press, Third Edition, 2020,ISBN: 978-1108476348
3	James R Evans, “Business Analytics”, Pearson, Second Edition, 2016,ISBN:978-0321997821.
4	V.K. Jain, “Big Data & Hadoop”, Khanna Book Publishing, 2017, ISBN: 978-9382609131
5	Jeeva Jose, “Beginner‟s Guide for Data Analysis using R Programming”, Khanna Book Publishing, First Edition, 2018,ISBN: 978-9386173454

Reference Book(s) / Web link(s):	
1	Jay Liebowitz, “Big Data and Business Analytics”, Auerbach Publications, CRC press, First Edition, 2013, ISBN: 978-1466565784.
2	Tom White, “Hadoop: The Definitive Guide”, Third Edition, O‟Reilly Media, 2012, ISBN: 978-1449311520
3	Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, First Edition, 2012, ISBN: 978-1118208786.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P16.1	3	2	3	2	2	-	-	-	2	2	-	3	3	3	2
CS19P16.2	3	2	3	2	3	-	-	-	2	-	-	3	3	3	3
CS19P16.3	3	2	3	2	3	-	-	-	2	-	-	3	3	1	3
CS19P16.4	3	2	3	2	3	-	-	-	2	-	-	3	3	3	3
CS19P16.5	3	3	3	3	3	-	-	-	2	3	-	3	3	3	3
Average	**3**	**2.2**	**3**	**2.2**	**2.8**	**-**	**-**	**-**	**2**	**2.5**	**-**	**3**	**3**	**2.6**	**2.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P18	DEEP LEARNING CONCEPTS	PE	2	0	2	3

Objectives:	
•	Have a thorough understanding of the fundamentals of machine learning and deep learning.
•	Familiarize with data-preprocessing and feature engineering required for building deep learning models.
•	Understand with the concepts of computer vision along with the required mathematical support.
•	To gain the knowledge required to handle continuous and time-series data.
•	To understand the requirement of reinforcement learning along with its applications.

UNIT-I	INTRODUCTION TO DEEP LEARNING	6
Introduction: History, AI vs ML vs DL, Deep Learning: Hardware, Data and Algorithms - Building blocks of neural networks: Data Representation - Gradient-based Optimization - Stochastic Gradient Descent - Backpropagation - Anatomy of a Neural Network: Layers, Models, Loss Functions and Optimizers.		
UNIT-II	**MODEL IMPROVEMENT AND REGULARIZATION**	**6**
Evaluating Machine learning models - Data Preprocessing, Feature Engineering and Feature Learning - Overfitting and Underfitting - Problems of Overfitting: Regularization, Parameter Sharing, Early Stopping, Trade Off Breadth for Depth, Ensemble Methods - Vanishing and Exploding Gradients in Convergence.		
UNIT-III	**CONVOLUTIONAL NEURAL NETWORKS**	**6**
Introduction to Convnets: Convolution Operation - Max-Pooling Operation - Training a convnet - Data Preprocessing - Data Augmentation - Using pretrainedConvnets. Backpropagating through convolutions - Backpropagation as Convolution with filters, Matrix Multiplications - Data Augmentation.		
UNIT-IV	**RECURRENT NEURAL NETWORKS**	**6**
Introduction - The Architecture of Recurrent Neural Networks - Language Modelling Example of RNN - Generating a Language Sample - Backpropagation Through Time - Bidirectional Recurrent Networks - Multilayer Recurrent Networks - Long Short-Term Memory (LSTM) - Gated Recurrent Units (GRUs).		
UNIT-V	**DEEP REINFORCEMENT LEARNING**	**6**
Introduction - Stateless Algorithms: Naive Algorithm, Epsilon-Greedy Algorithm, Upper Bounding Methods - Reinforcement Learning for Tic-tac-toe - Deep Learning Models as Function Approximators - On Policy Vs Off-Policy Methods - Modelling State Vs State-Action Pairs - Policy Gradient Methods - Monte Carlo Tree Search.		
	Contact Hours : 30	

List of Experiments			
1	Write a python program to build a simple neural network with Keras.		
2	Write a python program to build a Convolutional Neural Network with Keras.		
3	Write a python program to create a Neural Network to recognize handwritten digits using MNIST dataset.		
4	Write a python program to Visualize and design CNN with Transfer Learning.		
5	Write a python program to build a RNN with Keras.		
6	Write a python program to build autoencoders with Keras.		
7	Write a python program to build GAN with Keras.		
8	Write a python program to perform Object detection with YOLO3.		
9	Create a Mini-project in python using CNN.		
10	Create a Mini-project in python using RNN.		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the fundamentals of deep learning based on optimizations and backpropagation and machine learning.
•	Train neural network models that converge well without overfitting.
•	Learn how to improve the deep learning model performance using error analysis, regularization, hyper parameter tuning.
•	Build networks to perform sentiment analysis and work on real-time time series data.
•	Analyse different supervised, unsupervised, and reinforcement deep learning models and their applications in real world scenarios; Build, train, test and evaluate neural networks for different applications and data types.

Text Book(s):	
1	Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer International Publishing AG, part of Springer Nature, First Edition, 2018. ISBN 978-3319944623.
2	Francois Chollet, "Deep Learning with Python ", Manning Publications Company, First Edition, 2017. ISBN 978-1617294433.

