



RAJALAKSHMI ENGINEERING COLLEGE

An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

CURRICULUM AND SYLLABUS REGULATIONS 2019 CHOICE BASED CREDIT SYSTEM B. TECH. INFORMATION TECHNOLOGY

Vision

- To be a Department of Excellence in Information Technology Education, Research and Development.

Mission

- To train the students to become highly knowledgeable in the field of Information Technology.
- To promote continuous learning and research in core and emerging areas.
- To develop globally competent students with strong foundations, who will be able to adapt to changing technologies.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To provide essential background in Science, basic Electronics and applied Mathematics.

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

PEO 3: To engage the students in life-long learning, and make them to remain current in their profession and obtain additional qualifications to enhance their career positions in IT industries.

PEO 4: To enable the students to implement computing solutions for real world problems and carry out basic and applied research leading to new innovations in Information Technology (IT) and related interdisciplinary areas.

PEO 5: To familiarize the students with the ethical issues in engineering profession, issues related to the worldwide economy, nurturing of current job related skills and emerging technologies.

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.
- PO4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To comprehend and analyze user requirements to design IT based solutions

PSO 2: To identify and assess current technologies and review their applicability to address individual and organizational needs.

PSO 3: To engage in the computing profession by working effectively and utilizing professional skills to make a positive contribution to society.

PSO 4: To take on positions as promoters in business and embark on a research career in the field.

CURRICULUM

B.Tech. INFORMATION TECHNOLOGY Regulations 2019 | Total Credits: 163

SEMESTER I								
SL. 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								
SL. 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.	IT19241	Data Structures Fundamentals	PC	7	3	0	4	5
LABORATORY COURSES								
6.	GE19121	Engineering Practices-Civil & Mechanical	ES	2	0	0	2	1
NON CREDIT COURSES								
7.	MC19101	Environmental Science and Engineering	MC	3	3	0	0	0
TOTAL				30	17	3	10	22

SEMESTER III								
SL. 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.	IT19301	Digital Electronics	ES	4	3	0	0	3
3.	IT19302	Software Engineering Essentials	PC	3	3	0	0	3
4.	IT19303	Advanced Data Structures	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
5.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4
6.	IT19341	Introduction to OOP and Java	PC	7	3	0	4	5
NON CREDIT COURSES								
7.	MC19301	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0
TOTAL				29	21	1	6	22

SEMESTER IV								
SL. 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.	IT19401	Computer Organization	PC	3	3	0	0	3
3.	GE19304	Fundamentals of Management for Engineers	HS	3	3	0	0	3
4.	GE19301	Life Science for Engineers	BS	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
5.	IT19441	Operating System Design	PC	7	3	0	4	5
6.	CS19443	Database Management Systems	PC	7	3	0	4	5
LABORATORY COURSES								
7.	GE19421	Soft Skills-I	EEC	2	0	0	2	1
TOTAL				29	19	1	10	24

SEMESTER V								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	IT19501	Automata Theory & Compiler Design	PC	4	3	1	0	4
2.	EC19505	Analog and Digital Communication	ES	3	3	0	0	3
3.		Open Elective –I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	IT19541	Web Technology	PC	5	3	0	2	4
5.	CS19541	Computer Networks	PC	7	3	0	4	5
6.	EC19443	Principles of Microprocessors and Microcontroller	ES	7	3	0	4	5
LABORATORY COURSES								
7.	IT19521	Open Source Programming and Tutorial Lab	PC	4	0	0	4	2
8.	GE19521	Soft Skills-II	EEC	2	0	0	2	1
TOTAL				35	18	1	16	27

SEMESTER VI								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-I	PE	4	2	0	2	3
2.		Open Elective –II	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	IT19641	Mobile Communication	PC	5	3	0	2	4
4.	IT19642	Cryptography and Information Security	PC	5	3	0	2	4
5.	IT19643	Artificial Intelligence and Machine Learning	PC	5	3	0	2	4
6.	IT19644	Innovation and Design Thinking for Information Technology	EEC	5	3	0	2	4
LABORATORY COURSES								
7.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				29	17	0	12	23

SEMESTER VII								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-II	PE	3	3	0	0	3
2.		Professional Elective-III	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	IT19741	Cloud and Big Data Analytics	PC	7	3	0	4	5
LABORATORY COURSES								
4.	IT19711	Industry Practices Lab	PC	4	0	0	4	2
5.	IT19712	Project Phase I	EEC	8	0	0	8	4
TOTAL				25	9	0	16	17

SEMESTER VIII								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-IV	PE	3	3	0	0	3
2.		Professional Elective-V	PE	3	3	0	0	3
LABORATORY COURSES								
3.	IT19811	Project Phase II	EEC	12	0	0	12	6
TOTAL				18	6	0	12	12

TOTAL NO. OF CREDITS: 163

OPEN ELECTIVES Offered by IT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	OIT1901	Business Intelligence	OE	3	3	0	0	3
2.	OIT1902	Cyber Security	OE	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

Elective – I								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT19P61	Advanced R and Python Programming	PE	4	2	0	2	3
2.	IT19P62	Game Programming	PE	4	2	0	2	3
3.	IT19P63	Automation Tools	PE	4	2	0	2	3
4.	IT19P64	3D Imaging	PE	4	2	0	2	3
5.	IT19P65	Python for Data Science	PE	4	2	0	2	3
8.	GE19612	Professional readiness for innovation, employability and entrepreneurship	PE	6	0	0	6	3

Elective – II								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT19P71	Embedded and Realtime Systems	PE	3	3	0	0	3
2.	IT19P72	Digital Image Processing	PE	3	3	0	0	3
3.	IT19P73	Wireless communication	PE	3	3	0	0	3
4.	IT19P74	Internet of Things	PE	3	3	0	0	3
5.	IT19P75	Deep Learning Techniques	PE	3	3	0	0	3

Elective – III								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT19P80	Service Oriented Architecture	PE	3	3	0	0	3
2.	IT19P76	Image processing & Vision Techniques	PE	3	3	0	0	3
3.	IT19P77	Computational Linguistics	PE	3	3	0	0	3
4.	CS19P12	Distributed systems	PE	4	2	0	2	3
5.	IT19P78	Software Testing	PE	3	3	0	0	3
6	IT19P79	Comprehension	PE	3	3	0	0	3

Elective – IV								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT19P81	Block Chain Architecture and use cases	PE	3	3	0	0	3
2.	IT19P82	Cyber Forensics	PE	3	3	0	0	3
3.	IT19P83	Data Warehousing and Mining	PE	3	3	0	0	3
4.	IT19P84	Parallel Computing	PE	3	3	0	0	3
5.	IT19P85	Social Networks	PE	3	3	0	0	3

Elective – V								
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1.	IT19P90	Startup Management	PE	3	3	0	0	3
2.	IT19P86	Lateral Thinking Techniques	PE	3	3	0	0	3
3.	IT19P87	Total Quality Management	PE	3	3	0	0	3
4.	IT19P88	Professional Ethics	PE	3	3	0	0	3
5.	IT19P89	Software Project Management	PE	3	3	0	0	3

SUMMARY OF ALL COURSES

B.Tech Information Technology										
S.NO	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3	0	0	3	0	0	0	0	6
2	BS	8	8	4	7	0	0	0	0	27
3	ES	5	9	3	0	8	0	0	0	25
4	PC	0	5	15	13	15	12	7	0	67
5	PE	0	0	0	0	0	3	6	6	15
6	OE	0	0	0	0	3	3	0	0	6
7	EEC	0	0	0	1	1	5	4	6	17
8	MC	0	0	0	0	0	0	0	0	0
	Total	16	22	22	24	27	23	17	12	163

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/taboo 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 course students will be able to	
CO1	Discuss and respond to the listening content.
CO2	Read and comprehend different texts and appreciate them
CO3	Understand structures and techniques of precise writing
CO4	Analyse different genres of communication and get familiarized with new words, phrases, and sentence structures.
CO5	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	“Technical Communication”, Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
2	“Effective Communication Skills”, Kulbushan Kumar, Khanna Publishing House, Delhi.
3	“Communication Skills”, Pushplata, Sanjay Kumar, Oxford University Press.
4	“Practical English Usage”, Michael Swan, Oxford University Press, 1995.

5	“Remedial English Grammar”, F.T. Wood, Macmillan, 2007.
6	“On Writing Well”, William Zinsser, Harper Resource Book, 2001.
7	“Study Writing”, Liz Hamp-Lyons and Ben Heasley, Cambridge University Press, 2006.
8	“Exercises in Spoken English”, Parts I-III, CIEFL, Hyderabad, Oxford University Press.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	-	-	-	-	-	1	-	2	3	1	3	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	2	1	1	-	-	-	1
CO3	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	1
CO4	-	1	-	1	-	-	-	-	-	3	-	2	-	-	-	1
CO5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-	1
CO(Avg)	1.00	1.67	1.00	1.25	1.00	1.00	1.00	1.00	2.00	2.80	1.00	1.75	1.00	-	-	1.00

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 which 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 orthogonalisation.		
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:	
CO1	Apply the concept of Eigenvalues and eigenvectors, diagonalization of a matrix for solving problems.
CO2	Use concepts of basis and dimension in vector spaces in solving problems and to construct orthonormal basis using inner products.
CO3	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
CO4	Apply the techniques of Integration in engineering problems.
CO5	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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	3	3	1	-	-	-	-	2	2	2	3	3	3
CO2	3	3	3	3	2	1	-	-	-	-	-	2	2	3	3	3
CO3	3	3	3	3	3	1	1	-	-	-	2	3	1	2	1	3
CO4	3	3	3	3	3	1	1	-	-	-	1	3	1	2	1	3
CO5	3	3	3	3	2	1	-	-	-	-	1	3	1	2	1	3
CO(Avg)	3	3	3	3	2.6	1	1	-	-	-	1.5	2.6	1.4	2.4	1.8	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 of lubricating 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:					
CO1	Analyze the quality of water practically.				
CO2	Apply the knowledge of electrochemistry on corrosion and its control.				
CO3	Be assertive on types of batteries and fuel cells.				
CO4	Apply the knowledge of different types of polymers in various fields.				
CO5	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", Dhanpat Rai 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 Jayadev Sreedhar, "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. Billmeyer, "Textbook of Polymer Science", 3rd Edition, Wiley. N.Y. 2007.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	3	3	2	3	2	3	2	2	3	1	1	2	2
CO2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	2	1
CO3	3	2	2	2	2	2	1	1	2	1	1	1	1	1	1	2
CO4	3	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
CO5	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
CO(Avg)	2.60	2.00	2.00	1.80	2.00	1.80	1.80	1.20	1.60	1.40	1.20	1.40	1.00	1.00	1.40	1.40

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, Initialisation, 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, Initialisation 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.		
	Structured code writing with:		
2	Small but tricky codes		
3	Proper parameter passing		
4	Command line Arguments		
5	Variable parameter		
6	Pointer to functions		
7	User defined header		
8	Make file utility		
9	Multi file program and user defined libraries		
10	Interesting substring matching / searching programs		
11	Parsing related assignments		
		Contact Hours	: 60
		Total Contact Hours	: 90

Course Outcomes: On completion of the course, the students will be able to	
CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To implement conditional branching, iteration and recursion.
CO3	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO4	To use arrays, pointers and structures to formulate algorithms and programs.
CO5	To 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; 2 nd 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	Yashavant Kanetkar, "Let Us C", BPB Publications, 15 th 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	2	2	2	1	-	-	-	1	2	1	1	2	-	-	-
CO2	1	1	1	1	1	-	-	-	-	-	1	1	1	-	-	-
CO3	1	1	2	1	1	-	-	-	-	-	1	1	1	-	-	-
CO4	2	2	3	2	1	-	-	-	1	-	2	1	1	-	-	-
CO5	2	2	3	2	1	-	-	-	-	-	2	1	1	-	-	-
CO(Avg)	1.40	1.60	2.20	1.60	1.00	-	-	-	1.00	2.00	1.40	1.00	1.20	-	-	-

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 an 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	
CO1	Fabricate electrical and electronic circuits
CO2	Formulate the house wiring
CO3	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	1	-	-	-	-	1	1	2	-	1	-
CO2	3	3	3	2	1	1	2	-	1	1	1	1	2	2	1	-
CO3	3	3	3	3	2	1	2	-	2	2	3	1	2	1	1	1
CO(Avg)	3	3	3	2.33	1.5	1	2	-	1.5	1.5	1.67	1	2	1.5	1	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
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	6
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	6
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	6
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	6
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	6
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		: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1	Understand the functions of the Indian government
CO2	Understand and abide the rules of the Indian constitution.
CO3	Gain knowledge on functions of state Government and Local bodies
CO4	Gain Knowledge on constitution functions and role of constitutional bodies and non-constitutional bodies
CO5	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	Bipan Chandra, “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, “Prabhat Prakashan 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	-	1	1	2	1	-	-	-	-	-	-	1
CO2	-	-	-	-	-	1	1	2	1	-	-	-	-	-	-	1
CO3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1
CO4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1
CO5	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
CO(Avg)	-	-	-	-	-	1.00	1.00	1.40	1.00	-	-	-	-	-	-	1.00

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 arising 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 parallelopeds.		
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 , $\frac{1}{z}$, 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	
CO1	Apply various techniques in solving ordinary differential equations and partial differential equations
CO2	Use the concept of Gradient, divergence and curl to evaluate line, surface and volume integrals.
CO3	Use the concept of Analytic functions, conformal mapping and bilinear transformation.
CO4	Use complex integration techniques to solve Engineering problems.
CO5	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	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	PSO 4
CO1	-	-	-	-	-	1	1	2	1	-	-	-	-	-	-	1
CO2	-	-	-	-	-	1	1	2	1	-	-	-	-	-	-	1
CO3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1
CO4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1
CO5	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
CO(Avg)	-	-	-	-	-	1.00	1.00	1.40	1.00	-	-	-	-	-	-	1.00

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 these 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	PLANE CURVES 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 OF POINTS, LINES AND PLANE SURFACE		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	PROJECTION OF SOLIDS		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 DEVELOPMENT OF 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 PERSPECTIVE PROJECTIONS		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	
CO1	To construct different plane curves and free hand sketching of multiple views from pictorial objects.
CO2	To comprehend the theory of projection and to draw the basic views related to projection of points, lines and planes
CO3	To draw the projection of solids in different views
CO4	To draw the projection of Sectioned solids and development of surfaces of solids
CO5	To 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, 50 th Edition, 2010.
2	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, 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	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	PSO 4
CO1	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
CO(Avg)	2.00	-	-	-	-	-	-	-	-	1.00	-	2.00	-	-	-	-

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 quantumdot 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 -Fibre 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 fibre 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 Helmholtz 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				
CO1	Apply the concepts of electron transport in nanodevices.			
CO2	Analyse the physics of semiconductor devices			
CO3	Analyze the properties of optical materials for optoelectronic applications.			
CO4	Use the concepts of Laser and Fiber optics in communication.			
CO5	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	Jaspri 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, "Physics for Scientists and Engineers", Cengage Learning.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2	2	1	-	1	-	1	1	1	-	1	3	3
CO2	3	3	2	2	3	1	1	1	1	1	1	1	-	1	3	3
CO3	3	3	3	2	3	1	1	1	1	1	1	1	-	1	3	3
CO4	3	3	2	2	3	1	1	1	1	1	1	1	-	1	3	3
CO5	3	3	2	2	3	1	1	1	1	1	1	1	-	1	3	3
CO(Avg)	3	3	2.2	2	2.8	1	0.8	1	0.8	1	1	1	-	1	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
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	
CO1	Analyse DC and AC circuits and apply circuit theorems.
CO2	Realize series and parallel resonant circuits.
CO3	Understand the principles of electrical machines.
CO4	Understand the principles of different types of electronic devices, electrical measuring instruments and

	transducers.
CO5	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 Gabel, “Basic Electrical Engineering”, McGraw Hill Education(India) Private Limited, 2009

CO/PO	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	PS O4
CO1	3	3	2	3	2	1	-	-	-	-	1	2	2	-	1	-
CO2	3	3	2	3	3	1	2	-	-	-	1	2	2	-	1	-
CO3	3	3	2	3	3	2	2	-	-	-	2	2	2	-	2	1
CO4	3	3	2	3	3	2	2	-	-	-	2	2	2	-	2	2
CO5	3	3	2	3	3	2	2	-	-	-	2	2	2	-	2	2
CO(Avg)	3	3	2	3	2.80	1.60	2	-	-	-	1.60	2	3	-	1.60	1.67

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
IT19241	DATA STRUCTURES FUNDAMENTALS	PC	3	0	4	5

Objectives:						
★	To understand the standard and abstract data representation methods.					
★	To understand the memory requirement for various data structures.					
★	To operate on the various structured data.					
★	To understand various data searching and sorting methods with pros and cons.					
★	To understand various algorithmic strategies to approach the problem solution.					