Reference Book(s) / Web link(s):	
1	AurélienGéron, "Hands-on Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, Second Edition,2019. ISBN 978-9352139057.
2	Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, First Edition,2017, ISBN 978-0262035613.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P18.01	3	2	2	-	1	-	-	-	-	-	1	1	2	1	1
CS19P18.02	2	2	2	-	2	-	-	-	-	-	1	2	3	2	2
CS19P18.03	3	3	1	3	2	-	-	-	-	-	1	2	2	2	2
CS19P18.04	2	1	3	-	2	1	1	1	-	1	2	3	3	3	3
CS19P18.05	3	1	1	3	2	2	1	1	1	2	3	3	2	3	3
Average	**2.6**	**1.8**	**1.8**	**3.0**	**1.8**	**1.5**	**1.0**	**1.0**	**1.0**	**1.5**	**1.6**	**2.2**	**2.4**	**2.2**	**2.2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P19	COGNITIVE SCIENCE	PE	2	0	2	3

Objectives:	
•	To give an introduction to cognitive science and summary overview of different perspectives.
•	To describe the information processing view of mind, process model, theories of vision and model of attention.
•	To illustrate the memory, models of memory, visual imagery and problem solving.
•	To understand the importance of language, language acquisition and language deprivation.
•	To facilitate the use of analytical models, generic models and remembering

UNIT-I	INTRODUCTION	6
What is Cognitive Science? – Representations: Digital, Analog, The Dual-Coding Hypothesis, Propositional – The Interdisciplinary Perspective: Philosophical Approach, Psychological Approach, Cognitive Approach, Neuroscience Approach, Network Approach, Evolutionary Approach, Linguistic Approach, Artificial Intelligence Approach, Robotics Approach		
UNIT-II	**THE COGNITIVE APPROACH I: HISTORY, VISION, AND ATTENTION**	**6**
The Rise of Cognitive Psychology, The Cognitive Approach: Mind as an Information Processor, Modularity of Mind, Theories of Vision and Pattern Recognition, Template Matching Theory, Feature Detection Theory, A Computational Theory of Vision, Theories of Attention, Broadbent‟s Filter Model, Treisman‟s Attenuation Model, The Deutsch-Norman Memory Selection Model, Theory of Pattern Recognition.		
UNIT-III	**THE COGNITIVE APPROACH II: MEMORY, IMAGERY, AND PROBLEM SOLVING**	**6**
Types of Memory: Sensory Memory, Working , Long-Term Memory, Memory Models: The Modal Model, The ACT* Model, The Working Memory Model and evaluations, Visual Imagery: The, Kosslyn and Schwartz Theory of Visual Imagery, Image Structures, Image Processes, Problem Solving: The General Problem Solver Model, The SOAR Model and its evaluation		
UNIT-IV	**LANGUAGE AND COGNITIVE SCIENCE**	**6**
The Importance of Language, The Nature of Language, Language Use in Primates, Language Acquisition, Language Deprivation, Philosophy and Linguistics, Cognition and Linguistics, Neuroscience and Linguistics		
UNIT-V	**COGNITIVE SCIENCE IN ACTION**	**6**
The vernacular vocabulary of remembering, Neisser‟s paradox and the Ebbinghaus paradigm, The problem of the workings of memory machines, Collective remembering, Individual remembering, Models for the psychology of remembering, Transforming a cognitive model into an artificial intelligence simulation		
	Contact Hours : 30	

List of Experiments			
1	Word / Color relationship using Stroop Experiment		
2	Manipulation by tracking task and target detection task (Dual Task Experiment)		
3	Shape response experiment		
4	Staircase procedure with Memory Span		
5	Recognition of words utilising serial position		
6	Image interaction using mental rotation		
7	Lexical decision experiment		
8	Prisoner's Dilemma experiment in decision making experiment		
9	Experiment based on perception		
10	Visualizing Correlations by measuring Relationships		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the basics of cognitive science and different perspectives.
•	Explain the cognitive approaches on information processing, theories of vision and attention.
•	Enlighten the cognitive approaches on memory model, visual imagery and problem solving.
•	Describe importance of language, linguistics and cognitive science.
•	Comprehend the usage of analytical models, remembering and generic models.

Text Books(s):	
1	Jay Friedenberg and Gordon Silverman, "Cognitive Science: An Introduction to the study of Mind", Sage Publications, 2006.

Reference Books:	
1	Rom Harre, "Cognitive Science: A Philosophical Introduction", Sage Publications, 2002.
2	Paul Thagard, "Mind Introduction to Cognitive Science", A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England, Second Edition,2005.
3	http://nptel.ac.in/
4	https://psych.hanover.edu/javatest/cle/cognition/cognition.html

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P19.1	1	2	-	-	-	-	-	-	-	-	-	1	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
CS19P19.1	1	1	1	1	-	-	-	-	-	-	-	-	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
Average	**1**	**1.8**	**1.75**	**1.75**	**1.0**	**1.0**	**-**	**-**	**1.0**	**-**	**1.0**	**1.0**	**2**	**1**	**1**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19P20	SOCIAL, TEXT AND MEDIA ANALYTICS	PE	2	0	2	3

Objectives:	
•	Learning the fundamentals of Social Network Data Analysis.
•	Analyzing interactions between people, and determine structural patterns in such interactions in real time application
•	Understand the principles for Text Mining
•	Analyzing and Visualization of Relations in Social Networks.
•	Learning and applying Social Network Mining Tools for real time problems.

UNIT-I	BASICS OF SOCIAL NETWORKS		6
Introduction to Social Network Data Analytics, Statistical Properties of Social Networks-preliminary, Static Properties, Dynamic Properties			
UNIT-II	**ALGORITHM**		**6**
Random Walks in Social Networks and their Applications: A Survey-Background-Algorithms-Applications –Evaluation, Random Walk Community Discovery in Social Networks: Introduction – Core Methods.			
UNIT-III	**TEXT ANALYTICS**		**6**
Parts of speech Tagging - Obtaining lexical probabilities - Probabilistic Context Free Grammar- Best First Parsing - A Simple Context Dependent Best First Parser			
UNIT-IV	**ANALYSIS AND VISUALIZATION**		**6**
Node Classification problem formulation, methods, - local classifiers, random based, applying to large social networks Privacy in Social Networks: Visualizing Social Networks.			
UNIT-V	**SOCIAL MEDIA DATA ANALYTICS**		**6**
Social media data mining methods for social media -examples -Text Mining in Social Networks-key word search - classification -cluster -learning heterogeneous networks-Multimedia Information Networks-Ontology Based Learning Links from community media –personal photo albums.			
	Contact Hours	**:**	**30**

List of Experiments			
1	Collect the comments for any post in Tweet and classify the Tweet comments by using Random Forest algorithm		
2	Apply Random Walk Algorithm to identify the insights present in the Medical Sector during a pandemic taking Instagram data as input		
3	Collect the Tweets of a particular Movie and interpret the influence of the Movie providing the Positive/Negative Comments.		
4	Analyze emoticons feedbacks of consumable product and conclude whether to buy a product or not from e-newspaper.		
5	Based upon the counts of share, like, comments for a post in Facebook, analyze and comment the Post		
6	Consider the role of a marketing manager for an apparel software company develop a campaign for LinkedIn target audience		
7	Use Tabuleau to derive decision for knowledge worker from available previous data sets		
8	In a video frame sequence use snapchat to raise trigger to skip horror frames by analysing the video		
9	Create an ontology for news article in English contents that are good/bad to country		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**60**

Course Outcomes: On completion of the course, the students will be able to	
•	Perceive the trends in recent years on online social networks.
•	Draw the graphical relation between the community
•	Know various social network algorithms.
•	Determine the relation between the participants
•	Understand Social Network Mining Tools and apply in real time problems

Text Books(s):	
1	Charu C. Aggarwal,"Social Network Data Analytics",Springer, 2011.
2	Ajith Abraham, Aboul-Ella HassanienV´aclavSn´ a˘sel,, "Computational Social Network Analysis Trends, Tools and Research Advances", Springer, 2010

Reference Book(s) / Web Link(s):	
1	Brian V. Carolan," Social Network Analysis and Education: Theory, Methods & Applications", Kindle Edition,2013
2	Song Yang, Franziska B Keller," Social Network Analysis: Methods and Examples",Kindle Edition,2016

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P20.1	2	-	1	-	2	-	-	-	-	-	-	-	2	-	-
CS19P20.2	2	1	1	2	2	-	-	-	2	-	-	-	2	2	2
CS19P20.3	2	2	2	1	2	-	-	-	2	-	2	-	2	-	-
CS19P20.4	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-
CS19P20.5	-	-	2	-	2	-	-	-	-	1	-	-	-	2	-
Average	**2**	**1.5**	**1.6**	**1.5**	**2**	**-**	**2**	**-**	**2**	**1**	**2**	**-**	**2**	**2**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name	Category	L	T	P	C
CS19P21	Advanced Robotic Process Automation	PE	0	0	6	3

Objectives:	
●	Build an end-to-end process development.
●	Perform UiPath code reviews.
●	Provide RE Framework project support.
●	Create and review project specifications.
●	Add features to the existing automation processes.

List of Experiments			
1.	Build a workflow that uses specific properties of Click, Type Into, and Send Hotkey activities to input data in a Notepad file.		
2.	Build a workflow using Find and Exists activities.		
3.	Build a workflow that checks for books issued to the students and impose a fine if the students have not returned it after a week of the issued date.		
4.	Build a workflow that uses the data of an Excel file to create a Pivot Table and refreshes the Pivot Table after deleting a specific range from the pre-existing data.		
5.	Build a workflow that reads and extracts a scanned PDF using a Read PDF with OCR activity and store the data in an excel file.		
6.	Build a workflow that accesses the email account of the user.		
7.	Build a workflow using Data Scraping wizard that scrapes Whitepaper's details from UiPath Whitepaper website.		
8.	Build a workflow using Invoke PowerShell activity that creates two text files in the project folder and move both the files to a new folder.		
9.	Build a workflow using Python activities to check if the input number is a prime number.		
10.	Project - Vendor Onboarding Process.		
	Contact Hours	**:**	**90**

C**ourse Outcomes:** On completion of the course, students will be able to:	
●	Build a complete automation process from start to finish.
●	Check and improve UiPath automation scripts for better performance.
●	Gain skills in supporting and fixing issues in RE Framework projects.
●	Write and evaluate the requirements for automation projects to ensure they meet the needs.
●	Add new features to improve existing automated systems.

Text Books:	
1.	Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath, Alok Mani Tripathi, Packt Publishing Ltd., 2018.
2.	Democratizing Artificial Intelligence with UiPath, Fanny Ip, Jeremiah Crowley, Packt Publishing Ltd., 2022.
3.	UiPath Administration and Support Guide, Arun Kumar Asokan, Packt Publishing Ltd., 2022.

Reference Books:	
1.	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.
2.	UiPath Associate Certification Guide: The go-to guide to acing your Associate certification exam with the help of mock tests and quizzes, Niyaz Ahmed, Lahiru Fernando, Rajaneesh Balakrishnan, 2022.
3.	RPA Solution Architect's Handbook: Design modern and custom RPA solutions for digital innovation, Sachin Sahgal, Packt Publishing Ltd., 2023.
4.	UiPath RPA Developer Cookbook: Best Practices and Recipes for Success on UiPath, Ronald Vega, 2023.

Matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P21.1	3	3	3	2	3	-	-	-	2	2	2	3	3	3	3
CS19P21.2	3	2	3	3	3	-	-	-	2	2	2	3	3	3	3
CS19P21.3	3	2	3	3	3	-	-	-	3	2	2	3	3	3	3
CS19P21.4	3	3	3	2	3	2	-	-	2	3	3	3	3	3	3
CS19P21.5	3	3	3	3	3	2	2	-	2	3	2	3	3	3	3
Average	**3**	**2.6**	**3**	**2.6**	**3**	**3**	**3**	**-**	**2.2**	**2.4**	**2.2**	**3**	**3**	**3**	**3**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name	Category	L	T	P	C
CS19P23	Advanced Application Development with Oracle APEX	PE	0	0	6	3