UNIT-I	C PROGRAMMING - A REVIEW	9
Conditional statements – Control statements – Functions – Arrays – Pre-processor - Pointers -Function Pointers – Function with Variable number of arguments-Structures and Unions – Typedef- Structures with pointers -File handling concepts.		
UNIT-II	LINEAR DATA STRUCTURES – LIST	9
Abstract Data Types (ADTs) –Types- List ADT – array-based implementation – linked list implementation – Comparison of sequential and linked organizations– singly linked lists- doubly-linked lists- circularly linked lists— Types: Singly circular linked list- Doubly circular linked List- applications of lists –Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal).		
UNIT-III	LINEAR DATA STRUCTURES – STACKS	9
Stack ADT – Stacks- concept, Primitive operations, Stack Abstract Data Type, Implementation of Stack using array and List , stack operations,- Multiple Stacks, Applications of Stack - Evaluating Postfix expressions-Conversion of Expressions.		
UNIT-IV	LINEAR DATA STRUCTURES – QUEUES	9
Queue ADT – Concept - Realization of Queues Using Arrays and List - circular queue implementation – Advantages of using circular queues - Multi-queues -Double ended Queues – Priority Queue - Array implementation of priority queue -applications of queues.		
UNIT-V	SORTING, SEARCHING AND HASHING	9
Sorting-Types of Sorting-Sorting algorithms: Insertion sort - Selection sort - Shell sort - Bubble sort - Quick sort - Merge sort - Radix sort –Comparison of all Sorting algorithms- Searching: Linear search –Binary Search- Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.		
		Contact Hours : 45

List of Experiments			
1	Pointers		
2	Structures		
3	Array Implementation of List ADT		
4	Linked List Implementation of List ADT		
5	Array Implementation of Stack ADT		
6	Linked List Implementation of Stack ADT		
7	Array Implementation of Queue ADT		
8	Linked List Implementation of Queue ADT		
9	Application of List, Stack and Queue ADT		
10	Array implementation of Circular Queue		
11	Implementation of Searching Techniques		
12	Implementation of Sorting		
13	Implementation of hashing		
		Contact Hours	: 60
		Total Contact Hours	: 105

Course Outcomes: On completion of the course, the students will be able to	
CO1	Understand the concepts of C used for Data representation
CO2	Understand the different Data Structures for representation.
CO3	Describe and implement the Stack, Queue and List structure.
CO4	Implement various sorting and searching Techniques.
CO5	Analyze the problems and to apply suitable algorithm and data structure.

Text Books:	
1	Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, Pearson Education, 1988.
2	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 1997.

Reference Books:	
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Second Edition, Mcgraw Hill, 2002.
2	Reema Thareja, “Data Structures Using C”, Oxford University Press, 2011
3	Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983
4	Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Ed.

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

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	2	2	1	-	-	-	-	-	-	1	-	2	-	2	-
CO2	3	3	2	1	-	-	1	-	-	-	1	-	-		2	2
CO3	3	3	2	1	-	2	-	-	-	-	-	-	-	2	2	-
CO4	3	3	3	2	-	-	1	-	-	-	2	-	-	2	2	2
CO5	2	3	3	3	2	-	-	-	-	-	2	1	2	2	2	2
CO(Avg)	2.80	2.80	2.40	1.60	2.00	2.00	1.00	-	-	-	1.50	1.00	2.00	1.50	2.00	2.00

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&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

CO1	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.
CO2	Able to perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of the joints in roofs, doors, windows and furniture.
CO3	Able to 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
CO4	Able to perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
CO5	Able to perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	1	-	2	1	2	-	1	-	1	3	-	-	-	-
CO2	2	1	1	-	2	1	2	-	1	-	1	3	-	-	-	-
CO3	2	1	1	-	2	1	2	-	1	-	1	3	-	-	-	-
CO4	2	1	1	-	2	1	2	-	1	-	1	3	-	-	-	-
CO5	2	1	1	-	2	1	2	-	1	-	1	3	-	-	-	-
CO(Avg)	2.00	1.00	1.00	-	2.00	1.00	2.00	-	1.00	-	1.00	3.00	-	-	-	-

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	ENVIRONMENTAL 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 about 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-renewableenergy 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 SO ₂ , NO _x , 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	
CO1	Be conversant to utilize resources in a sustainable manner.
CO2	Find ways to protect the environment and play proactive roles.
CO3	Apply the strategies to handle different wastes
CO4	Develop and improve the standard of better living.
CO5	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”, 2 nd edition, 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”, 3 rd edition, Universities Press, 2015.
3	G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, 15 th edition, Cengage Learning India, 2014.
4	Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, 3 rd edition, Oxford University Press, 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	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	PSO 4
CO1	2	1	3	1	1	1	1	1	-	-	-	1	2	-	2	1
CO2	2	1	3	2	2	2	1	1	1	-	2	2	2	1	2	1
CO3	2	1	3	2	2	2	1	1	1	-	2	2	2	1	2	1
CO4	2	1	3	2	2	2	1	1	1	-	2	2	2	1	2	1
CO5	2	1	3	1	1	-	1	-	1	-	-	1	2	-	2	1
CO(Avg)	2.00	1.00	3.00	1.60	1.60	1.75	1.00	1.00	1.00	-	2.00	1.60	2.00	1.00	2.00	1.00

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	Category	L	T	P	C
MA19354	TRANSFORMS AND DISCRETE MATHEMATICS	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 course students will be able to	
CO1	develop skills to construct Fourier series for different periodic functions and to evaluate infinite series.
CO2	solve difference equations using Z – transforms that arise in discrete time systems.
CO3	apply the concepts of logic to test the validity of a program.
CO4	use the counting principles in implementing various programmes.
CO5	apply the concepts and properties of Boolean algebraic structures.

Text Books:	
1	Grewal B.S., "Higher Engineering Mathematics", 44 th Edition, Khanna Publishers, Delhi, 2018.
2	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd.,New Delhi, Second reprint, 2016.
3	Kenneth H.Rosen, "Discrete Mathematics and its Applications", Special Indian edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 7 th edition (2017).

Reference Books / Web links:	
1	Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
2	Glyn James, "Advanced Modern Engineering Mathematics", 4 th Edition, Pearson Education, 2016.
3	Erwin Kreyszig, "Advanced Engineering Mathematics", 10 th Edition, Wiley India, 2015.
4	Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth 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, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 3 rd edition, (2017).

PO/PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P S O 1	PS O2	PS O3	PS O4
MA19354.1	3	3	2	2	1	-	-	-	-	-	-	2	-	-	1	2
MA19354.2	3	3	2	2	1	-	-	-	-	-	-	2	-	-	1	2
MA19354.3	3	3	3	3	3	-	-	-	-	-	2	2	1	-	1	2
MA19354.4	3	3	3	3	1	-	-	-	-	-	2	2	1	-	1	2
MA19354.5	3	3	3	3	3	-	-	-	-	-	2	2	1	-	1	2
Average	3.00	3.00	2.60	2.60	1.80	-	-	-	-	-	2.00	2.00	1.00	-	1.00	2.00

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
IT19301	DIGITAL ELECTRONICS	ES	3	0	0	3

Objectives:	
★	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions.
★	To introduce the methods for simplifying Boolean expressions.
★	To outline the formal procedures for the analysis and design of combinational circuits.
★	To give outline about sequential circuits.
★	To introduce the concept of memories and programmable logic devices.

UNIT I MINIMIZATION TECHNIQUES	9
Boolean postulates and laws – De-Morgan’s Theorem – Principle of Duality – Boolean Expression – Minimization of Boolean expressions — Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Method – Don’t care conditions – Quine – Mc Cluskey Method.	
UNIT II LOGIC GATES	9
Basic and Universal Gates - Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations.	
UNIT III COMBINATIONAL CIRCUITS	9
Introduction to Combinational Circuits – Adder - Subtractor -Multiplexer/ De multiplexer – Decoder – Encoder – Parity Checker – Parity Generator – Code Converters – Magnitude Comparator.	
UNIT IV SEQUENTIAL CIRCUITS	9
Introduction to Sequential Circuits - Latches- Flip-flops – Counters – Shift Registers.	
UNIT V MEMORY DEVICES	9
Classification of memories – Programmable Logic Devices(PLD) – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) - Implementation of Combinational Logic Circuits using ROM, PLA, PAL.	
TOTAL PERIODS: 45	

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Learn different methods used for simplification of Boolean expressions.
CO2	Understand the use of electronic circuits involved in the design of logic gates.
CO3	Design various Combinational digital circuits using logic gates.
CO4	Do the analysis and design of sequential circuits.
CO5	Understand the concept of memory devices and design using PLD.

Text Books:	
1	M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

Reference Books / Web links:	
1	John F.Wakerly, “Digital Design”, Fourth Edition, Pearson/PHI, 2008
2	John.M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2006.
3	Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.
4	Donald P.Leach and Albert Paul Malvino, “Digital Principles and Applications”, 6th Edition, TMH, 2006.
5	Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011
6	Donald D.Givone, “Digital Principles and Design”, TMH, 2003.

CO/ PO	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	PS O4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	1	-	3	-	-
CO(Avg)	3.00	2.60	2.75	2.80	-	-	-	-	-	-	3.00	1.00	3.00	3.00	3.00	-

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
IT19302	SOFTWARE ENGINEERING ESSENTIALS	PC	3	0	0	3

Objectives:	
★	Understand the software development process
★	Determine requirements to develop software
★	Apply modeling and modeling languages
★	Develop correct and robust software products
★	Understand Advanced Engineering Concepts and Tools.

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 requirements - User Requirements, System Requirements - Requirement Specification Documentation - Requirements elicitation and analysis Requirement Discovery- Developing scenario and use case- Requirements Validation and Management	
UNIT-III DESIGN AND CODING	9
System Modeling – Context, Interaction, Structural, and Behavioral - Architectural patterns - Design patterns - Observer – Modeling Data – Data Flow Diagrams Software Implementation Techniques-Coding Practices- Refactoring.	
UNIT-IV TESTING AND QUALITY MANAGEMENT	9
Software Testing – Software testing strategies – Testing Conventional applications – OO Testing - Development testing - Test-driven development - Release testing - User testing - Software maintenance - Software reengineering- Quality management-Software Standards-CMM -ISO 9000 - Six Sigma-Software measurement and metrics.	
UNIT-V ADVANCE SOFTWARE ENGINEERING AND TOOLS	9
Software Reuse – Component Based Software Engineering- Distributed Software Engineering - Aspect Oriented Software Engineering-Scrum and Agile Methodologies-Reverse Engineering-overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modeling tools; testing tools; Configuration management tools-Case Studies.	
TOTAL PERIODS : 45	

Course Outcomes: On completion of the course, the students will be able to	
CO1	Understand the concepts of software life cycle models
CO2	Identifying and Writing functional and non functional requirements
CO3	Design and implement software project
CO4	Testing the developed product
CO5	Understanding reusability and distributed software engineering and tools.

Text Books:	
1	“Software Engineering” by Ian Sommerville, 9 th edition, 2010, Pearson Education.

Reference Books / Web links:	
1	Software Engineering – A Practitioner’s Approach, Roger SPressman, seventh edition, 2010.
2	Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
3	Pankaj Jalote, "CMM in Practice: Processes for Executing Software Projects at Infosys", Addison-Wesley Professional; 1 edition (November 7, 1999).

CO/ PO	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	PS O4
CO1	2	2	3	2	2	2	2	2	2	2	3	2	1	3	-	2
CO2	2	3	1	2	2	1	-	1	1	1	2	-	1	2	-	2
CO3	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1	2
CO4	2	2	3	2	2	2	1	0	2	2	2	1	1	2	1	2
CO5	2	2	2	1	1	1	1	0	2	1	1	1	2	1	-	2
CO(Avg)	2.00	2.20	2.00	1.60	1.60	1.40	1.25	0.80	1.60	1.40	1.80	1.25	1.40	2.00	1.00	2.00

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
IT19303	ADVANCED DATA STRUCTURES	PC	3	0	0	3

Objectives:	
★	To apply the basic queue structure and understand the heaps
★	To demonstrate the concepts of trees and applications
★	To understand and implement the advanced tree structures
★	To understand about the balanced search trees
★	To understand the implementation of graphs and their applications

UNIT-I PRIORITY QUEUES (HEAPS)	9
Introduction – Basic Model of Priority Queue - Binary Heap - Properties of Heap – Operations of Heap - Applications of Priority Queues- Fibonacci Heap - Leftist Heap - Skew Heaps - Binomial Queues- Binomial Queue Structure – Binomial Queue Operation- Implementation of Binomial Queues	
UNIT-II TREE STRUCTURES	9
Binary Tree – Binary tree traversals – Expression Trees – Huffman Codes – Operations in Trees - Binary search tree – Operations in BST – Applications of BST - Balanced Trees - AVL Tree – Operations in AVL Trees – Applications of Trees.	
UNIT-III MULTI WAY TREES	9
M-way Search Trees – Properties - B-Trees – Implementation – B-Trees ADT – B+ Trees – Operations in B+ Trees - Lexical Search Trees – Applications of B Trees	
UNIT-IV BALANCED SEARCH TREE	9
Height Balanced Trees – Weight Balanced Trees – Red Back Trees – Top-Down Balancing of Red Black Trees – Finger Trees – Level Thinking - Splay trees – Operation of Splay Trees – Joining of Balanced Search Tree – Splitting of Balanced Search Tree	
UNIT-V GRAPHS	9
Representation of graph - Graph Traversals - Depth-first and breadth-first traversal -Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra's algorithm –Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms	
TOTAL PERIODS : 45	

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Analyze and implement the various data structure
CO2	Implement the tree and heap structures for solving the real world problems
CO3	Analyze and implement the Multi way search trees
CO4	Structure the balanced search trees
CO5	Implement the traversal and graph algorithms to solve complex problems

Text Books:	
1	Data structures and Algorithm Analysis in C, 2nd Edition, Mark Allen Weiss, Pearson (Chapter 6 & 9).
2.	Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.(Chapter 9,10& 11).

3.	Advanced Data Structures , Peter Brass , First Edition , CamBridge Univeristy Press , 2019. (Chapter 3)
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Reference Books / Web links:	
1	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein , 3 rd Edition
2	C and Data Structures: A Snap Shot oriented Treatise with Live examples from Science and Engineering, NB Venkateswarlu & EV Prasad, S Chand, 2010

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	3	2	2	-	-	-	-	-	-	1	-	2	2	1	-
CO2	3	3	2	3	-	-	1	-	-	-	-	-	-	3	2	-
CO3	1	3	2	3	-	1	-	-	-	-	-	-	1	2	3	-
CO4	2	2	3	2	-	-	-	-	-	-	1	-	2	2	-	-
CO5	2	2	1	3	-	1	1	-	-	-	-	2	-	3	2	2
CO(Avg)	2.20	2.60	2.00	2.60	-	1.00	1.00	-	-	-	1.00	2.00	1.67	2.40	2.00	2.00

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
CS19341	DESIGN AND ANALYSIS OF ALGORITHMS	PC	3	0	2	4

Objectives: The student should be made to:						
★	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: Kruskals 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 Colouring - 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 Greedy 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	
CO1	Analyze the time and space complexity of various algorithms and compare algorithms with respect to complexities.
CO2	Ability to decide and Apply Brute Force and Divide and Conquer design strategies to Synthesize algorithms for appropriate computing problems.
CO3	Ability to decide and Apply Greedy and Dynamic Programming techniques to Synthesize algorithms for

	appropriate computing problems.
CO4	Ability to decide and Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing problems.
CO5	Apply string matching algorithms in vital applications

Text Books:

1	AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2	Ellis Horowitz, Shani, SanguthevarRajasekaran, "Computer Algorithms" Universities Press, Second Edition 2008.