Course Objectives:	
●	To provide students with an understanding of Oracle APEX as a platform for rapid application development using Oracle Autonomous Database.
●	To enable students to create, design, and manage database-driven applications with interactive features.
●	To introduce advanced techniques for managing interactive reports, grids, and dynamic data visualization tools like cards and smart filters.
●	To teach students how to enhance applications using dynamic actions, computations, processes, validations, and implement robust security features.
●	To prepare students to handle application lifecycle tasks such as migrating development between environments and managing application data effectively.
List of Experiments	
1.	Setting up the environment and getting started with Oracle APEX.
2.	Exploring SQL Workshop, creating tables, and executing SQL queries.
3.	Creating database application and deploying it on APEX.
4.	Adding and customizing pages and regions in an application.
5.	Creating and formatting reports to visualize data.
6.	Modifying interactive reports to enhance user interaction.
7.	Managing and personalizing interactive grids in an application.
8.	Adding page controls like buttons, list items, and selectors.
9.	Integrating computations, processes, and validations for application logic.
10.	Implementing dynamic actions to enhance user interactivity.
11.	Designing and implementing advanced search and filter options.
12.	Creating interactive forms and connecting them with database tables.
13.	Designing and implementing navigation menus and breadcrumbs.
14.	Customizing application look and feel using themes and styles.
15.	Adding plugins and JavaScript to extend functionality.
16.	Importing, exporting, and managing data within an application.
17.	Implementing security measures like authentication and authorization.
18.	Integrating new pages into the existing application structure.
19.	Deploying and migrating applications across different environments.
Contact Hours	**: 90**

Course Outcomes:	
Upon completing the course, students will be able to:	
●	Demonstrate the ability to use Oracle APEX to create and deploy scalable database applications.
●	Develop and customize pages, regions, forms, and navigation components for a seamless user experience.
●	Integrate interactive reports, grids, dynamic actions, and search functionalities to enhance application interactivity and usability.
●	Apply best practices for securing applications and managing data, including implementing authentication and authorization techniques.
●	Exhibit proficiency in migrating applications between environments and extending their capabilities using themes, plugins, and advanced customization techniques.

Software Requirements:	
1.	Oracle APEX Installation Requirements URL: https://docs.oracle.com/en/database/oracle/apex/24.1/htmig/apex-installation-requirements.html#GUID-02BE4A34-B631-412C-8A82-EB92DABBACE0
2.	Oracle Database Requirements Oracle APEX release 24.1 requires an Oracle Database release 19c or later. APEX runs on all database editions, including Enterprise Edition (EE), Standard Edition (SE), and Oracle Database Free. APEX can be installed in single-instance database and in Oracle Real Application Clusters (Oracle RAC) database.
3.	Browser Requirements Oracle APEX requires a JavaScript-enabled browser and supports the current and prior major release of Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Edge.
4.	Web Server Requirements Oracle APEX requires Oracle REST Data Services (ORDS) 20.x or later. The use of Quick SQL requires Oracle REST Data Services (ORDS) 23.3 or later.
5.	Disk Space Requirement • Free space for APEX software files on the file system: 599 MB if using English only download (apex_24.1_en.zip) and 983 MB if using full download (apex_24.1.zip). • Free space in APEX tablespace: 190 MB • Free space in SYSTEM tablespace: 125 MB • Free space in APEX tablespace for each additional language (other than English) installed: 60 MB
6.	Oracle XML DB Requirement Oracle XML DB must be installed in the Oracle database that you want to use if you are installing a full development environment. If you are using a preconfigured database created either during an installation or by Database Configuration Assistant (DBCA), Oracle XML DB is already installed and configured.
7.	Free APEX Workspace URL: https://apex.oracle.com/pls/apex/r/apex/quick-sign-up/request-workspace
8.	Run APEX in a Virtual Machine URL: https://www.oracle.com/database/technologies/databaseappdev-vm.html

Text Books:	
1.	Oracle APEX: The Essentials, Patrick Cimolini, Packt Publishing, 1st Edition, 2020.
2.	Pro Oracle Application Express, John Scott and Scott Spendolini, Apress, 2nd Edition, 2021
3.	Oracle APEX Cookbook, Marcel van der Plas, Packt Publishing, 3rd Edition, 2019.

Reference Books:	
1.	Beginning Oracle Application Express, Rick Greenwald, Apress, 1st Edition, 2022.
2.	Oracle APEX Best Practices, Alex Nuijten, Iloon Ellen-Wolff, Learco Brizzi, Packt Publishing, 1st Edition, 2016.
3.	Oracle Database 19c and 21c New Features, Bert Scalzo, Mukesh Sharma, Oracle Press (McGraw Hill), 1st Edition, 2021.
4.	Oracle Application Express for Beginners: A Hands-on Approach, Riaz Ahmed, Independently Published, 1st Edition, 2020.
5.	Advanced Oracle PL/SQL Developer's Guide, Saurabh K. Gupta, Packt Publishing, 3rd Edition, 2019.

Websites:	
1.	Oracle APEX Official Documentation URL: https://docs.oracle.com/en/database/oracle/application-express/index.html
2.	Oracle APEX Community URL: https://apex.oracle.com/community/
3.	Oracle APEX Tutorials on Oracle Learning Library URL: https://apex.oracle.com/en/learn/

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P23.1	3	2	2	1	3	-	2	-	1	2	1	3	3	2	2
CS19P23.2	3	3	3	2	3	1	2	1	2	3	2	3	3	3	3
CS19P23.3	2	3	3	2	3	1	1	1	2	3	2	3	3	3	2
CS19P23.4	3	2	2	3	2	3	3	3	2	2	3	3	2	2	3
CS19P23.5	3	2	3	3	3	1	2	2	2	3	3	3	3	3	3
Average	**2.8**	**2.4**	**2.6**	**2.2**	**2.8**	**1.5**	**2**	**1.8**	**1.8**	**2.6**	**2.2**	**3**	**2.8**	**2.6**	**2.6**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name	Category	L	T	P	C
CS19P24	Introduction to Modern Databases with MongoDB	PE	0	0	6	3

Course Objectives:	
●	To introduce the fundamental concepts of modern general-purpose databases and distinguish between relational and non-relational database systems.
●	To provide practical exposure to MongoDB's features, architecture, and developer ecosystem, including MongoDB Atlas.
●	To enable students to design, query, and manipulate complex data using MongoDB Query Language (MQL) and aggregation frameworks.
●	To develop skills in data modeling, indexing, sharding, and implementing transactions in MongoDB for scalable and efficient database applications.
●	To explore the integration of MongoDB with modern application development through drivers, connectors, and real-time capabilities like change streams.
	List of Experiments
1.	Exploring the Features of a Modern General-Purpose Database.
2.	Comparing Relational and Non-Relational Databases through Practical Examples.
3.	Demonstrating Different Types of Non-Relational Databases.
4.	Identifying Scenarios for Using Non-Relational Databases.
5.	Understanding the Document Model and Getting Started with MongoDB.
6.	Building Applications Using MongoDB as a Developer Data Platform.
7.	Investigating MongoDB's Architecture with Hands-On Exploration.
8.	Managing Databases in the Cloud Using MongoDB Atlas.
9.	Writing Queries in Relational and Non-Relational Databases.
10.	Crafting Queries Using MongoDB Query Language (MQL)
11.	Querying Complex Data Structures in MongoDB Using MQL.
12.	Applying Operators and Compound Conditions in MongoDB Queries.
13.	Inserting and Updating Documents in MongoDB Collections.
14.	Deleting Data Efficiently in MongoDB Collections.
15.	Exploring the MongoDB Aggregation Framework.
16.	Using the Aggregation Framework to Query Data in MongoDB.
17.	Designing Data Models and Schema Patterns in MongoDB.
18.	Implementing Sharding to Distribute Data Across Multiple Nodes in MongoDB.
19.	Optimizing Query Performance with Indexing in MongoDB.
20.	Implementing Transactions in MongoDB for Multi-Document Operations.
21.	Real-Time Data Streams with Change Streams in MongoDB.
22.	Integrating MongoDB with Applications Using Drivers, Connectors, and Exploring the Ecosystem.
	Contact Hours : 90

Course Outcomes:	
Upon completing the course, students will be able to:	
●	Differentiate between relational and non-relational databases and identify scenarios for the use of modern database systems.
●	Utilize MongoDB to build, query, and manage databases effectively using MQL and aggregation techniques.
●	Design and implement optimized schemas and data models, leveraging indexing and sharding for performance and scalability.
●	Demonstrate the ability to handle transactions, manage data integrity, and perform real-time data streaming using MongoDB's advanced features.
●	Integrate MongoDB with various application platforms using drivers and connectors to build robust, data-driven solutions.

Text Books:	
1.	MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, O'Reilly Media, 3rd Edition,

	2019.
2.	Modern Database Management, Jeffrey A. Hoffer, Ramesh Venkataraman, Heikki Topi, Pearson, 13th Edition, 2020.
3.	Mastering MongoDB 6.x: Expert techniques to build scalable and high-performance databases, Alex Giamas, David S. Guttman, Packt Publishing, 2nd Edition, 2022.

Reference Books:	
1.	Data Modeling for MongoDB: Building Well-Designed and Supportable MongoDB Databases, Steve Hoberman, Technics Publications, 1st Edition, 2014.
2.	Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design, Michael J. Hernandez, Addison-Wesley Professional, 4th Edition, 2023.
3.	MongoDB Applied Design Patterns, Rick Copeland, O'Reilly Media, 1st Edition, 2013.
4.	The MongoDB Workshop: Learn how to develop and deploy real-time database-driven applications, Matt Zand, Joel Sammut, Tanay Pant, Packt Publishing, 1st Edition, 2020.
5.	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage, Martin Fowler, Addison-Wesley, 1st Edition, 2012.
Websites:	
1.	MongoDB Official Documentation URL: https://www.mongodb.com/docs/
2.	MongoDB University URL: https://university.mongodb.com/
3.	MongoDB Blog URL: https://www.mongodb.com/blog/

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P24.1	3	3	2	2	3	-	-	-	-	-	-	2	3	2	1
CS19P24.2	2	3	2	3	3	-	-	-	-	1	-	2	3	2	2
CS19P24.3	3	3	3	3	3	-	2	-	-	-	-	2	3	3	3
CS19P24.4	2	3	3	3	3	-	2	1	-	1	1	2	3	3	3
CS19P24.5	3	2	3	3	3	-	1	-	2	3	2	3	3	2	3
Average	**2.6**	**2.8**	**2.6**	**2.8**	**3**	**-**	**1.7**	**1**	**2**	**1.7**	**1.5**	**2.2**	**3**	**2.4**	**2.4**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CS19P27	Data Analytics and Insights in MindSphere	PE	1	0	4	3

Course Objectives:
• To Understand MindSphere Architecture
• To Analyze data visualization and management in Mindsphere
• To Develop mindsphere application
• To Apply the Security and integration in Mindsphere
• To develop Final Project using Mindsphere kit

UNIT-I	**Introduction to IoT and MindSphere**	**3**
Understanding IoT, MindSphere architecture, and its components, Research and present examples of IoT applications in various industries, Exploring MindConnect devices and connectivity options, Set up a simulated device and establish its connection to MindSphere.		
UNIT-II	**Data Management and Visualization**	**3**
Data ingestion, storage, and basic visualization in MindSphere,Ingest sample data into MindSphere and create basic visualizations, Introduction to MindSphere APIs and development environment,Start building a simple application using MindSphere SDKs.		
UNIT-III	**Advanced Application Development**	**3**
Delving deeper into MindSphere APIs and development tools,Enhance the previously built application with more features or integrations. Understanding data analytics capabilities in MindSphere,Analyze the collected data, derive insights, and present findings.		
UNIT-IV	**Security and Integration**	**3**
Security protocols and compliance considerations in MindSphere,Perform a security assessment and propose improvements in a simulated MindSphere environment,Design an end-to-end IoT solution incorporating MindSphere, considering security measures.		
UNIT-V	**Project and Presentation**	**3**
Work on a final project (e.g., creating an innovative IoT application or solving a specific industry problem using MindSphere), Presentation: Present the project to the class, showcasing the application, findings, or proposed solution.		
	Total Contact Hours :	**15**