Reference Books:

1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third 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	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	PSO 4
CO1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2	3
CO2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1	2
CO4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1	2
CO5	1	2	2	2	-	-	-	-	-	-	-	1	3	3	1	1
CO(Avg)	2.00	2.75	2.00	2.00	-	-	-	-	-	-	-	1.00	3.00	2.80	1.20	2.00

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 Oriented Theory Course)	Category	L	T	P	C
IT19341	INTRODUCTION TO OOP AND JAVA	PC	3	0	4	5

Objectives:	
★	To understand Object Oriented Programming concepts and fundamentals of Java
★	To know the Principles of classes, inheritance and interface
★	To Learn to create a packages, define exceptions and use strings
★	To develop a java application with Collections and I/O streams
★	To design and build simple application using JDBC

UNIT-I FUNDAMENTALS OF JAVA	9
Introduction to Object Oriented Programming – Basic concepts of OOP - An overview of Java - Java Architecture - Data Types - Variables- Operators -Flow Control Statements-Arrays - Command Line Arguments.	
UNIT-II CLASSES AND INHERITANCE	9
Defining Classes in Java: Member Variables, Object and reference, Constructors, Static Members-Static Block-Access Specifiers.Inheritance:Association,Aggregation,Composition-Super,Final &This Keyword-Types-Interface-Method Overriding-Dynamic Method Dispatch-Cosmic Class- Abstract Class-Garbage Collection.	
UNIT-III PACKAGES, EXCEPTION HANDLING AND STRINGS	9
Packages - Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions, User defined Exceptions. 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 – Wrapper Class-Collection –Hierarchy-Interfaces –Generic Class-Raw Type-Type Erasure-AutoBoxing & UnBoxing-List-Set-Map.	
UNIT-V MULTITHREADING AND JDBC	9
Multithreading: Introduction- Thread Life Cycle- Thread Creation- Thread Synchronization.JDBC:Architecture & Querying with JDBC-Connection-Executing Query& Processing Results-MetaData & Prepared Statement-Event Handling.	
TOTAL PERIODS: 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	Simple applications using database connectivity
15	Develop a mini project for any application using Java Concepts
PERIODS: 60	
Total Contact Hours : 105	
Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Develop Simple Java programs
CO2	Develop Java program with the concepts of inheritance and interfaces.
CO3	Build Java applications using package, exceptions and string.
CO4	Develop Java applications with I/O streams and generics classes
CO5	Develop interactive Java programs using event handling with JDBC.

Text Books:	
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, 2013.

Reference Books / Web links:	
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. McGrawHill, 6 th edition.

CO/ PO	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	PS O4
CO1	3	2	1	0	1	-	-	-	1	-	-	1	1	1	1	3
CO2	3	1	1	0	1	-	-	-	1	-	-	1	2	1	1	3
CO3	3	1	1	0	1	-	-	-	2	-	-	1	2	2	2	3
CO4	3	2	1	0	1	-	-	-	2	-	-	2	3	2	2	3
CO5	3	2	2	2	1	-	-	-	3	1	3	2	3	2	3	3
CO(Avg)	3.00	1.60	1.20	0.40	1.00	-	-	-	1.80	1.00	3.00	1.40	2.20	1.60	1.80	3.00

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:						
★	This course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is the core Indian traditional knowledge system connecting society and nature. Holistic life style of yogic science and wisdom a important in modern society with rapid technological advancements and societal disruptions. The course mainly focuses on introduction to Indian knowledge system, Indian perspective of modern science, basic principles of Yoga and holistic healthcare system, Indian philosophical, linguistic and artistic traditions.					

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

UNIT-I	Introduction to Indian Knowledge System: 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.	6
UNIT-II	Modern Science And Yoga: 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.	6
UNIT-III	Indian Philosophical Tradition: Sarvadarshan/Sadhdharshan – Six systems (dharshans) of Indian philosophy - Nyaya, Vaisheshika, Sankhya, Yoga, Vedanta-Other systems- Chavarka, Jain (Jainism), Boudh (Buddhism) – Case Studies.	6
UNIT-IV	Indian Linguistic Tradition: Introduction to Linguistics in ancient India – history – Phonetics and Phonology – Morphology – Syntax and Semantics-Case Studies.	6
UNIT-V	Indian Artistic Tradition: Introduction to traditional Indian art forms – Chitrakala (Painting), Murthikala / Shilpakala (Sculptures), Vaasthukala, Sthaapathya kala (Architecture), Sangeeth (Music), Nruthya (Dance) and Sahithya (Literature) – Case Studies.	6
		Total Contact Hours
		: 30
Course Outcomes: On completion of the course students will be able to		
CO1	Understand basic structure of the Indian Knowledge System	
CO2	Apply the basic knowledge of modern science and Indian knowledge system in practice	
CO3	Understand the importance Indian Philosophical tradition	
CO4	Appreciate the Indian Linguistic Tradition.	
CO5	Understand the concepts of traditional Indian art forms	

Text Book (s):	
1	V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
2	Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4	Fritzo Capra, Tao of Physics.
5	Fritzo Capra, The Wave of life.
Reference Books(s) / Web links:	
1	VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam.
2	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
3	GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016.
4	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakashan, Delhi 2016.

CO/ PO	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	PS O4
CO1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-	1
CO2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-	2
CO3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-	3
CO4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-	3
CO5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-	3
CO(Avg)	-	-	-	-	-	1.00	1.00	3.00	2.00	-	-	1	-	-	-	2.4

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	Category	L	T	P	C
MA19454	PROBABILITY, STATISTICS AND QUEUEING THEORY	BS	3	1	0	4

Objectives:	
★	To provide the required mathematical support in real life problems.
★	To develop probabilistic models which 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 - $(M/M/1):(GD/\infty/\infty)$, $(M/M/1):(GD/k/\infty)$, $(M/M/c):(GD/\infty/\infty)$, $(M/M/c):(GD/k/\infty)$, - $(M/G/1):(GD/\infty/\infty)$.		
Total Contact Hours		: 60

Course Outcomes:	
On completion of course, students will be able to	
CO1	Apply the basic concepts of probability, one dimensional and two dimensional Random Variables.
CO2	Apply the concept of correlation and regression in real life situation.
CO3	Use the concepts of Testing of Hypothesis for industrial problems.
CO4	Characterize phenomena which evolve with respect to time in a probabilistic manner.
CO5	Characterize features of a queuing system and analyze different queuing models.

Text Books:	
1	Veerarajan T, 'Probability and Statistics, Random Processes and Queueing Theory', Mc Graw Hill, First edition, 2018.
2	Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition, 5 th edition, 2018.
3	Oliver C ibe., "Fundamentals of Applied Probability and Random Processes", 2 nd edition, Academic Press, June 2014

Reference Books / Web links:	
1	Robertazzi, "Computer Networks and Systems: Queueing Theory and performance evaluation", Springer, 3rd Edition, 2013.
2	Taha H.A., "Operations Research", Pearson Education, Asia, 9th Edition, 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, "Schaum's 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	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	PSO 4
CO1	3	3	2	2	1	-	-	-	-	-	-	2	1	-	1	2
CO2	3	3	2	2	1	-	-	-	-	-	-	2	1	-	1	2
CO3	3	3	3	3	2	-	-	-	-	-	2	2	2	-	1	2
CO4	3	3	3	3	3	-	-	-	-	-	1	2	1	-	1	2
CO5	3	3	3	3	2	-	-	-	-	-	2	2	2	-	1	2
CO(Avg)	3.00	3.00	2.60	2.60	1.80	-	-	-	-	-	1.67	2.00	1.40	-	1.00	2.00

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	Category	L	T	P	C
IT19401	COMPUTER ORGANIZATION	PC	3	0	0	3

Objectives: The student should be made to:						
★	To understand the structure, function and characteristics of computer systems.					
★	To understand the design of the various functional units and components of computers.					
★	To identify the elements of modern instructions sets and their impact on processor design.					
★	To explain the function of each element of a memory hierarchy.					
★	To identify and compare different methods for computer I/O.					

UNIT-I	INTRODUCTION	9
Functions and Structure of a computer - Computer architecture Vs organization - Functional components – Performance measures – Von Neumann architecture - Multiprocessors and Multi computers –Addressing modes (Text Book-1: Chapters 1 and 2)		
UNIT-II	INSTRUCTION FORMATS AND BUS STRUCTURES	9
Instructions and Instruction sequencing – Instructions: operations and operands –Bus Organization: Single Bus Organization - Multiple bus organization – Execution of a complete instruction – Hardwired control – Micro programmed control. (Text Book-1: Chapter 2 and 7)		
UNIT-III	PIPELINING	9
Basic concepts – Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations –Case study – UltraSPARC II. (Text Book-1: Chapter 8 and Case study on Processor families)		
UNIT-IV	MEMORY SYSTEM	9
Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance –Associative memories – Secondary storage devices - Memory management requirements – Introduction to Virtual Memory. (Text Book-1: Chapter 5)		
UNIT-V	I/O ORGANIZATION	9
Accessing I/O devices – Programmed Input/output -Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, and USB), I/O devices and processors –RISC - CISC. (Text Book-1: Chapter 4)		
Total Hours		: 45

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Comprehend the basic structure and operation of digital computer system.
CO2	Understand the design of the various functional units and components of computers
CO3	Understand the Hazards and to design and analyse the pipelined control units.
CO4	Evaluate performance of memory systems.
CO5	Understand the IO devices organization.

Text Books:	
1	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.

Reference Books:	
1	David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware / Software interface”, Third Edition, Elsevier, 2005.
2	William Stallings, “Computer Organization and Architecture – Designing for Performance”, Sixth Edition, Pearson Education

3	John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 1998.
4	V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education, 2004.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	-	1	-	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	-	2	1	2	2	-	1	1	-	-	-	-	1	2	2	-
CO4	-	2	1	1	1	-	-	-	-	-	-	-	2	2	-	-
CO5	3	1	-	1	-	-	-	-	-	1	-	-	1	-	-	-
CO(Avg)	3.00	1.50	1.33	1.50	1.50	-	1.00	1.00	-	1.00	-	-	1.20	1.75	2.00	-

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	
GE19304	FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS	HS	3	0	0	3	
Objectives:							
★	To expose the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today’s business firms.						
UNIT-I	Intoduction To Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of management thought. Organization: Types and environmental factors.					9	
UNIT-II	Planning And Decision Making: General Framework for Planning – Planning Process, Types of Plans, Management by Objectives; Decision making and Problem Solving - Steps in Problem Solving and Decision Making.					9	
UNIT-III	Organization And HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization. Human Resource Management & Business Strategy: Talent Management and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.					9	
UNIT-IV	Leading And Motivation: Leadership, Power and Authority, Leadership Styles, Leadership Skills, Leader as Mentor and Coach, Team Leadership. Motivation – Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories – Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.					9	
UNIT-V	Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems. Managing productivity- Cost control- Purchase control- Maintenance control- Quality control- Planning operations. Managing globally- Strategies for International business.					9	
					Total Contact Hours	:	45
Course Outcomes: After completing the course, the Learners should be able to:							
CO1	Understand and apply the basic principles of management.						
CO2	Understand and apply the planning, organizing and control processes.						
CO3	Will be able to understand and design organization as well as manage and develop human resource.						
CO4	Understand various theories related to the development of leadership skills, motivation techniques and team work.						
CO5	Will be able to understand and apply controlling practices in all applications.						
Text Book (s):							
1	Principles of Management, Prakash Chandra Tripathi, Tata McGraw-Hill Education, 2008.						
2	Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.						
Reference Books(s) / Web links:							
1	Essentials of Management, Koontz Kleihrich, Tata Mc – Graw Hill.						

2	Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
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CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO4
CO1	2	2	-	2	-	2	2	2	3	3	3	3	-	3	3	3
CO2	3	2	-	2	-	2	2	2	3	3	3	3	-	3	3	3
CO3	3	2	-	2	-	3	2	3	3	3	3	3	-	3	3	3
CO4	2	3	-	2	-	2	3	2	3	3	3	3	-	3	3	3
CO5	2	3	-	2	-	2	2	2	3	3	3	3	-	3	3	3
CO(Avg)	2.40	2.40	-	2.00	-	2.20	2.20	2.20	3.00	3.00	3.00	3.00	-	3.00	3.00	3.00

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	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					
★	Help students to familiarize with human physiology					
★	Learn about life style diseases and their management					
★	Introduce basic diagnostic aspects					

UNIT-I	OVERVIEW OF CELLS AND TISSUES	9
Introduction to Bacteria, virus, fungi and animal cells. Organisation 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 RELEVANCE	9
Normal range of biochemical parameters, significance of organ function tests, organ donation.		
		Contact Hours : 45

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Classify the living organisms and relate the functions of vital organs
CO2	Demonstrate the importance of balanced diet and plan methods for healthy living
CO3	Analyse the hazards of unhealthy practices and take preventive measures
CO4	Categorise the various life style disorders and recommend ways to manage the common diseases
CO5	Evaluate and interpret biochemical parameters and their significance

Text Books:	
1	1.Diseases of human body , Carol D Tamparo, Marcia A Lewis , Marcia A, Lewis ,EdD, RN, CMA-AC, F.A Davis Company, 2011.
2	Textbook of Medical Biochemistry ,Chatterjea ; Rana Shinde.

Reference Books:	
1	Biology for Engineers, Arthur.T.,Johnson, CRC Press, Taylor and Francis, 2011.

2	Cell Biology and Genetics, Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008.
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Web links	
1	https://nptel.ac.in/courses/122103039/

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2	2
CO2	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2	2
CO3	3	1	2	2	2	3	1	3	1	2	1	3	3	1	2	2
CO4	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2	2
CO5	3	1	2	2	3	3	1	1	1	2	1	3	3	1	2	2
CO(Avg)	3.00	1.00	2.00	2.00	2.20	3.00	1.00	1.40	1.00	2.00	1.00	3.00	3.00	1.00	2.00	2.00

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
IT19441	OPERATING SYSTEM DESIGN	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 of Distributed operating systems.

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	DISTRIBUTED OPERATING SYSTEMS	8
Introduction to Distributed Systems: Distributed systems: Goals Hardware Concepts Software – design- Communication distributed systems: Layered Protocol: ATM Networks client server model - remote procedure call – group communication.		
		Contact Hours : 45

List of Experiments	
1	Installation and Configuration of Linux in a Virtual Machine
2	Basic Linux commands
3	Shell Scripting
4	System calls based Programs

5	Inter-process Communication using Shared Memory			
6	Scheduling algorithms			
7	Producer Consumer Problem Solution using Semaphore			
8	Deadlock Avoidance algorithm			
9	Contiguous Memory Allocation			
10	Page Replacement Algorithms			
11	File Allocation Strategy			
12	Study on Customization of Linux Kernel			
		Contact Hours	:	60
		Total Contact Hours	:	105

Course Outcomes:

On completion of the course, the students will be able to

CO1	Explain the concepts and structures of Operating Systems.
CO2	Design various Scheduling algorithms and methods to avoid Deadlock..
CO3	Compare and contrast various memory management schemes.
CO4	Summarize the concepts of I/O management and design a prototype file system.
CO5	Describe the concepts of Distributed operating systems.

Text Books:

1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John Wiley and Sons Inc., 2012.
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Reference Books:

1	NikolayElenkov, “Android Security Internals : An In-Depth Guide to Android’s Security Architecture, No Starch Press,2015.
2	William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Pearson, 2013.
3	Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.
4	Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”, 1996.
5	D M Dhamdhare, “Operating Systems: A Concept-Based Approach”, Second Edition, Tata McGraw-Hill Education, 2007.
6	Andrew S.Tanenbaum: Distributed Operating System, Prentice Hall International Inc. 1995.

CO/ PO	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2	PS O3	P S O 4
CO1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1	2
CO2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2	2
CO3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2	2
CO4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1	2
CO5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2	2
CO(Avg)	2.00	2.00	1.67	1.00	2.20	-	1.00	1.00	1.40	2.00	2.00	2.00	2.60	2.67	1.60	2.00

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 Oriented Theory Course)	Category	L	T	P	C
CS19443	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5

Objectives:	
★	Understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
★	Construct simple and moderately advanced database queries using Structured Query Language (SQL).
★	Know the importance of functional dependency and normalization, and what role it plays in the database design process.
★	Understand the concept of a database transaction including concurrency control, backup and recovery, and data object locking and handling deadlocks.
★	Work with the foundation for No SQL 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 NORMAL FORMS	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		
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.		
3	Creating an Employee database to set various constraints and subqueries.		
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

CO1	Understand the use of the Relational model, ER diagrams.
CO2	Apply SQL Queries to define and manipulate the database.
CO3	Understand the concept of normalization and apply as a case study
CO4	Understand concurrency control and recovery mechanisms.
CO5	Apply the different models of NoSQL databases.

Text Books:

1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.
2	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

Reference Books:	
1	Ramez Elmasri 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	Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl, "Oracle PL/SQL Programming", 6th edition, Publisher: O'Reill 2014.
5	MongoDB: The Definitive Guide, 3rd Edition, by Kristina Chodorow, Shannon Bradshaw, Publisher: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-	2
CO2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-	2
CO3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1	2
CO4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1	2
CO5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3	2
CO(Avg)	3.33	3.33	3.67	11.00	3.00	-	-	-	2.67	-	2.00	1.67	1.75	3.00	2.50	3.33

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	Category	L	T	P	C
GE19421	SOFT SKILLS-I	EEC	0	0	2	1

Course 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 organisation.

Course Objectives:

The major course objectives are:

- a. To help students break out of shyness.
- b. To build confidence
- c. To enhance English communication skills.
- d. To encourage students’ creative thinking to help them frame their own opinions,

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

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 students 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.
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to	The aim is to do both give feedback to students as well as

		the students on best practices for future benefits	obtain feedback on the course from them.
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Course Learning Outcome:

On successful completion of the course, students should be able to:

1. Be more confident
2. Speak in front of a large audience
3. Be better creative thinkers
4. Be spontaneous
5. Know the importance of communicating in English.

Learning Resources:

Kings Learning work sheets.

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT19501	AUTOMATA THEORY AND COMPILER DESIGN	PC	3	1	0	4

Objectives: Broad objective of this course is to						
★	Learn the design principles of a Compiler					
★	Familiar with the basics of the theory of automata					
★	Understand the various parsing techniques and different levels of translation					
★	Learn intermediate code generation					
★	Learn code optimization strategies and the process of code generation					

UNIT-I	INTRODUCTION TO COMPILER	9
Translators - Compilers and Interpreters - Language processors - The Phases of Compiler – Symbol table – Errors encountered in different phases – Grouping of phases – Compiler Construction tools. (Ref. Book 1: Chapter 1)		
UNIT-II	AUTOMATA THEORY	12
Introduction to Finite Automata - Regular Languages – Operations - Regular Expressions – Recognition of Tokens – Transition Diagrams – Converting Regular Expressions to NFA and to DFA – Minimization of DFA – Lex Tool. (Text Book: Chapter 3)		
UNIT-III	CONTEXT FREE GRAMMARS AND PARSING	15
Context Free Grammars – derivation - parse tree - Top Down Parsing - Recursive Descent Parser Predictive Parser-LL(1) Parser – Bottom up parsing - Shift Reduce Parser – LR parser – SLR – CLR – LALR – YACC Specification. (Text Book: Chapter 4)		
UNIT-IV	SEMANTICS AND RUN TIME ENVIRONMENT	12
Syntax directed translation – S-attributed and L-attributed grammars - applications of SDT - Storage organization and storage allocation strategies – Three address codes – types – Implementation. (Text Book: Chapter 5,6 &7)		
UNIT-V	CODE OPTIMIZATION AND CODE GENERATION	12
Principal Sources of Optimization - Optimization of Basic Blocks –Flow Graphs - Data Flow Analysis of Flow Graphs - DAG representation of basic block – Issues in the design of Code Generation - Generic code generation algorithm - Peephole Optimization. (Text Book: Chapter 8 & 9)		
Contact Hours		: 60 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Learn the major concept areas of language translation and phases of compiler design
CO2	Understand automata theory and use it in token recognition
CO3	Identify the similarities and differences among various parsing techniques and grammar transformation techniques
CO4	Infer knowledge on run time environment and intermediate code.
CO5	Apply various optimization techniques and develop target code.

Text Books:	
1	Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, 2nd Edition, Pearson Education, 2007.

Reference Books:	
1	Michael Sipser. Introduction to the Theory of Computation, PWS Publishing Company.
2	Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
3	Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
4	Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
5	Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	2	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	1	3	3	1	3	-	-	-	-	-	-	1	1	-	-	2
CO3	1	3	3	1	3	-	-	-	-	-	-	1	1	-	-	2
CO4	-	2	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	-	3	3	3	-	-	-	-	-	-	-	1	3	-	-	3
CO (Avg)	1.00	4.33	5.00	5.00	2.00	-	-	-	-	-	-	1.00	1.75	-	-	2.33

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
EC19505	ANALOG AND DIGITAL COMMUNICATION	ES	3	0	0	3

Objectives: Broad objective of this course is to						
★	Understand analog modulation techniques.					
★	Acquire knowledge in digital modulation techniques.					
★	Learn the necessity of data and pulse communication techniques.					
★	Be familiarized with source and Error control coding.					
★	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 - 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	9
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM– Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).		
UNIT-III	DATA AND PULSE COMMUNICATION	9
Data Communication systems, Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).		
UNIT-IV	SOURCE AND ERROR CONTROL CODING	9
Entropy, 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 algorithm.		
UNIT-V	MULTI USER RADIO COMMUNICATION	9
Global System for Mobile Communications (GSM) – Overview of multiple access scheme - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handoff.		
		Contact Hours : 45

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Describe various analog modulation techniques.
CO2	Differentiate various digital modulation techniques employed in communication systems.
CO3	Explain data communication and pulse modulation techniques.
CO4	Analyze Source and Error control coding.
CO5	Demonstrate the multi-user radio communication.

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

Reference Books:	
1	B.Sklar, “Digital Communication Fundamentals and Applications” 2 nd 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”, 3 rd Edition, Prentice Hall of India, 2002.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1
CO2	3	2	2	1	2	1	1	1	1	1	2	1	2	2	1
CO3	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1
CO4	3	3	3	2	2	1	1	1	1	1	2	2	1	1	1
CO5	2	2	1	1	1	2	1	2	2	1	2	1	1	1	1
CO (Avg)	2.60	2.00	1.80	1.20	1.40	1.20	1.00	1.20	1.40	1.20	1.80	1.20	1.20	1.20	1.00

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
IT19541	WEB TECHNOLOGY	PC	3	0	2	4

Objectives: Broad objective of this course is to						
★	To design and create a basic webpage using HTML and Cascading Style Sheets.					
★	To have a basic idea about scripting language JavaScript and build dynamic webpage.					
★	To understand about Bootstrap and JQuery.					
★	To create dynamic web pages using server side scripting.					
★	To gain knowledge to develop Web Application for various field.					

UNIT-I	MARK-UP LANGUAGE AND STYLE SHEET	9
HTML5 – Elements,Attributes-Basic Elements-Lists-Image-Tables – Links – HTML5 control elements – Semantic elements – Audio – Video controls .CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Box Model –Navigation Bar-Dropdowns- Shadows – Text – Transformations – Transitions – Animations.		
UNIT-II	CLIENT SIDE PROGRAMMING	9
The JavaScript Language: Introduction-Syntax-Variables and Data Types-Statements-Operators-Functions-Arrays-Syntax, Accessing elements, objects-properties and methods. Strings- Syntax, Accessing elements, objects-properties and methods. Built-in Objects. Regular Expressions- Introduction-Modifiers-Patterns-Quantifiers-Methods. Validation- Event Handling DHTML with JavaScript.		
UNIT-III	FRONT –END FRAMEWORK	9
Bootstrap: Introduction-History- Grid System-Classes and Structure-Buttons-Button Groups-Forms-Vertical, Horizontal and Inline-Inputs-Input Sizing-Dropdowns-Navigation Bar-Pagination.JQUERY-Introduction-Syntax-Selectors-Events-Effects:Hide and Show-Animation.		
UNIT-IV	SERVER SIDE PROGRAMMING	9
An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Numbers and Math-Form Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- Introduction-MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code.		
UNIT-V	APPLICATION DEVELOPMENT	9
Creation of simple interactive applications - Simple database applications – Multimedia applications - Design and development of information systems – Personal Information System –Information retrieval system – Social networking applications.		
Contact Hours		: 45

List of Experiments	
1	Write a html program for Creation of web site with forms, frames, links, tables etc
2	Design a web site using HTML and DHTML. Use Basic Text Formatting, Images etc.
3	Create a web page with the following using HTML5 (i) To embed an image map in a web page (ii) To fix the hot spots (iii) Show all the related information when the hot spots are clicked.
4	Create a web page with all types of Cascading style sheets.
5	Design a Scientific calculator using Java script.
6	Design a Registration form and validate.
7	Develop a responsive web page using Bootstrap.
8	Design a webpage with Grid System using Bootstrap.

9	Design a webpage with Dropdown, Navigation bar and Pagination.			
10	Design a web page using JQuery selector.			
11	Create a simple web page using JQuery Effects.			
12	Design a web page to calculate the factorial of a given number using PHP.			
13	Create a web page to perform arithmetic operation using PHP.			
14	Program using Regular Expression in PHP.			
15	Develop an any application using PHP with MySQL.			
		Contact Hours	:	60
		Total Contact Hours	:	105

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Construct a basic webpage using HTML and Cascading Style Sheets.
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop a responsive web page.
CO4	Construct simple web pages in PHP and Create simple database applications.
CO5	Design an interactive web-application.

Text Books:	
1	Paul Deitel,Harvey Deitel and Abbey Deite, —Internet and World Wide Web - How to Program, 5th Edition, 2011.
2	Jake Spurlock, ”Bootstrap-Responsive Web Development” Kindle Edition,O’REILLY,2013.
3	Robin Nixon, “Learning PHP, MySQL, JavaScript, CSS & HTML5” Third Edition, O’REILLY, 2014.

Reference Book:	
1	Jeffrey C and Jackson, —Web Technologies A Computer Science Perspectivel, Pearson Education, 2011.

Web Link	
1.	W3SCHOOL.com

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	-	-	3	-	-
CO (Avg)	3.00	2.60	2.75	2.80	-	-	-	-	-	-	3.00	-	3.00	3.00	3.00	-

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
CS19541	COMPUTER NETWORKS	PC	3	0	4	5

Objectives: Broad objective of this course is to
★ 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	To Configuration of Network in Linux Environment.
2	Learning and Assign of IP Address to computers.
3	Implementation of Subnet mask in IP addressing.
4	Write a socket PING program to testing 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 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 routing algorithm using OPNET or NS3 tool.			
14	Simulation of Distance Vector Routing algorithm 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

CO1	Choose the required functionality at each layer for given application.
CO2	Trace the flow of information from one node to another node in the network.
CO3	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
CO4	Monitor the traffic within the network and analyze the transfer of packets.
CO5	Develop real time applications of networks using different tools.

Text Books:

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:

1	William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Education, 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.

Web Link

1.	Website reference: https://realpython.com/python-sockets/
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CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	1	-	3	1	1	1	1	-	1	1	2	1	1	1
CO2	2	2	1	-	2	1	1	-	-	-	2	2	1	1	1	1
CO3	3	3	1	-	3	0	1	-	-	-	2	1	2	3	2	2
CO4	2	3	-	-	3	1	1	1	-	-	2	2	1	2	3	3
CO5	3	2	2	2	3	0	1	1	-	-	3	3	3	3	3	3
CO (Avg)	2.60	2.40	1.25	2.00	2.80	0.60	1.00	1.00	1.00	-	2.00	1.80	1.80	2.00	2.00	2.00

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
EC19443	PRINCIPLES OF MICROPROCESSORS AND MICROCONTROLLER	ES	3	0	4	5

Objectives: Broad objective of this course is to
★ Infer the programming concept by illustrating and elucidating the basic functionalities of 8085.
★ Infer the programming concept by illustrating and elucidating the basic functionalities of 8086.
★ Peruse the knowledge of peripherals and interface various devices with the processor.
★ Infer the programming concept by illustrating and elucidating the basic functionalities of 8051.
★ Peruse the knowledge of microcontroller to interface various devices with it.

UNIT-I	THE 8085 MICROPROCESSOR	9
8085 Architecture - Pin configuration - Instruction Set - Addressing modes – Interrupts - Timing diagram – Assembly Language Programming.		
UNIT-II	THE 8086 MICROPROCESSOR	9
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming –8086 signals – Maximum mode and minimum mode- Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations.		
UNIT-III	PERIPHERALS & INTERFACING	9
Parallel communication interface (8255) – Serial communication interface (8251) – D/A and A/D Interface – Programmable Timer controller (8254) – Keyboard /display controller (8279) – Programmable Interrupt controller (8259) – DMA controller (8237).		
UNIT-IV	MICROCONTROLLER	9
Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports- Timers – Interrupts – Serial communication - Instruction set - Addressing modes - Assembly language programming.		
UNIT-V	INTERFACING MICROCONTROLLER	9
Interfacing – LCD & Keyboard Interfacing – RTC and EEPROM interface using I2C protocol- Stepper Motor, Traffic Light Controller.		
Contact Hours		: 45

List of Experiments	
CYCLE 1 8085 MICROPROCESSOR	
1	Arithmetic and Logical Operations
2	Code Conversion and Searching Operations
3	Parallel interfacing and Timer interfacing
CYCLE 2 8086 MICROPROCESSOR	
4	Arithmetic and Logical Operations
5	Square, Cube, 1's and 2's Complement
6	Code Conversion, Sorting and Searching Operations
7	String manipulation Operation
8	Keyboard & Display, ADC & DAC interfacing

CYCLE 3 8051MICROPROCESSOR			
9	Arithmetic and Logical Operations		
10	Code Conversion		
11	Traffic control interfacing		
12	Stepper Motor control interfacing		
		Contact Hours	: 60
		Total Contact Hours	: 105

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Develop an algorithm and write programs in 8085
CO2	Develop an algorithm and write programs in 8086
CO3	Assess various interfacing devices interfaced with the processor to adapt an application.
CO4	Develop an algorithm and write programs in 8051
CO5	Assess various interfacing devices interfaced with the controller to adapt an application

Text Books:	
1	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Sixth edition, Penram International Publishing, 2012.
2	A.K. Ray, K.M. Bhurchandi, —Advanced Microprocessor and Peripherals, Second edition, Tata McGraw-Hill, 2010.
3	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008. Fifth impression 2011.

Reference Book:	
1	Krishna Kant, Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2011.
2	Kenneth J. Ayala., The 8051 Microcontroller, Third Edition, Thompson Delmar Learning,

Web links for virtual lab:	
1	https://nptel.ac.in/courses/108105102/
2	https://e-box.co.in/micro-processor-and-micro-controller.shtml

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3	3	3	3	2	2	1	2	2	2	2	1	1	1
CO2	1	2	3	3	3	3	2	2	1	2	2	2	2	1	1	1
CO3	1	2	3	3	3	3	2	2	1	2	2	2	2	1	1	1
CO4	3	2	3	3	3	3	2	2	1	2	2	2	2	1	1	1
CO5	1	2	3	3	3	3	2	2	1	2	2	2	2	1	1	1
CO (Avg)	1.80	2.00	3.00	3.00	3.00	3.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00

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
IT19521	OPEN SOURCE PROGRAMMING AND TUTORIAL LAB	PC	0	0	4	2

Objectives: Broad objective of this course is						
★	To learn fundamentals of Python decision making and functions					
★	To understand NumPy array operations					
★	To perform openCV basic applications on images and videos.					
★	Be familiar with Minitab.					
★	To understand basic constructs of R – programming.					

List of Experiments	
1	Python, conditional decision making
2	Exercises based on list, tuple, set, Dictionary
3	Built-in functions, User-defined functions
4	numpy array, basic array operations.
5	Load data with various file extensions (.txt,.docx,.csv,.jpg)
6	Load a data file and perform data cleaning operations (Drop column, Drop row, fill missing data, replace values)
7	Perform data wrangling operations (Sort, Filter, reduce, join, combine and reshape)
8	Perform basic plotting and visualization.
9	Getting Started with Images - cv2.imread(), cv2.imshow() , cv2.imwrite() using Matplotlib.
10	Matplotlib Plotting Styles and Features – Changing Color spaces, object tracking - cv2.cvtColor(), cv2.inRange().
11	Geometric Transformations of Images - like translation, rotation, affine transformation - cv2.getPerspectiveTransform.
12	Concept of Canny edge detection – Canny Edge Detection - cv2.Canny() .
13	Getting Started with Videos - cv2.VideoCapture(), cv2.VideoWriter()
14	Install minitab, opening minitab, entering data, saving and retrieving your data.
15	Basic commands, arithmetic (LET) command.
16	Character graphs, true graphics, pasting into a word.
17	install R-studio, implement basics data structure in R programming(list, vector, factors, data frames, matricesand arrays).
18	Visualizes the data using plots (scatter, box, histogram).
Total Contact Hours: 30	

Software Tools required:

- Anaconda for python 3.9
- Pycharm
- OpenCV python
- Minitab
- RStudio IDE

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Understand openCV and usage of its various functions.
CO2	Apply the basic knowledge of openCV and develop applications.
CO3	Understand and explore the basics knowledge of minitab.
CO4	Apply basic constructs of R.
CO5	Apply machine learning by classification techniques.