List of Experiments			
1	Device Connectivity and Data Ingestion **Objective**: Connect a simulated or physical device to MindSphere and ingest data.		
2	**Data Storage and Model Definition** **Objective**: Organize and store collected data in MindSphere.		
3	Lab 3: Real-Time Data Monitoring Objective: Set up a dashboard for live data monitoring using MindSphere Visual Analyzer.		
4	**Lab 4: Anomaly Detection using Analytical Tools** **Objective**: Apply anomaly detection algorithms on collected data.		
5	**Lab 5: Data Insights and Reporting** **Objective**: Generate actionable insights and reports from the collected data.		
6	**Lab 6: Predictive Maintenance Model Development** **Objective**: Develop a predictive maintenance model for an industrial application.		
7	Lab 7: Data Integration with Third-Party Tools Objective: Integrate MindSphere with external analytical tools for advanced analytics.		
8	**Lab 8: Custom App Development on MindSphere** **Objective**: Create a custom analytics app using Mendix or MindSphere SDK.		
	Contact Hours	:	**60**
	Total Contact Hours	:	**75**

Course Outcomes: On completion of the course, the students will be able to
• Understanding basics of MindSphere Architecture
• Analyze data visualization and management in Mindsphere
• Develop mindsphere application
• Apply the Security and integration in Mindsphere
• Develop Final Project using Mindsphere kit

Textbooks:	
1.	Official Siemens MindSphere Documentation Siemens provides comprehensive online documentation on MindSphere through its MindSphere Academy and MindSphere Documentation Portal.
2.	"Industrial IoT: Challenges, Design Principles, Applications, and Security" by Sabina Jeschke, Christian K. Becker, and others.
3.	Machine Learning for the Internet of Things" by Nuno M. Garcia, Sergio V. Oliveira, and Joao P. Silva — addresses machine learning techniques designed for IoT applications, closely related to the analytics you can perform on MindSphere.

Reference Books(s):	
1	"Data Science for IoT Engineers" by Daniel K. Gardner.
2	"Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst" by Dean Abbott

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP1927.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
CSP1927.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
CSP1927.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
CSP1927.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
CSP1927.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	**1.0**	**1.7**	**1.0**	**1.3**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**2.8**	**1.0**	**1.8**	**2.0**	**2.0**	**1.0**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial High) If there is no correlation, put "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
OCS1901	DATA STRUCTURES USING C	OE	0	0	6	3

Objectives:	
•	To apply the concepts of List ADT in the applications of various linear and nonlinear data structures.
•	To demonstrate the understanding of stacks, queues and their applications.
•	To be able to incorporate various searching and sorting techniques in real time scenarios.
•	To analyze the concepts of tree data structure and understand the implementation of graphs and their applications.
•	To analyze an algorithm and learn the fundamental algorithmic strategies.

List of Experiments				
1	**LINEAR DATA STRUCTURES – LIST**			
	a. Conceptual Understanding: LIST ADT - Arrays, and Linked List. b. Problem solving using LIST concepts c. Competitive Programming tips and techniques in LIST concepts.			
2	**LINEAR DATA STRUCTURES – STACKS, QUEUES**			
	a. Conceptual Understanding: Stack using Arrays and Linked List. b. Conceptual Understanding: Queue using Arrays and Linked List. c. Problem solving using STACK and QUEUE concepts. d. Competitive Programming tips and techniques in STACK and QUEUE concepts.			
3	**SEARCHING AND SORTING**			
	a. Conceptual Understanding: Linear Search and Binary Search. b. Conceptual Understanding: Simple and optimized Sorting Technique c. Problem solving using Searching and sorting techniques. d. Competitive Programming tips and techniques in Searching and sorting concepts.			
4.	**TREE AND GRAPHS**			
	a. Conceptual understanding: Binary Search Tree b. Conceptual understanding: Graph Traversal c. Problem solving using Searching and sorting techniques. d. Competitive Programming tips and techniques in Tree and Graph			
5.	**ALGORITHM ANALYSIS AND DESIGN TECHNIQUES**			
	a. Conceptual Understanding: Analysis of Algorithms b. Problem solving using Brute Force. c. Problem solving using Divide and Conquer Technique. d. Problem solving using Dynamic Programming. e. Competitive Programming tips and techniques in algorithm optimization			
	Total Contact Hours	**:**	**90**	

Course Outcomes: On completion of the course, the students will be able to

•	Analyze the various data structure concepts.
•	Apply the different linear and non-linear data structures to problem solutions.
•	Apply tree and graph algorithms for real world applications.
•	Apply different Sorting, Searching algorithms.
•	Analyze running times of algorithms based on asymptotic analysis and apply different algorithmic approaches to solve problems.

Text Book(s):	
1	Mark Allen Weiss,Data Structures and Algorithm Analysis in C, 2nd Edition, PearsonEducation,1997.
2	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2012.

Reference Books(s) / Web links:	
1	Ellis Horowitz, SartajSahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, University Press, 2008.
2	https://www.hackerrank.com/
3	https://www.geeksforgeeks.org/
4	https://leetcode.com/

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
OCS1901.1	2	2	-	-	-	-	-	-	-	-	-	2	3	2	2
OCS1901.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2
OCS1901.3	3	3	3	3	3	3	2	-	-	-	2	3	3	3	3
OCS1901.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3	2
OCS1901.5	3	3	3	3	3	3	2	-	2	2	2	3	3	3	3
Average	**2.8**	**2.8**	**3**	**3**	**2.6**	**3**	**2**	**-**	**2**	**2**	**2**	**2.4**	**3**	**2.8**	**2.4**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-“

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
OCS1902	OBJECT ORIENTED PROGRAMMING USING JAVA	OE	0	0	6	3

Objectives:	
•	To understand Object Oriented Programming concepts and characteristics of Java.
•	To know the principles of classes, abstraction and inheritance.
•	To create packages, exceptions and usage of strings.
•	To emphasize the Input/output streams and collections classes.
•	To analyze and design algorithms.

List of Experiments			
1	**JAVA FUNDAMENTALS**		
	Concepts and Programs to understand and apply the knowledge of java fundamentals through a. Implementing Data Types b. Using Variables to program simple java applications c. Implementing Arrays to access a greater number of inputs in single variable d. Using Operators to implement arithmetic, logical and relational expressions e. Implementing decision making strategy using Control Statements f. Getting Input to code with Command Line Arguments		
2	**CLASSES AND INHERITANCE**		
	Develop a java project by applying OOPS concepts a. Defining Classes: Methods, Constructors, b. Garbage Collection c. Access Specifiers d. Method Overloading e. Inheritance: Super keyword, this keyword, Method Overriding, f. Abstract Classes – Static Members -Final Method and Class		
3	**PACKAGES, EXCEPTION HANDLING AND STRINGS**		
	Programs to understand and develop concepts of Packages, Interfaces and Strings with Exception Handling a. Crate a java application to demonstrate java existing package b. Create a java project to create and use user defined packages c. Create a java application to include ● Interfaces ● Exceptions to understand and apply Exception Hierarchy – Throwing and Catching Exceptions ● Built-in Exceptions, User defined Exceptions and Stack Trace Elements d. Implement Strings - String Buffer concepts by solving case studies		
4.	**I/O AND COLLECTIONS**		
	a. Implement Input / Output Basics with IO Streams – Byte streams and Character streams b. Create a java application to Read and Write Data from Console c. Create java application to read and write data from file d. Solve case studies to implement Collection Interfaces – Collection Classes.		
5.	**COMPETITIVE PROGRAMMING USING JAVA**		
	a. Conceptual Understanding: Analysis of Algorithms b. Problem solving using Divide and Conquer Technique. c. Problem solving using Dynamic Programming. d. Competitive Programming tips and techniques in algorithm optimization		
	Total Contact Hours	**:**	**90**

Course Outcomes: On completion of the course, the students will be able to	
•	Develop Java programs using OOP principles.
•	Develop Java programs with the concept of inheritance.
•	Build Java applications using exceptions and strings.
•	Develop Java applications using I/O and collections.
•	Analyze and design optimal algorithms

Text Book(s):	
1	Herbert Schildt, ―Java The complete reference, 11th Edition, McGraw Hill Education, 2019
2	Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals, 9th Edition, Prentice Hall, 2012.
3	Kathy sierra, Bert bates – Head First Java: A Brain-Friendly Guide, 2nd Edition,2005.

Reference Books(s) / Web links:	
1	SCJP Sun Certified Programmer for Java 6 Study Guide. McGrawHill, 6th edition,2008.
2	Steven Holzner, ―Java 2 Black book, Dreamtech press, 2006.
3	Timothy Budd, ―Understanding Object-oriented programming with Java, Updated Edition, Pearson Education,1993.
4	Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers, 3rd Edition, Pearson,2014.

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
OCS1902.1	3	3	3	2									3	3	2
OCS1902.2	3	3	3	2									3	3	2
OCS1902.3	3	3	3	3									3	3	3
OCS1902.4	3	3	3	3	3							3	3	3	3
OCS1902.5	3	3	3	3	3		2		2	2	3	3	3	3	3
Average	**3**	**3**	**3**	**2.6**	**3**		**2**		**2**	**2**	**3**	**3**	**3**	**3**	**2.6**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE19211	**PROBLEM SOLVING AND PROGRAMMING IN PYTHON** (with effect from 2021 batch onwards) (Common to AERO, AUTO, BME, BT, CHEMICAL, CIVIL, EEE, ECE, FT, MECH, MCT, R&A)	**ES**	**1**	**0**	**4**	**3**

Objectives:

•	To understandcomputers, programming languages and their generations and essential skills for a logical thinking for problem solving.
•	To write, test, and debug simple Python programs with conditionals, and loops and functions
•	To develop Python programs with defining functions and calling them
•	To understand and write python programs with compound data- lists, tuples, dictionaries
•	To search, sort, read and write data from/to files in Python.

List of Experiments

1.	Study of algorithms, flowcharts and pseudocodes.
2.	Introduction to Python Programming and Demo on Python IDLE / Anaconda distribution.
3.	Experiments based on Variables, Datatypes and Operators in Python.
4.	Coding Standards and Formatting Output.
5.	Algorithmic Approach: Selection control structures.
6.	Algorithmic Approach: Iteration control structures.
7.	Experiments based on Strings and its operations.
8.	Experiments based on Lists and its operations.
9.	Experiments based on Tuples and its operations.
10.	Experiments based on Sets and its operations.
11.	Experiments based on Dictionary and its operations.
12.	Functions: Built-in functions.
13.	Functions: User-defined functions.
14.	Functions: Recursive functions.
15.	Searching techniques: Linear and Binary.
16.	Sorting techniques: Bubble and Merge Sort.
17.	Experiments based on files and its operations.
	Contact Hours : 75

Course Outcomes: On completion of the course, students will be able to:

•	Understand the working principle of a computer and identify the purpose of a computer programming language and ability to identify an appropriate approach to solve the problem.
•	Write, test, and debug simple Python programs with conditionals and loops.
•	Develop Python programs step-wise by defining functions and calling them.
•	Use Python lists, tuples, dictionaries for representing compound data.
•	Apply searching, sorting on data and efficiently handle data using flat files.

1.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, second edition, Updated for Python 3, Shroff/O‟Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2.	Guido Van Rossum and Fred L. Drake Jr, An Introduction to Python - Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books:	
1.	John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3.	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4.	Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.
5.	Charles Dierbach, Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.
6.	Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

Platform Needed:

Python 3 interpreter for Windows/Linux

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19211.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
GE19211.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
GE19211.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
GE19211.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
GE19211.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	**1.8**	**1.6**	**2.2**	**1.6**	**1.8**	**-**	**-**	**-**	**1**	**1**	**1.4**	**1**	**2.4**	**2.4**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

SubjectCode	Subject Name (Laboratory Course)	Category	L	T	P	C
CS19411	**PYTHON PROGRAMMING FOR MACHINE LEARNING** (with effect from 2021 batch onwards) (Common toAERO,AUTO,BME,BT,CHEMICAL,CIVIL,EEE,ECE,FT,MECH,MCT,R&A)	**ES**	**1**	**0**	**4**	**3**

Objectives:	
•	To understand the relationship of the data collected for decision making.
•	To know the concept of principle components, factor analysis and cluster analysis for profiling and interpreting the data collected.
•	To lay the foundation of machine learning and its practical applications.
•	To develop self-learning algorithms using training data to classify or predict the outcome of future datasets.
•	To prepare for real-time problem-solving in data science and machine learning.