CO / P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	-	-	-	-	-	1	-	-	-	3	1	-	3
CO2	3	3	3	2	-	2	-	-	-	-	-	2	2	3	-	2
CO3	3	3	3	2	3	-	-	2	2	-	-	-	-	3	-	3
CO4	3	3	3	-	3	1	-	-	-	-	1	2	2	-	-	-
CO5	3	3	2	3	2	-	-	1	3	-	3	3	3	3	1	3
CO (Avg)	3.00	3.00	2.60	2.33	2.67	1.50	-	1.50	2.00	-	2.00	2.33	2.50	2.50	1.00	2.75

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	Category	L	T	P	C
GE19521	SOFT SKILLS-II	EEC	0	0	2	1

Course 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 organisation.

Course Objectives:

The major course objectives are:

- 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,

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

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
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.

Course Learning Outcome:

On successful completion of the course, students should be able to:

1. Be more confident
2. Speak in front of a large audience without hesitation
3. Think creatively
4. Speak impromptu
5. Communicate in English

Learning Resources:

Kings Learning work sheets.

Subject Code	Subject Name (Lab oriented Theory course)	Category	L	T	P	C
IT19641	MOBILE COMMUNICATION	PC	3	0	2	4

Objectives: Broad objective of this course is						
•	To understand the basic concepts of mobile computing.					
•	To learn the basics of mobile telecommunication system .					
•	To be familiar with the network layer protocols and Ad-Hoc networks.					
•	To know the basis of application layer protocols.					
•	To gain knowledge about different mobile platforms and application development					

UNIT-I	INTRODUCTION	6
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA		
UNIT-II	MOBILE TELECOMMUNICATION SYSTEM	6
Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security		
UNIT-III	MOBILE IP NETWORK AND TRANSPORT LAYER	6
Introduction to Mobile IP: Requirements, IP packet delivery- agent discovery- registration, tunneling and encapsulation- optimization- reverse tunneling; Mobile adhoc networks - routing - destination sequence distance vector - dynamic source routing and alternative metrics; Traditional TCP - congestion control- slow start- fast retransmit - fast recovery- implications of mobility; Classical TCP improvements – methods of mobile TCP: Indirect TCP - snooping TCP - mobile TCP - fast retransmit.		
UNIT-IV	MOBILE APPLICATION LAYER	6
WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML-imod-SyncML-WAP2.0		
UNIT-V	MOBILE PLATFORMS AND APPLICATIONS	6
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues		
Total Contact Hours		: 30

List of Experiments			
1	Develop an application that uses GUI components, Font and Colours		
2	Develop an application that uses Layout Managers and event listeners.		
3	Develop a native calculator application.		
4	Write an application that draws basic graphical primitives on the screen.		
5	Develop an application that makes use of Database.		
6	Implement an application that implements Multi-threading.		
7	Develop a native application that uses GPS location information.		
8	Implement an application that writes data to the SD card		
9	Implement an application that creates an alert upon receiving a message.		
10	Write a mobile application that creates alarm clock		
Contact Hours			: 60
Total Contact Hours			: 90

Course Outcomes:	
On completion of course students will be able to	
•	Explain the basics of mobile telecommunication systems
•	Understand and Illustrate the generations of telecommunication systems in wireless networks
•	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
•	Explain the functionality of the Application layers
•	Develop a mobile application using android/blackberry/ios/Windows SDK

Text Book(s):	
1	Jochen Schiller, —Mobile Communications , PHI, Second Edition, 2003.
2	Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing , PHI Learning Pvt.Ltd, New Delhi – 2012

Reference Books(s):	
1	Dharma Prakash Agarwal, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
2	Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing , Springer, 2003.
3	William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems , Second Edition,TataMcGraw Hill Edition ,2006.
4	C.K.Toh, —AdHoc Mobile Wireless Networks , First Edition, Pearson Education, 2002.
5	Android Developers : http://developer.android.com/index.html
6	Apple Developer : https://developer.apple.com/
7	Windows Phone DevCenter : http://developer.windowsphone.com
8	BlackBerry Developer : http://developer.blackberry.com

CO/P O	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	PSO 4
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	1	-	1	-	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	-	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	-	2	-	1	-	-	-	-	-	-	-	-	1	1	1
CO5	2	1	2	-	2	-	-	-	-	-	-	1	1	1	2	2
CO(Avg)	1.60	1.00	1.60	-	1.50	-	-	-	-	-	-	1.00	1.00	1.00	1.25	1.20

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
IT19642	CRYPTOGRAPHY AND INFORMATION SECURITY	PC	3	0	2	4

Objectives: Broad objective of this course is to learn						
•	Basics of encryption and Number Theory.					
•	Methods of public key encryption.					
•	Authentication and hash functions.					
•	Approaches to Information Security.					
•	Issues in Information Security.					

UNIT-I	INTRODUCTION & NUMBER THEORY	9
Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography)-Finite Fields and Number Theory: Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers- Fermat's and Euler's theorem- Testing for primality -The Chinese Remainder theorem- Discrete logarithms.		
UNIT-II	BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY	9
Data Encryption Standard-Block cipher principles-block cipher modes of operation-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 - Side channel analysis- side channel attacks.		
UNIT-III	HASH FUNCTIONS AND DIGITAL SIGNATURES	9
Authentication requirement – MAC – Hash function – MD5 - SHA - HMAC –Digital signature and authentication protocols – DSS– Blockchain - Case Study: Bitcoin – Ethereum – Zcash.		
UNIT-IV	INTRODUCTION TO INFORMATION SECURITY	8
Components of an Information system – Approaches to Information Security Implementation: The Systems Development Life Cycle - The Security Systems Development Life Cycle – Security Professionals and the Organization – Communities of Interest.		
UNIT-V	LEGAL, ETHICAL AND PROFESSIONAL ISSUES	10
Introduction – Law and Ethics in Information Security – Relevant U.S. Laws – International Laws and Legal Bodies – Ethics and Information Security – Codes of Ethics and Professional Organizations		
Total Contact Hours		45

List of Experiments	
1	Implement the following Substitution and Transposition Techniques: a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher e. Rail fence – row & Column Transformation f. Affine Cipher
2	Implement the following algorithms a. DES b. RSA Algorithm c. Diffie-Hellman d. MD5 e. SHA-1

3	Implement the Digital Signature Algorithm (DSA).	
4	Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).	
5	Setup a honey pot and monitor the honeypot on network (KF Sensor)	
6	Installation of rootkits and study about the variety of options	
7	Perform wireless audit on an access point or a router and decrypt WEP and WPA.(NetStumbler)	
8	Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)	
9	Study of Sniffing and Spoofing attacks.	
10	Study of Techniques uses for Web Based Password Capturing.	
	Contact Hours	: 60
	Total Contact Hours	: 105

Course Outcomes:	
On completion of course students will be able to	
CO1	Apply the methods of conventional encryption and Number Theory.
CO2	Apply the concepts of Public Key Encryption.
CO3	Experiment methodology for Authentication and Hashing.
CO4	Comprehend the approaches of Information security
CO5	Identify the issues in information security.

Text Book(s):	
1	William Stallings , Cryptography and Network Security-Principles and Practices, Seventh Edition, Pearson Education, 2017
2	Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Fourth Edition, Thomson Publishing, India Edition, 2011.
3	Christo Paar and Jan Pelzl ,Understanding Cryptography: A Textbook for Students and Practitioners, First Edition, Springer, 2010
4	Joxean Koret and Elias Bachaalany, The Antivirus Hackers Handbook, First Edition, Wiley, 2015

Reference Books(s):	
1	Yehuda Lindell and Jonathan Katz, Introduction to Modern Cryptography, Second Edition, CRC Press, 2015
2	Bruce Schneier , Applied Cryptography: Protocols, Algorithms and Source Code in C, Special Edition, Wiley, 2015
3	Atul Kahaet, Cryptography and Network Security, Third Edition, Tata McGraw-Hill, 2013
4	Imran Bashir, Mastering Blockchain: Deeper insights into decentralization, cryptography, bitcoin and popular Blockchain frameworks, First Edition, Packt, 2017

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	2	-	2	1	-	-	-	2	2	-	-	1	2
CO2	3	2	-	2	-	2	1	2	-	-	2	1	-	-	1	2
CO3	2	2	-	2	-	2	2	2	-	-	3	2	-	2	2	2
CO4	2	1	-	2	-	2	1	2	1	-	2	2	-	2	2	2
CO5	2	1	-	2	-	2	1	3	1	-	2	2	-	2	2	2
CO(Avg)	2.40	1.60	-	2.00	-	2.00	1.20	2.25	1.00	-	2.20	1.80	-	2.00	1.60	2.00

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
IT19643	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	PC	3	0	2	4

Objectives: Broad objective of this course is						
•	To learn the methods of solving problems using Artificial Intelligence.					
•	To formalise a given problem in the language/framework of different AI methods.					
•	To introduce the concepts of machine learning.					
•	To know the basics of neural networks and other machine learning algorithms.					
•	To familiarize about the Expert Systems					

UNIT-I	INTRODUCTION TO AI AND PRODUCTION SYSTEMS	9
Introduction to AI-Problem formulation, Problem Definition-Production systems, Control strategies, Search strategies- Problem characteristics, Production system characteristics-Specialized productions system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.		
UNIT-II	KNOWLEDGE REPRESENTATION AND INFERENCE	9
Game playing, Knowledge representation using Predicate logic and calculus, Structured representation of knowledge- Production based system, Frame based system, Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.		
UNIT-III	MACHINE LEARNING BASICS	9
Learning – Designing a learning system, Perspectives and issues in machine learning, Concept Learning – as task, as search. Types of Machine Learning – Supervised Learning- Regression, Classification. Testing Machine Learning Algorithms- Over fitting, Training, Testing and Validation Sets, The confusion Matrix, Accuracy Metrics, ROC Curve, Unbalanced Datasets, Measurement Precision.		
UNIT-IV	NEURAL NETWORKS	9
The Brain and the Neuron – Neural Networks –The Perceptron- Linear Separability- Linear Regression-Examples. Unsupervised Learning- The K-means algorithm-Vector Quantization- The self organizing feature map.		
UNIT-V	EXPERT SYSTEMS	9
Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.		
Total Contact Hours		45

List of Experiments	
1	Study of Prolog.
2	Write simple fact for the statements using PROLOG.
3	Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4	Write a program to solve the Monkey Banana problem.
5	WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
6	Write a program to solve 4-Queen problem.

7	Write a program to solve traveling salesman problem.		
8	Write a program to solve water jug problem.		
9	Write a python program to implement linear regression.		
10	Write a python program for ML classification algorithms a. Logistic Regression b. Decision Tree		
11	Write a python program to implement a. K-Nearest Neighbor algorithm b. SVM		
12	Write a python program to implement a simple Neural Network.		
	Platforms: Prolog, Anaconda, PyCharm		
		Contact Hours	: 30
		Total Contact Hours	: 75

Course Outcomes:	
On completion of course students will be able to	
CO1	Learn the methods of solving problems using Artificial Intelligence.
CO2	Formalize a given problem in the language/framework of different AI methods.
CO3	Introduce the concepts of machine learning.
CO4	Know the basics of neural networks and other machine learning algorithms.
CO5	Familiarize about the Expert Systems

Text Book(s):	
1	Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008. (Units-I,II & V)
2	Stephen Marsland, —Machine Learning – An Algorithmic Perspective], Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3	Tom M Mitchell, —Machine Learning], First Edition, McGraw Hill Education, 2013

Reference Books(s):	
1	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007. (Unit-III).
2	Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.
3	Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
4	Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	2	3	2	-	-	-	-	-	-	-	2	2	1	1
CO2	1	3	3	1	1	-	-	-	-	-	-	-	-	1	-	-
CO3	1	3	3	3	3	-	-	-	-	-	-	-	-	1	2	3
CO4	1	2	3	2	-	-	-	-	-	-	-	-	-	1	2	3
CO5	-	3	3	3	-	-	-	-	-	-	-	-	2	1	2	2
CO(Avg)	1.25	2.80	2.80	2.40	2.00	-	-	-	-	-	-	-	2.00	1.20	1.75	2.25

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
IT19644	INNOVATION AND DESIGN THINKING FOR INFORMATION TECHNOLOGY	EEC	3	0	2	4

Objectives: Broad objective of this course is						
•	To explain the principles of Design thinking and describe the phases of Design Thinking					
•	To summarize the phases of Explore and Empathise					
•	To analyze and categorize the tools used in experiment and engage phases					
•	To illustrate the various tools in evolve phase and list the innovation tools					
•	To discuss the use of Toolkit in leading the growth and innovation in an organization					

UNIT-I	INTRODUCTION	9
Principles of Design Thinking- Process of Design Thinking – Planning a Design Thinking project- Understanding of the problem - Observation Phase - Point-of-View Phase - Ideate Phase - Prototype Phase - Test Phase–Implementation.		
UNIT-II	EXPLORE & EMPATHISE	9
Explore phase-STEEP Analysis, Strategic priorities, Activity System, Stakeholder Mapping, Opportunity Framing-Empathise - Methods & Tools, Field observation, Deep user interview, Needs Finding, Persona Development.		
UNIT-III	EXPERIMENT & ENGAGE	9
Experiment-Methods & Tools, Ideation using Scamper, Analogous Inspiration, Deconstruct & Reconstruct, User Experience Design, Prototyping-Engage-Methods & Tools, Storytelling, Storyboarding, co-creation		
UNIT-IV	EVOLVE & INNOVATION TOOLS	9
Evolve- Methods & Tools, Concept Synthesis, Strategic requirements, Activity system integration, viability analysis, Innovation Tool (Using User needs,CAP,4S),Change management tool using review, Quick wins, Art of Story telling.		
UNIT-V	DESIGN THINKING TOOLKIT	9
Visualization-Journey Mapping-Value chain analysis-Mind mapping-Brainstorming-Concept Development-Assumption Testing-Rapid prototyping-customer co-creation-Learning launch-Leading growth and innovation in an organization		
Total Contact Hours		: 45

Indicative List of Experiments	
Topics / Areas for the Project: (Not restricted to the following)	
1	Internet Based Live Tracking System.
2	Android based Application Development
3	Network Security Projects.
4	Security Based on Cryptographic techniques.
5	Steganography Based projects.
6	Developing Smart devices using IOT
7	Authentication and data Privacy projects.
8	Web based socio networking projects
9	Wireless Data handling and management System.
10	Cloud Based Projects.
11	Biometric based security Projects.
12	Image processing.
13	Applications to aid physically challenged people.
14	Mobile networks data management.
15	Mobile Location Based Systems.
16	E-Learning and Evaluation systems.
17	Embedded system designing and implementation.
18	Secured Health Care applications
19	Secured Transaction with Block chain.

20	Crypto currency and Bit coin Based projects.			
		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:	
On completion of course students will be able to	
CO1	Explain the principles of Design thinking and describe the phases of Design Thinking
CO2	Summarize the phases of Explore and Empathise
CO3	Analyze and categorize the tools used in experiment and engage phases
CO4	Illustrate the various tools in evolve phase and list the innovation tools
CO5	Discuss the use of Toolkit in leading the growth and innovation in an organization

Text Book(s):	
1	Christian Mueller-Roterberg, Handbook of Design Thinking, 2018, Kindle Direct Publishing.
2	Design Thinking-The Guide Book https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf
3	Jeanne Liedtka and Tim Ogilvie 2011, Designing for Growth: A Design Thinking Tool Kit for Managers, Columbia University Press [ISBN: 9780231158381]

Reference Books(s):	
1	Tim Brown, Barry Katz Change by Design - How Design Thinking Transforms Organizations and Inspires Innovation, First Edition, Happer Collins,2009
2	Thomas Lockwood, Design Thinking – Integrating, Innovation, Customer experience and Brand value, First Edition, Allworth Press, 2009

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	2	-	-	-	-	-	-	-	-	3	-	-	-	3
CO2	1	2	2	-	-	2	2	2	-	-	-	3	3	3	3	3
CO3	1	2	2	-	2	2	2	2	-	-	-	3	3	3	3	3
CO4	1	-	2	3	2	2	2	2	-	-	3	3	3	3	3	3
CO5	-	-	2	3	2	-	2	2	3	-	-	-	3	3	3	3
CO(Avg)	1.25	2.00	2.00	3.00	2.00	2.00	2.00	2.00	3.00	-	3.00	3.00	3.00	3.00	3.00	3.00

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
GE19621	PROBLEM SOLVING TECHNIQUES	EEC	0	0	2	1

Objectives: Broad objective of this course is						
•	To improve the numerical ability and problem-solving skills.					