List of Experiments			
1.	NumPy Basics: Arrays and Vectorized Computation		
2.	Getting Started with pandas		
3.	Data Loading, Storage, and File Formats		
4.	Data Cleaning and Preparation		
5.	Data Wrangling: Join, Combine, and Reshape		
6.	Plotting and Visualization		
7.	Data Aggregation and Group Operations		
8.	Time Series		
9.	Supervised Learning		
10.	Unsupervised Learning		
11.	Representing Data and Engineering Features		
12.	Model Evaluation and Improvement		
	Contact Hours	**:**	**75**

Course Outcomes:	
On completion of the course, the students will be able to:	
•	Develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
•	Use appropriate packages for analysing and representing data.
•	Analyze and perform an evaluation of learning algorithms and model selection.
•	Compare the strengths and weaknesses of many popular machine learning approaches.
•	Apply various machine learning algorithms in a range of real-world applications.

Text Books:	
1.	Wes McKinney, Python for Data Analysis - Data wrangling with pandas,Numpy, and ipython, Second Edition, O‟Reilly Media Inc, 2017.
2.	Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python - A Guide for Data Scientists, First Edition, O‟Reilly Media Inc, 2016.

Reference Books:	
1.	AurélienGéron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O‟Reilly Media Inc, 2019.

Platform Needed:

Python 3 interpreter for Windows/Linux

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19411.1	2	2	2	2	1	-	-	-	1	2	-	1	3	3	3
CS19411.2	2	2	1	1	2	-	-	-	-	-	-	1	2	1	3
CS19411.3	2	3	2	1	2	-	-	-	1	1	-	1	2	3	2
CS19411.4	1	1	1	-	1	-	-	-	-	1	1	-	1	2	3
CS19411.5	3	3	2	3	3	-	-	-	2	1	-	1	2	3	3
Average	**2**	**2.2**	**1.6**	**1.75**	**1.8**	**-**	**-**	**-**	**1.33**	**1.25**	**1**	**1**	**2**	**2.4**	**2.8**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19242	**FUNDAMENTALS OF DATA STRUCTURES USING C** (with effect from 2021 batch onwards for Biomedical Engineering)	**ES**	**3**	**0**	**4**	**5**

Objectives:	
•	To learn the features of C
•	To learn about functions, pointers and structures
•	To explore the applications of linear data structures list
•	To explore the applications of linear data structures stack and queue
•	To learn the basic sorting and searching algorithms and about hashing

UNIT-I	**PROGRAMMING BASICS**		**10**
Structure of a C program – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. Strings - String operations			
UNIT-II	**FUNCTIONS, POINTERS AND STRUCTURES**		**9**
Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Structures and unions - definition – Structure within a structure - Programs using structures.			
UNIT-III	**LINEAR DATA STRUCTURES – LIST**		**9**
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists– applications of lists –Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal)			
UNIT-IV	**LINEAR DATA STRUCTURES – STACKS, QUEUES**		**8**
Stack ADT – Evaluating arithmetic expressions- Balancing Symbols- Queue ADT – circular queue implementation – applications of queues			
UNIT-V	**SORTING, SEARCHING AND HASH TECHNIQUES**		**9**
Sorting algorithms: Insertion sort – Selection sort – Bubble sort – Quick sort – Merge sort – Searching: Linear search – Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing			
	Contact Hours	**:**	**45**

List of Experiments				
1	Programs using I/O statements and expressions.			
2	Programs using decision-making statements			
3	Programs using Arrays and Strings			
4	Programs using Functions			
5	Programs using Structures			
6	Linked list implementation of List			
7	Array implementation of Stack and Queue ADTs			
8	Linked list implementation of Stack and Queue ADTs			
9	Applications of List, Stack and Queue ADTs			
10	Implementation of Searching and Sorting algorithms			
11	Hashing –Linear probing			
		Contact Hours	**:**	**60**
		Total Contact Hours	**:**	**105**

Course Outcomes: On completion of the course, the students will be able to	
•	Formulate simple algorithms and programs using branching and looping.
•	Use arrays, pointers and structures to formulate algorithms and programs.
•	Implement linear data structure operations using C.
•	Suggest appropriate linear data structures for any given data set.
•	Appropriately choose the sorting and searching algorithm for an application and apply hashing concepts for a given problem.

Text Books(s):	
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India, Second Edition, 2015.
2	Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2002

Reference Book(s):	
1	Ellis Horowitz, SartajSahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 2009.
3	ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.
4	Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
5	Ellis Horowitz, SartajSahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2ndEdition, University Press, 2008.
6	Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.

Web Link(s):	
1	https://www.tutorialspoint.com/compile_c_online.php
2	https://www.codechef.com/ide
3	https://www.jdoodle.com/c-online-compiler
4	https://rextester.com/l/c_online_compiler_gcc
5	http://vlabs.iitb.ac.in/vlab/labscse.html
6	https://www.hackerrank.com/
7	https://www.geeksforgeeks.org/
8	https://leetcode.com/

PLATFORM NEEDED:

Hardware: PC with 2 GB RAM, i3 Processor
Software: C compiler for Windows/Linux

CO - PO – PSO matrices of course

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19242.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
CS19242.2	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
CS19242.3	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19242.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19242.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	**1.2**	**1.6**	**2.0**	**1.6**	**1.0**	**-**	**-**	**-**	**1**	**2**	**1.5**	**1.2**	**1.6**	**2.2**	**2**

Note: Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial High) If there is no correlation, put "-"