List of Experiments						
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 confidence.					

CO/PO	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	PSO 4
CO1	2	2	2	2	1	1	-	-	-	-	1	1	2	2	2	2
CO2	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2	2
CO3	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2	2
CO(Avg)	2.67	2.67	2	2.67	1	1	-	-	-	-	1.00	1	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
IT19741	CLOUD AND BIG DATA ANALYTICS	PC	3	0	4	5

Objectives:						
•	To understand and appreciate the evolution of cloud from the existing technologies.					
•	To be familiar with cloud computing and have knowledge on the various service models.					
•	To introduce the concepts of Big Data and Hadoop, and implement map reduce.					
•	To describe the data stream analytics methodologies.					
•	To visualize and analyze various data visualization techniques.					

UNIT-I	CLOUD ENABLING TECHNOLOGIES	9
Technologies for Network-Based Systems - System Models for Distributed and Cloud Computing - Implementation Levels of Virtualization - Virtualization Structures/Tools and Mechanisms - Virtualization of CPU, Memory, and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Data-Center Automation.		
UNIT-II	CLOUD ARCHITECTURE AND SERVICES	9
Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture - Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS - Architectural Design of Compute and Storage Clouds -Public Cloud Platforms: GAE, AWS, and Azure.		
UNIT-III	INTRODUCTION TO BIG DATA AND HADOOP	9
Introduction to Big Data, Types of Digital Data, Challenges of conventional systems - Web data, Evolution of analytic processes and tools, Analysis Vs reporting - Big Data Analytics, Introduction to Hadoop - Distributed Computing Challenges - History of Hadoop, Hadoop Eco System - Use case of Hadoop – Hadoop Distributors – HDFS – Processing Data with Hadoop – Map Reduce.		
UNIT-IV	MINING DATA STREAMS	9
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 - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.		
UNIT-V	DATA VISUALIZATION	9
Input for Visualization: Data and Tasks - Encoding Data with Marks and Channels - Creating a Scatter Plot - Common Visualization Idioms: Bar Chart - Vertical & Horizontal - Pie Chart and Coxcomb Plot -Line Chart - Area Chart - Making Maps - Visualizing Trees and Networks - Data Reduction: Histograms - Hexbin Mapping – Crossfiltering.		
Total Contact Hours		45

List of Experiments	
1	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3	Install Google App Engine. Create hello world app and other simple web applications using python/java
4	Use GAE launcher to launch the web applications
5	Install Hadoop single node cluster and run simple applications like word count
6	Implement the following Substitution and Transposition Techniques: a) Caesar Cipher b) Playfair Cipher c) Hill Cipher d) Vigenere Cipher e) Rail fence – row & Column Transformation f) Affine Cipher
7	Implement the following algorithms a) DES

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	2	3	3	-	2	-	-	-	-	2	2	3	-	2
CO2	-	-	2	2	3	-	2	-	-	-	-	2	2	3	2	2
CO3	-	-	2	2	3	-	2	-	-	-	-	2	1	3	-	2
CO4	-	2	2	3	3	-	2	-	-	-	-	2	1	3	-	2
CO5	1	2	2	3	3	-	2	-	-	-	-	2	1	3	2	2
CO(Avg)	1.00	2.00	2.00	2.60	3.00	-	2.00	-	-	-	-	2.00	1.40	3.00	2.00	2.00

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	Category	L	T	P	C
IT19711	Industry Practices Lab	PC	0	0	4	2
Course Objectives:						
●	Prepare to become Junior RPA Developers.					
●	Learn the basic concepts of Robotic Process Automation.					
●	Develop familiarity and deep understanding of UiPath tools.					
●	Develop the ability to design and create robots for business processes independently.					
●	Develop skills required to pass UiPath RPA Associate v1.0 Exam.					
Unit-I	Robotic Process Automation (RPA) Basics					9
<ul style="list-style-type: none">• Downloading and Installing UiPath Academic Alliance• Installing UiPath Extension in Browsers• Installing Activity Packages in UiPath Studio• Build a workflow that prints “Hello World” in a message box.						
Unit-II	Introduction to UiPath, Variables and Arguments					9
<ul style="list-style-type: none">• Build a workflow that swaps two numbers using a third variable.						
Unit-III	Selectors and Control Flow					9
<ul style="list-style-type: none">• Build a workflow using an If statement, which asks a user, whether the user will get the second Marshmallow or not.• Build a workflow using Switch activity that asks users’ their eye color and display their personality in a message box.• Build a workflow for a 'Guessing Game'.• Build a workflow using a While loop that tells the user if the input is a prime number or not.• Build a workflow to display file names from a folder in the Output panel and also store names in an MS Word file.• Build a workflow using a Parallel activity.• Build a workflow that uses different Input Methods to input data in a Notepad.• Build a workflow that opens a browser and then opens UiPath’s website.• Build a workflow using Web Recorder in UiPath Studio to Sign in to UiPath’s website.						
Unit-IV	Data Manipulation, Automation Concepts and Techniques					9
<ul style="list-style-type: none">• Build a workflow that fills the form on RPACHallenge.com website with organized data from an excel file.• Build a workflow that replaces double spaces with single spaces from a text stored in multiple Notepad files with different names.• Build a workflow using .ToString method that converts an integer to string.• Build a workflow using Format, Join, IndexOf, Split, and Substring methods that extract key information from a text and prints in a different format.• Build a workflow using Split and Contains methods that extract sentences containing “RPA” from a paragraph.• Build a workflow using data table activities to join two library databases using matching student ID and display the output in a message box.• Build a workflow using Concat and Join method that merges two lists containing the UK and Spain city names, sorts it, capitalizes the first letter of each item, and displays it in a message box.• Build a workflow using a Screen Scraper Wizard that scrapes text using the Tesseract OCR scraping method from an image and stores it in a Notepad.• Build a workflow using the Screen Scraper Wizard that scrapes text using the Full-Text scraping method and stores it in a Notepad file.• Build a workflow using the Data Scraping wizard that scrapes blog post titles from the UiPath Blog from multiple pages.• Build a workflow using a Read PDF Text activity and extract only Email IDs and Phone Numbers from a PDF file and store it in an MS Word file.• Build a workflow using Read Range and Append Range activity to read data from a workbook and append data to another workbook.• Build a workflow that calculates the total monthly deposit of a bank from an Excel file and store output in a new sheet.• Build a workflow that extracts attachments from emails containing the word “Resume” in its subject.						
Unit-V	Orchestrator and Capstone Projects					9
<ul style="list-style-type: none">• Sales Order Processing Project• Stock-Broker Project• Email Auto-responder Project						

• Disk Monitoring & Clean-Up Project					
			Contact Hours	:	45
Course Outcomes:					
On completion of the course, students will be able to:					
CO1	Become Junior RPA Developers.				
CO2	Understand the basic concepts of Robotic Process Automation.				
CO3	Understand the UiPath tools.				
CO4	Ability to design and create robots for business processes independently.				
CO5	Ability to pass UiPath RPA Associate v1.0 Exam.				
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.				
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.				

CO/PO	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	PSO 4
CO1	3	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	1	1	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	2	1	1	1
CO4	2	1	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	1	1	-	-	-	-	-	-	1	1	1	1	1	1
CO (Avg)	2.40	1.40	1.00	1.00	-	-	-	-	-	-	1.00	1.00	1.20	1.20	1.00	1.00

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial

(High) No correlation: “-”

OPEN ELECTIVE

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
OIT1901	BUSINESS INTELLIGENCE	OE	3	0	0	3

Objectives: Broad objective of this course is
★ Be exposed with the basic rudiments of business intelligence system
★ understand the modeling aspects behind Business Intelligence
★ understand of the business intelligence life cycle and the techniques used in it
★ Be exposed with different data analysis tools and techniques
★

UNIT-I	BUSINESS INTELLIGENCE	9
Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.		
UNIT-II	KNOWLEDGE DELIVERY	9
The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.		
UNIT-III	EFFICIENCY	9
Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis.		
UNIT-IV	BUSINESS INTELLIGENCE APPLICATIONS	9
Marketing models – Logistic and Production models –Telecommunication Industry & Banking Case studies.		
UNIT-V	FUTURE OF BUSINESS INTELLIGENCE	9
Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Explain the fundamentals of business intelligence.
CO2 Link data mining with business intelligence.
CO3 Apply various modeling techniques.
CO4 Explain the data analysis and knowledge delivery stages.
CO5 Apply business intelligence methods to various situations and decide on appropriate technique.

Text Books:
1 Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9 th Edition, Pearson 2013.

Reference Books:	
1	Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2	Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3	David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition, 2012.
4	Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw- Hill, 2007.
5	Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.
6	G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, 1 st Edition, Wiley India.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	2	2	2	1	-	-	-	-	1	1	2	2	2	2
CO2	2	3	3	2	2	1	-	-	-	-	1	1	2	2	2	2
CO3	2	3	3	3	3	1	-	-	-	-	1	1	2	2	2	2
CO4	2	3	3	3	3	1	-	-	-	-	1	1	2	2	2	2
CO5	2	3	3	3	3	1	1	1	-	-	1	3	3	3	3	3
CO (Avg)	2.00	2.80	2.80	2.60	2.60	1.00	1.00	1.00	-	-	1.00	1.40	2.20	2.20	2.20	2.20

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
OIT1902	CYBER SECURITY	OE	3	0	0	3

Objectives: Broad objective of this course is to
★ Learn the basics of Security Trends.
★ Know the operational and organizational security.
★ Study the fundamentals of cryptography.
★ Explore Authentication methods and Tools.
★ Identify the purpose of Intrusion Detection Systems.

UNIT-I	INTRODUCTION TO SECURITY TRENDS AND CONCEPTS	9
The Computer Security Problems - Targets and Attacks - Approaches to Computer Security – Ethics - Basic Security Terminologies – Security Models.		
UNIT-II	OPERATIONAL AND ORGANIZATIONAL SECURITY	9
Policies, Procedures, Standards and Guidelines – Security Awareness and Training – Interoperability Agreements – The security Perimeter – Physical Security – Environmental Issues – Wireless – Electromagnetic Eavesdropping – The Role of Security in People.		
UNIT-III	CRYPTOGRAPHY	9
Cryptography in Practice – Historical Perspectives – Algorithms – Hashing Functions – Symmetric Encryption – Asymmetric Encryption – Quantum Cryptography – Steganography – Cryptography Algorithm Use.		
UNIT-IV	AUTHENTICATION AND REMOTE ACCESS	9
User, Group and Role Management – Password Policies – Single Sign-On – Security Controls and Permissions – Preventing Data Loss or Theft – The Remote Access Process – Remote Access Methods.		
UNIT-V	INTRUSION DETECTION SYSTEMS AND NETWORK SECURITY	9
History of Intrusion Detection Systems – IDS Overview – Network-Based IDSs – Host-Based IDSs – Intrusion Prevention Systems – Honeypots and Honeynets – Tools.		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Learn the basics of Security Trends.
CO2 Know the operational and organizational security.
CO3 Explain the fundamentals of cryptography.
CO4 Apply Authentication methods and Tools.
CO5 Demonstrate the Intrusion Detection Systems.

Reference Books:
1 W.A.Coklin, G.White, Principles of Computer Security: Fourth Edition, McGrawHill, 2016.
2 William Stallings, Cryptography and Network Security Principles and Practices, Seventh Edition, Pearson.
3 Achyut S. Godbole, Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing, Tata McGraw-Hill Education, 2013.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	-	2	-	-	-	-	1	-	-	-	-	1	-	-	-
CO2	2	-	-	2	-	-	-	-	-	-	-	-	1	3	-	-
CO3	2	-	-	3	-	-	-	-	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	1	-	-	-	-	-	-	-	2	2	-
CO5	-	2	-	-	-	-	-	-	-	-	-	-	1	-	2	3
CO (Avg)	1.67	2.00	2.00	2.50	2.00	1.00	-	1.00	-	-	-	-	1.25	2.50	2.00	2.50

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

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

No correlation : “-”

SEMESTER – VI
PROFESSIONAL ELECTIVE - I

Subject Code	Subject Name	Category	L	T	P	C
IT19P61	ADVANCED R AND PYTHON PROGRAMMING	PE	2	0	2	3

Objectives: Broad objective of this course is						
★	To know the basics of python programming					
★	To learn the concept of python modules and frameworks.					
★	To understand the different types of database connectivity using python.					
★	To get the basic idea of R programming.					
★	To implement machine learning algorithm using python data science package.					

UNIT-I	INTRODUCTION TO PYTHON PROGRAMMING	6
Basics of Python-Starting with python interpreter-Control flow statements-Functions-List,tuple,Dictionary-Files-Modules –Packages - Regular expressions – Exception handling- Python OOPS Concepts – Classes and Objects-Constructor-Inheritance		
UNIT-II	PYTHON MODULE AND FRAMEWORKS	6
Python Modules- Collection Module- Math Module –OS Module –Random Module –Sys Module- Statistics Module – JSON Module- -Numpy,Scipy and Pandas modules- Python Frameworks:Django,Flask,Pytorch,Web2PY,Pygame.		
UNIT-III	PYTHON DATA BASE CONNECTIVITY	6
Python MySQL Database Connectivity :Environment Setup-Create Data Base Connection-Create Database-Creating Tables-Insert,select,update,drop,join operations-Performing Transactions-Introduction to Python and MongoDB connectivity-Introduction to Python SQLite Connectivity.		
UNIT-IV	INTRODUCTION TO R	6
OverviewDataTypes,Variables,Operator,DecisionMaking,Loops,Functions,Strings,Vector,List, Matrices, Arrays,Factors,Data Frames,Packages-Data Visualization – Data Interfaces- Reading and writing of CSV files Exploratory Data Analysis using R- Statistical Methods for Evaluation using R.		
UNIT-V	DATA SCIENCE USING R	6
Association –Classification – Clustering – Time series Analysis-Text Analysis–Prediction Algorithm–Image Analytics – Video Analytics – Data base analytics		
Total Contact Hours		: 30

List of Experiments	
1	Implement python programs using interactive and script mode.
2	Implement various control statements in python.
3	Implement python programs using packages.
4	Implement python OOPs concepts using programs
5	Implement python modules, Collection Module, Math Module, Pandas module using simple programs
6	Develop programs using Python frameworks such as Django, Flask etc.
7	Implement Python MySQL Database Connectivity
8	Implement MangoDB connectivity
9	Implement Python SQLite connectivity
10	Implementation of vector data objects operations
11	Study and implementation of various control structures in R
12	Study and implementation of Data Visualization with ggplot2
13	CLASSIFICATION MODEL a. Install relevant package for classification. b. Choose classifier for classification problem.

	c. Evaluate the performance of classifier			
14	CLUSTERING MODEL a. Clustering algorithms for unsupervised classification. b. Plot the cluster data using R visualizations.			
		Contact Hours	:	15
		Total Contact Hours	:	45

Course Outcomes: On completion of course students will be able to	
CO1	Learn the major concept of python programming and oops principles.
CO2	Understand the concept of Python modules and frameworks
CO3	Connect the different types of database with Python
CO4	Learn the basic idea of R programming.
CO5	Implement the supervised and unsupervised algorithm concept using R data science library.

Reference Books(s):	
1	MARK LUTZ, David Ascher,, “Learning Python”, 2nd Edition, O'REILLY Media Inc, 2003.
2	Sebastian Raschka, "Python Machine Learning", 2nd Edition, 2017 Packt Publishing.
3	Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", 2018 Release O'REILLY Media Inc.
4	Garrett Golemund, "Hands on Programming with R", 2nd Edition, O'REILLY Media Inc
5	Hadley Wickham, Garrett Golemund, "R for Data Science", O'REILLY Media Inc.

CO/PO	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	PSO 4
CO1	2	3	3	3	2	1	-	-	-	-	1	2	2	1	2	2
CO2	2	3	3	3	3	2	-	-	-	-	1	2	2	1	2	2
CO3	2	3	3	3	3	2	-	2	2	-	1	2	2	1	2	2
CO4	2	3	3	3	3	2	-	-	-	-	1	2	2	1	2	2
CO5	2	3	3	3	3	2	-	2	2	-	3	2	2	1	2	2
CO(Avg)	2.00	3.00	3.00	3.00	2.80	1.80	-	2.00	2.00	-	1.40	2.00	2.00	1.00	2.00	2.00

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	Category	L	T	P	C
IT19P62	GAME PROGRAMMING	PE	2	0	2	3

Objectives: Broad objective of this course is						
★	To have an introduction into the Game programming and rendering.					
★	To learn the principles, mechanics and logics of Game Design.					
★	To learn the various Game Development process and its design attributes.					
★	To gain working knowledge in various game platforms.					
★	To learn to design games using python.					

UNIT-I	INTRODUCTION	6
Elements of Game Play — Artificial Intelligence — Getting Input from the Player - Sprite Programming — Sprite Animation - Multithreading — Importance of Game Design — Game Loop, Software and Hardware Rendering.		
UNIT-II	GAME DESIGN PRINCIPLES	6
Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Path Finding. Game Engine Design: Rendering, Controller based animation, collision detection, standard objects, and physics, Design Scope in Redesigning games.		
UNIT-III	GAME DEVELOPMENT	6
Game development: Developing 2D and 3D interactive games using OpenGL, DirectX — Puzzle games, Single / Multi-player games-Games using HTML and Java Script, Scratch 2.0, Unity 3D - Introduction, Creating games and Designing and Coding gameplay systems.		
UNIT-IV	GAMING PLATFORMS AND FRAMEWORKS	6
Basics of Augmented Reality, Virtual Reality and Mixed Reality- Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio.		
UNIT-V	GAME PROGRAMMING USING PYTHON	6
Basic game objects, Getting started with cocos2d, Creating game assets, Implementing steering behaviours, Seek and flee, Arrival, Pursuit and evade Wander, Obstacle avoidance, Gravitation game, Pygame and 3D.		
Contact Hours		30
List of experiments:		
1. Explore animation using sprite programming and incorporate multithreading 2. Implement Collision detection in 3D gaming using python/ other tools 3. Implement “virtual pet” game using python/other tools 4. Implement “treasure hunt ” game using python/other tools 5. Implement Shooting Game using python/other tools 6. Develop puzzle game using python/other tools 7. Develop any interactive game using Unity3D 8. Implement mobile gaming for android/ios		
Contact Hours		15
Total Contact Hours		45

Course Outcomes:	
On completion of course students will be able to	
CO1	Identify the need for Game programming.
CO2	Have knowledge on the concepts <u>and</u> techniques used in Game design.
CO3	Design and model interactive game.
CO4	Understand the need for advanced game development platforms.
CO5	Design and develop games with open source components.

Text Book(s):	
1	Jeannie Novak, Game Development Essentials, Third Edition, Delmar Cengage Learning, ISBN-13: 978-1111307653, 2011.
2	Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game, Designer, First edition, Wiley, ISBN 0471968943, 2007.
3	Joseph Howse, Alejandro Rodas de Paz, Python Game Programming by Example, Packt Publishing, First edition, 2015.
Reference Book(s):	
1	Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 3 rd edition 2016.
2	John Horton, "Learning Java by Building Android Games", Packt Publishing Limited, 1st edition, 2015.
3	Jorge Palacios, "Unity 5.x Game AI Programming Cookbook", Packt Publishing Limited, 1st edition, 2016.

CO/PO	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	PSO 4
CO1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2	2
CO2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2	3
CO3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2	3
CO4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-	-
CO5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-	3
CO(Avg)	2.00	2.50	2.00	1.80	2.00	-	1.00	2.00	3.00	2.00	2.00	2.25	2.00	2.40	2.00	2.75

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	Category	L	T	P	C
IT19P63	AUTOMATION TOOLS	PE	2	0	2	3

Objectives: Broad objective of this course is						
★	To understand Basic Programming concepts and the underlying logic/structure					
★	To Describe RPA , where it can be applied and how its implemented					
★	To Describe the different types of variables, Control Flow and data manipulation techniques					
★	To Understand Image, Text and Data Tables Automation					
★	To Describe automation to Email and various types of Exceptions and strategies.					

UNIT-I	INTRODUCTION	6
Programming Concepts Basics - Understanding the application - Basic Web Concepts - Protocols - Email Clients -. Data Structures - Data Tables - Algorithms - Software Processes - Software Design - Scripting - .Net Framework - .Net Fundamentals - XML - Control structures and functions - XML - HTML - CSS - Variables & Arguments.		
UNIT-II	ROBOTICS PROCESS AUTOMATION	6
RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.		
UNIT-III	RPA TOOLS	6
Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.		
UNIT-IV	RPA DATA MANIPULATION	6
Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.		
UNIT-V	EMAIL AUTOMATION	6
Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.		
		Contact Hours : 30
List of Experiments <ol style="list-style-type: none"> 1. Design and implementation of BOT using RPA Tool. 2. Implement Emptying Trash in gmail 3. Implement Emptying Recycle Bin 4. Develop a simple project that asks for the name of the user and then displays his or her response 5. Implement workflow,flowchart and delay activity 6. Building a data table using data scraping 7. Implement File operation 		

8. Implement a project to extract data from an Excel file into a data table			
9. Creating a data table and then writing all its data to an Excel file			
10. Implementing the Attach Window activity			
11. Implement Element, Image and System triggering events.			
12. Implement Screen Scraping			
13. Implement Email Automation			
	Contact Hours	:	15
	Total Contact Hours		45

Course Outcomes:	
On completion of course students will be able to	
CO1	To understand Basic Programming concepts and the underlying logic/structure
CO2	To Describe RPA , where it can be applied and how its implemented
CO3	To Describe the different types of variables, Control Flow and data manipulation techniques
CO4	To Understand Image, Text and Data Tables Automation
CO5	To Describe automation to Email and various types of Exceptions and strategies.

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

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

CO/P O	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	PSO 4
CO1	3	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	1	1	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	2	1	1	1
CO4	2	1	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	1	1	-	-	-	-	-	-	1	1	1	1	1	1
CO(Av g)	2.40	1.40	1.00	1.00	-	-	-	-	-	-	1.00	1.00	1.20	1.20	1.00	1.00

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	Category	L	T	P	C
IT19P64	3D IMAGING	PE	2	0	2	3

Objectives: Broad objective of this course is						
★	To understand the basic representation of images and image processing concepts					
★	To understand the basic transformations and image processing operations					
★	To describe the 3D imaging principles and approaches					
★	To understand quantification and evaluation of 3D imaging					
★	To describe reconstruction of 3D images and object recognition					

UNIT-I	INTRODUCTION TO IMAGE PROCESSING	6
Digital Image Fundamentals: Digital Image – Monochrome and Color Images – Color Models – Digital Image Representations – File Formats - Fundamental Image Operations - Fundamental Steps in Digital Image Processing.(Text Book 1)		
UNIT-II	IMAGE CHARACTERISTICS AND PROCESSING	6
Image Formation: Geometric primitives - 2D transformations - 3D transformations - 3D rotations - 3D to 2D projections - Image Processing: Point, Local, and Global Operators -Three Procedural Components –Classes of Local Operators -Advanced Edge Detector.(Text Book 2 and Text Book 3)		
UNIT-III	3D IMAGING PRINCIPLES AND APPROACHES	6
Representation of 3D structures - 3D Imaging principle and approaches - Image Visualization- Visualization methods. (Text Book 4 and Reference 1, 2, 3)		
UNIT-IV	QUANTIFICATION AND EVALUATION OF 3D IMAGING	6
Quantification using 3D imaging- Introduction, Methods - 3D Surface Image Generation, Point location, Distance calculation, Volume calculation, Evaluation of 3D imaging.(Reference 1,3, 4, 5)		
UNIT-V	3D OBJECT RECOGNITION	6
3D reconstruction - Epipolar geometry - Stereo calibration - Rectification of stereo images -Modeling and Recognizing Classes of Shapes 3D - Object Recognition from stereo images data-3D object recognition from range data.(Text Book 2, Text Book 3).		
Contact Hours		30
List of Experiments		
1. Create 3D model from a single 2D image using PyTorch(Link 5) 2. PyTorch implementation of "PointNet: Deep Learning on Point Sets for 3D Classification and Segmentation" (Link 4) 3. D image classification from CT scans (Link 1) 4. Classification of Pneumonia using 3D Medical Images(Link 2) 5. Peeled Human: Robust Shape Representation for Textured 3D Human Body Reconstruction (Link 3) 6. Classification of 3D data (Link 3) 7. 3D Action Retrieval (Link 3) 8. A Large Scale Database for 3D Object Recognition(link 4)		
Contact Hours		15
Total Contact Hours		45

Course Outcomes:	
On completion of course students will be able to	
CO1	Describe the basic representation of images and image processing concepts
CO2	Apply the transformations and image processing operations

CO3	Explain the 3D imaging principles and approaches
CO4	Summarize the quantification and evaluation methods of 3D images
CO5	Apply reconstruction of 3D images and object recognition

Text Books(s):	
1	Sheila Anand, L.Priya , “A Guide for Machine Vision in Quality Control” , CRC Press, 2019.
2	Richard Szeliski, “Computer Vision -Algorithms and Applications”, Springer, 2011.
3	Reinhard Klette, “Concise Computer Vision - An Introduction into Theory and Algorithm”, Springer, 2014.
4	Dana A.Ballard, Christopher M.Brown, “Computer Vision” , 1st Edition,Prentice Hall.
5	Bernd Girod, Gunther Greiner, Heinrich Niemann, “Principles of 3D Images Analysis and Synthesis”, Springer, 2000.

Reference Books(s):	
1	Orhan Hakki Karatas, Ebubekir Toy, “Three-dimensional imaging techniques: A literature review”, European Journal of Dentistry, Vol 8 / Issue 1 / Jan-Mar 2014.
2	Robb, R.A., “Three-Dimensional Visualization in Medicine and Biology”, Book Chapter in: Handbook of Medical Imaging: Processing and Analysis, ed. Isaac N. Bankman, Academic Press, San Diego, CA, Chapter 42, pp. 685-712, 2000.
3	Jayaram K. Udupa, “Three-dimensional Visualization and Analysis Methodologies: A Current Perspective”, Imaging & Therapeutic Technology, Vol 19, May-June 1999
4	Gabor T.Herman, “Quantification Using 3D Imaging”, Critical Reviews in Diagnostic Imaging, Volume 42, 2001
5	Tae-Kyun Kim, Josef Kittler and Roberto Cipolla, “Discriminative Learning and Recognition of Image Set Classes Using Canonical Correlations”, IEEE Transactions On Pattern Analysis And Machine Intelligence, June- 2007.
6	D.A.Forsyth & J.Ponce – “Computer Vision – a modern approach”, Prentice Hall, 1 st Edition, 2003.

CO/PO	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	PSO 4
CO1	2	-	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	1	2	1	-	-	-	-	-	-	1	-	2	1	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1	1
CO5	1	2	1	1	-	-	-	-	-	-	1	1	2	2	1	1
CO(Avg)	1.40	1.33	1.40	1.00	-	-	-	-	-	-	1.00	1.00	1.40	1.20	1.00	1.00

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	Category	L	T	P	C
IT19P65	PYTHON FOR DATA SCIENCE	PE	2	0	2	3

Objectives:

- To understand the basics of Data Science
- To learn the basics of Python
- To learn Sequence data types and associated operations
- To learn and implement Data visualization techniques
- To understand the case studies and implement various machine learning techniques

UNIT-I	INTRODUCTION TO DATA SCIENCE	6
Introduction - Data Science, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation- Statistical Methods for Evaluation, Hypothesis Testing, Difference of Means, ANOVA		
UNIT-II	BASICS OF PYTHON SPYDER (TOOL)	6
Introduction Spyder - Setting working Directory - Creating and saving a script file - File execution, clearing console removing variables from environment, clearing environment - Commenting script files - Variable creation – Arithmetic and logical operators - Data types and associated operations		
UNIT-III	SEQUENCE DATA TYPES AND ASSOCIATED OPERATIONS	6
Sequence Data types - Strings, Lists , Arrays , Tuples , Dictionary , Sets , Range - NumPy – ndarray		
UNIT-IV	DATA VISUALIZATION	6
Pandas dataframe and dataframe related operations - Reading files, Exploratory data analysis, Data preparation and preprocessing- Data visualization - Scatter plot , Line plot , Bar plot , Histogram , Box plot , Pair plot - Control structures- if-else family , for loop , for loop with if break , while loop - Functions		
UNIT-V	CASE STUDY	6
Case studies - Regression – Classification – Clustering		
Contact Hours		30
List of Experiments		
1	Implement basic Python programs for reading input from console	
2	Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem	
3	Handle numerical operations using math and random number functions	
4	Import a CSV file and perform various Statistical and Comparison operations on rows/columns.	
5	Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.	
6	Import any CSV file to Pandas DataFrame and perform the following: (a) Visualize the first and last 10 records (b) Get the shape, index and column details (c) Select/Delete the records(rows)/columns based on conditions. (d) Perform ranking and sorting operations. (e) Do required statistical operations on the given columns. (f) Find the count and uniqueness of the given categorical values. (g) Rename single/multiple columns.	
7	Load an image file and do crop and flip operation using NumPy Indexing.	
8	Implement Data visualization techniques and visualize data using any plotting framework (a) Scatter plot (b) Line plot (c) Bar plot (d) Histogram (e) Box plot (f) Pair plot	
9	Implementation of Linear Regression and Logistic Regression.	
10	Implementation of classification techniques – SVM and Decision tree.	
11	Implementation of clustering techniques – K-Mean and Hierarchical methods.	
Contact Hours		15

Total Contact Hours												:	45			
Course Outcomes: On completion of course students will be able to																
CO1: Gain knowledge on the basics of Data science																
CO2: Apply programming knowledge of Python in Data Science																
CO3: Apply the sequence data types and do the associated operations																
CO4: Analyze the data using various Visualization techniques																
CO5: Build analytical models using Machine learning techniques																
Reference Books(s):																
1. Wes McKinney, "Python for Data Analysis", O'Reilly Media.2012																
2. Sebastian Raschka, “Python Machine Learning”,Packpub.com,2015																
3. https://www.datacamp.com/courses/statistical-thinking-in-python-part-1																
CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	2	1	3	3	3	1	3	-	-	-	-	1	3	3	1	1
CO2	2	1	3	3	3	1	3	-	-	-	-	1	3	3	1	1
CO3	2	1	3	3	3	1	3	-	-	-	-	1	3	3	1	1
CO4	2	1	3	3	3	1	3	-	-	-	-	1	3	3	1	1
CO5	2	1	3	3	3	1	3	-	-	-	-	1	3	3	1	1
CO (Avg.)	2.00	1.00	3.00	3.00	3.00	1.00	3.00	-	-	-	-	1.00	3.00	3.00	1.00	1.00

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

- 1: Slight (Low)
- 2: Moderate (Medium)
- 3: Substantial (High)
- Nocorrelation : “-”

Subject Code	Subject Name	Category	L	T	P	C
GE19612	Professional readiness for innovation, employability and entrepreneurship	PE	6	0	0	6

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

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

Course Outcomes:

- CO1: Upskill in emerging technologies and apply to real industry-level use cases
- CO2: Understand agile development process
- CO3: Develop career readiness competencies, Team Skills / Leadership qualities
- CO4: Develop Time management, Project management skills and Communication Skills
- CO5: Use Critical Thinking for Innovative Problem Solving and develop entrepreneurship skills

SEMESTER – VII
PROFESSIONAL ELECTIVE - II

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT19P71	EMBEDDED AND REALTIME SYSTEMS	PE	3	0	0	3

Objectives: Broad objective of this course is to						
★	The architecture and programming of ARM processor.					
★	The embedded computing platform design and analysis.					
★	The basic concepts of real time Operating system.					
★	The fundamentals of system design techniques and networks.					
★	Having exploratory analysis on the various existing real time systems.					

UNIT-I	INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS	9
Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.		
UNIT-II	EMBEDDED COMPUTING PLATFORM AND DESIGN ANALYSIS	9
CPU buses – Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.		
UNIT-III	RTOS BASED EMBEDDED SYSTEM DESIGN	9
Introduction to basic concepts of RTOS- Task, process & threads, – power optimization strategies for processes, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes- semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux.		
UNIT-IV	SYSTEM DESIGN TECHNIQUES AND NETWORKS	9
Design methodologies- Design flows – Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.		
UNIT-V	CASE STUDY	9

Data compressor – Alarm Clock – Audio player – Software modem-Digital still camera – Telephone answering machine-Engine control unit – Video accelerator.			
			Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Describe the architecture and programming of ARM processor.
CO2	Demonstrate the embedded computing platform and design analysis.
CO3	Explain the basics of real time operating systems.
CO4	Use the system design techniques to develop software for embedded systems.
CO5	Model real-time applications using embedded-system concepts

Text Books:	
1	Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Morgan Kaufmann Publisher, 2006.
2	Marilyn Wolf, “Computers as Components – Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

Reference Books:	
1	Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
2	David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
3	Raymond J.A. Buhr, Donald L.Bailey, “An Introduction to Real-Time Systems- From Design to Networking with C/C++”, Prentice Hall, 1999.
4	C.M. Krishna, Kang G. Shin, “Real-Time Systems”, International Editions, Mc Graw Hill 1997.
5	K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
6	Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill, 2004.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	-	2	1	3	-	-	3	-	-	-	3	3	3	3	-
CO (Avg)	2.60	2.67	2.00	1.50	2.50	-	-	3.00	-	-	-	3.00	2.50	2.50	3.00	-

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
IT19P72	DIGITAL IMAGE PROCESSING	PE	3	0	0	3

Objectives: Broad objective of this course is to learn
★ Basics of digital image processing.
★ Methods of image transformation techniques.
★ Enhancement and restoration techniques.
★ Approaches to segmentation and morphological processing.
★ Various compression techniques.

UNIT-I	DIGITAL IMAGE FUNDAMENTALS	9
Elements of digital image processing systems, Digital Camera working principles, Elements visual perception, brightness, contrast, hue, saturation, Mach Band effect, Image sampling, Quantization, Dither, Two dimensional mathematical preliminaries.		
UNIT-II	IMAGE TRANSFORMS	9
1D DFT, 2D transforms - DFT, DCT, Discrete Sine Transform, Walsh Transform, Hadamard Transform, Slant Transform, Haar Transform.		
UNIT-III	IMAGE ENHANCEMENT AND RESTORATION	9
Spatial domain filtering, intensity transformations, contrast stretching, histogram equalization, smoothing filters, sharpening filters, noise distributions, mean filters, order statistics filters. Image restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering - removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations - spatial transformations, Gray - Level interpolation.		
UNIT-IV	IMAGE SEGMENTATION AND MORPHOLOGY	9
Image segmentation - Edge detection, Edge linking and boundary detection, Region growing, Region splitting and Merging, Image Recognition - Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Morphological Image Processing - Basics, SE, Erosion, Dilation, Opening, Closing, Hit – or - Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.		
UNIT-V	IMAGE COMPRESSION	9
Need for data compression, Huffman, Run Length Encoding, shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding, Transform coding, JPEG, MPEG.		
Contact Hours		: 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Apply the basic steps of image processing techniques.
CO2 Apply the concepts of transformation.
CO3 Experiment methodology for enhancement and restoration.
CO4 Comprehend the approaches of segmentation and morphological techniques.
CO5 Identify various compression techniques.

Text Books:	
1	Rafael C. Gonzalez, Richard E. Woods, “ Digital Image Processing”, Pearson Education, Inc., Second Edition, 2004.
2	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,” Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.

Reference Books:	
1	Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 2002.
2	William K. Pratt, “ Digital Image Processing”, John Wiley, New York, 2002.
3	S. Sridhar, “Digital Image Processing”, Oxford University Press.
4	Milan Sonka et al, “Image Processing, Analysis and Machine Vision”, Brooke s/Cole, Vikas Publishing House, 2nd edition, 1999.
5	Sid Ahmed, M.A., “ Image Processing Theory, Algorithms and Architectures”, McGrawHill, 1995.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	2	-	2	1	-	-	-	2	2	-	2	1	2
CO2	3	1	-	2	-	2	1	2	-	-	2	1	-	2	1	2
CO3	2	1	-	2	-	2	1	2	-	-	3	2	-	2	2	2
CO4	2	1	-	2	-	2	1	2	-	-	2	2	-	2	2	2
CO5	2	1	-	2	-	2	1	3	-	-	2	2	-	2	2	2
CO (Avg)	2.40	1.00	-	2.00	-	2.00	1.00	2.25	-	-	2.20	1.80	-	2.00	1.60	2.00

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
IT19P73	WIRELESS COMMUNICATION	PE	3	0	0	3

Objectives: Broad objective of this course is
★ To study the characteristic of wireless channel.
★ To learn the design of a cellular system.
★ To be familiar with various digital signaling techniques.
★ To know the basis of multipath mitigation techniques.
★ To gain knowledge on the concepts of multiple antenna techniques.

UNIT-I	WIRELESS CHANNELS	9
Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.		
UNIT-II	CELLULAR ARCHITECTURE	9
Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.		
UNIT-III	DIGITAL SIGNALING FOR FADING CHANNELS	9
Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.		
UNIT-IV	MULTIPATH MITIGATION TECHNIQUES	9
Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.		
UNIT-V	MULTIPLE ANTENNA TECHNIQUES	9
MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.		
Contact Hours		: 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Explain the Characterize a wireless channel and evolve the system design specifications.
CO2 Design a cellular system based on resource availability and traffic demands.
CO3 Understand the digital signaling for fading channels.
CO4 Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
CO5 Explain the Multipath Mitigation Techniques.

Text Books:
1 Rappaport,T.S., —Wireless communications, Pearson Education, Second Edition, 2010.(UNIT I, II, IV).
2 Andreas.F. Molisch, —Wireless Communications, John Wiley – India, 2006. (UNIT III,V).

Reference Books:	
1	Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011.
2	Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000.
3	David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4	Upena Dalal, —Wireless Communication, Oxford University Press, 2009.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	-	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	-	2	-	1	-	-	-	-	-	-	-	-	1	1	1
CO5	2	-	2	-	2	-	-	-	-	-	-	1	-	1	2	2
CO (Avg)	1.60	2.00	1.60	-	1.50	-	-	-	-	-	-	1.00	-	1.00	1.25	1.20

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
IT19P74	INTERNET OF THINGS	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To understand the basics of Internet of things and protocols.					
★	To understand about the IoT Design methodology.					
★	To understand about IoT elements.					
★	To Understand State of the Art - IoT Physical servers and cloud					
★	To introduces some of the application areas where Internet of Things can be applied.					

UNIT-I	INTRODUCTION	9
Introduction – Definition and characteristics of IoT – How IoT Works? – IoT Applications- Challenges of IoT – Advantages and Disadvantages of IoT - IoT Protocols – Logical Design of IoT: IoT Functional blocks – IoT Communication Models – IoT Communication APIs.		
UNIT-II	IOT DESIGN METHODOLOGY	9
IoT Architecture – IoT Reference Architecture – IOT Design Methodology: Domain Specification- Functional View, Information View, Operation and deployment, Device and Component Integration, Application development and deployment		
UNIT-III	IOT ELEMENTS	9
Building blocks of an IoT Device – Raspberry Pi, Arduino – Sensors, Communication Modules: Bluetooth, Zigbee, RFID - Power Sources –Data Management, Business Processes in IoT		
UNIT-IV	IOT PHYSICAL SERVERS CLOUD	9
Physical servers and cloud - XaaS, M2M , WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django – Designing a RESTful Web API –Google cloud for IoT.		
UNIT-V	APPLICATIONS	9
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home.		
		Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Know about IoT and its functionalities.
CO2	Interpret IoT Architecture.
CO3	Implement the various IoT elements and design the system.
CO4	Understand the IoT physical servers and cloud integration
CO5	Design and develop the various applications in IoT

Text Books:	
1	Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet Of Things”, Springer, 2011.
3	David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
4	Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key Applications and Protocols”, Wiley, 2012.

Reference Books:	
1	Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2	Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.
3	CunoPfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1-4493-9357-1

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	–	-	–	–	–	–	–	–	–	–	–	2	–	–	2
CO2	–	2	3	2	–	–	–	–	–	–	–	–	–	–	3	–
CO3	–	2	2	–	–	–	–	–	–	–	–	–	1	–	2	–
CO4	1	2	3	-	–	–	–	–	–	–	–	–	2	2	–	1
CO5	-	–	3	–	–	–	–	–	–	–	–	–	3	–	–	-
CO (Avg)	0.75	1.20	2.75	0.50	–	–	–	–	–	–	–	–	1.60	0.40	1.00	0.75

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
IT19P75	DEEP LEARNING TECHNIQUES	PE	3	0	0	3

Objectives:	
★	To get familiar with basic concepts and theory
★	To understand the basics of Neural Networks
★	To be familiar with CNN
★	To have deep knowledge in optimizers
★	To know about advances deep architectures

UNIT-I	INTRODUCTION	9
Introduction – Feature Descriptor, Bayesian Learning, Discriminant Function, Linear Classifier, Support Vector Machine, Linear Machine, Multiclass Support Vector Machine, Optimization – Optimization Techniques in Machine Learning, Non-Linear Functions.		
UNIT-II	BASICS OF NEURAL NETWORKS	9
Introduction to Neural Networks -Multilayer Perceptron, Backpropagation Learning, Loss Function, Backpropagation Learning Examples, Autoencoders – Autoencoders Training, Autoencoders Variants		
UNIT-III	CONVOLUTIONAL NEURAL NETWORKS	9
Convolutional – Cross Correlation, CNN Architecture, MLP versus CNN, LeNet, AlexNet, VGG16 and Transfer Learning, Vanishing and Exploding Gradient		
UNIT-IV	OPTIMIZATION TECHNIQUES	9

GoogleNet, ResNet, Optimizers – Momentum Optimizer, Momentum and Nesterov Accelerated Gradient (NAG) Optimizer, Adagrad Optimizer, RMSProp, AdaDelta and Adam Optimizer. Normalization – Batch Normalization, Group Normalization, Training Tricks – Regularization, Early Stopping, Dropouts			
UNIT-V	ADVANCED DEEP ARCHITECTURES		9
Recurrent Neural Networks (RNN), Advanced RNNs – LSTM, GRU Generative Adversarial Networks (GAN), Advanced GANs, Case Study: Face Recognition, Image Denoising and Image Classification.			
Total Contact Hours			: 45

Course Outcomes:	
On completion of course students will be able to	
CO1	Know the basic concepts and theory
CO2	Have knowledge in Neural Networks
CO3	Implement CNN
CO4	Have more knowledge in deep learning optimizers
CO5	Know the advanced deep architectures

Text Book(s):	
1	Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016
2	https://nptel.ac.in/courses/106/105/106105215/

Reference Books(s):	
1	Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.
2	Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3	Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press, 2013.
4	Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

CO/PO	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	PSO 4
CO1	3	2	1	2	2	-	-	-	-	-	-	2	-	1	1	3
CO2	2	3	2	3	2	-	-	-	-	-	-	3	-	1	2	3
CO3	2	3	3	3	3	-	-	-	-	-	-	2	-	1	-	3
CO4	2	2	2	2	1	-	-	-	-	-	-	-	1	1	3	3
CO5	2	2	3	3	2	-	-	-	-	-	-	3	1	1	3	3
CO(Avg)	2.20	2.40	2.20	2.60	2.00	-	-	-	-	-	-	2.50	1.00	1.00	2.25	3.00

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

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

PROFESSIONAL ELECTIVE - III

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT19P80	SERVICE ORIENTED ARCHITECTURE	PE	3	0	0	3

Objectives: Broad objective of this course is to
★ Learn XML fundamentals.
★ Be exposed to build applications based on XML.
★ Understand the key principles behind SOA.
★ Be familiar with the web services technology elements for realizing SOA.
★ Learn the various web service standards.

UNIT-I	INTRODUCTION TO XML KEY FEATURES	9
XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.		
UNIT-II	BUILDING ,CREATING XML APPLICATIONS	9
Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.		
UNIT-III	INTRODUCTION SERVICE ORIENTED ARCHITECTURE	9
Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA -- Principles of Service orientation – Service layers		
UNIT-IV	WEB SERVICES AND ITS STANDARDS	9
Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration(WS-BPEL) – Choreography –WS Transactions((WS-Coordination).		
UNIT-V	UNDERSTANDING SOA-BASED APPLICATIONS	9
Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines - Composition – WS-Policy – WS-Security – SOA support in J2EE-Current trends in Industry(Case Study).		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Build applications based on XML.
CO2 Develop web services using technology elements.
CO3 Developing services and deploying based on relevance.
CO4 Building and composing services with necessary Business activities.
CO5 Build SOA-based applications for intra-enterprise and inter-enterprise applications.

Text Books:
1 Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002 2.
2 Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.

Reference Books:	
1	Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
2	Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, Pearson Education, 2005.
3	Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004.
4	. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, ”Java Web Services Architecture”,Morgan Kaufmann Publishers, 2003.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	1	2	-	-	2	-	-	-	2	2	-	3	2	1	2
CO2	-	3	3	3	3	2	1	-	3	2	3	-	3	2	-	3
CO3	-	2	2	3	3	2	-	-	2	-	2	2	2	3	-	-
CO4	2	-	2	2	2	-	2	-	3	-	3	3	-	-	3	-
CO5	2	2	3	3	3	-	2	-	-	-	-	3	-	3	2	3
CO (Avg)	2.00	2.00	2.40	2.75	2.75	2.00	1.67	-	2.67	2.00	2.50	2.67	2.67	2.50	2.00	2.67

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
IT19P76	IMAGE PROCESSING AND VISION TECHNIQUES	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To review image processing techniques for computer vision.					
★	To outline the image enhancement in the Spatial and Frequency Domain.					
★	To understand Image Restoration and Image Compression.					
★	To understand three-dimensional image analysis.					
★	To study some applications of computer vision algorithms.					

UNIT-I	IMAGE PROCESSING FOUNDATION	9
Introduction-Image Processing Operations– Basic Image filtering operations: Noise Suppression by Gaussian Smoothing- Median Filters- Mode Filters- Rank Order Filters- The Role of Filters in Industrial Applications of Vision- Thresholding- Adaptive Thresholding-Edge detection techniques – corner and interest point detection – mathematical morphology – Some Basic Approaches to Texture Analysis.		
UNIT-II	IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN	9
Image enhancement by point processing-Image enhancement by neighbourhood processing- Basic Gray Level 20% Transformations-Histogram Processing-Enhancement Using Arithmetic and Logic Operations-Zooming- Basics of Spatial Filters- Smoothing and Sharpening Spatial Filters-Combining Spatial Enhancement Methods. Introduction to Fourier Transform and the frequency Domain-Smoothing and Sharpening Frequency Domain Filters- Homomorphic Filtering.		
UNIT-III	IMAGE RESTORATION AND IMAGE COMPRESSION	9
Model of The Image Degradation / Restoration Process-Noise Models- Restoration in the presence of Noise Only Spatial Filtering- Periodic Noise Reduction by Frequency Domain Filtering-Linear Position-Invariant Degradations- Estimation of Degradation Function- Inverse Filtering-Wiener filtering- Constrained Least Square Filtering-Geometric Mean Filter-Geometric Transformations. Data Redundancies-Image Compression Models-Elements of Information Theory- Lossless and Lossy compression-Huffman Coding-Shanon-Fano Coding- Arithmetic Coding-Golomb Coding- LZW Coding-Run Length Coding-Loss less predictive Coding- Bit Plane Coding- Image compression standards.		
UNIT-IV	3D VISION	9
3-D Vision - Methods for 3D vision – projection schemes – shape from shading – photometric stereo – Surface Smoothness– shape from texture – use of structured lighting- three-dimensional object recognition schemes- Image Transformations and Camera Calibration.		
UNIT-V	APPLICATION	9
Automated Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application- Surveillance-foreground-background separation – particle filters – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human gait analysis Application- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrians.		
		Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Implement fundamental image processing techniques required for computer vision.
CO2	Understand the image enhancement in the Spatial and Frequency Domain.
CO3	Apply Image Restoration and Image Compression.
CO4	Apply 3D vision techniques.
CO5	Develop applications using computer vision techniques.

Text Books:	
1	E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2	Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, 2nd edition, Pearson Education.

Reference Books:	
1	R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
2	Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012
3	Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4	D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
5	Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.
6	A.K. Jain, “Fundamental of Digital Image Processing”, PHI.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	-	-	3	-	-
CO (Avg)	3.00	2.60	2.75	2.80	-	-	-	-	-	-	3.00	-	3.00	3.00	3.00	-

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
IT19P77	COMPUTATIONAL LINGUISTICS	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To learn the fundamentals required for Computational Linguistics.					
★	To understand the concept of Phonology and Morphology.					
★	To deal with Statistical and Rule based Models.					
★	To understand the concepts of Language Structure, Analysis and their Applications.					
★	To study various Linguistic Models.					

UNIT-I	INTRODUCTION	9
Introduction about Computational Linguistics – Linguistics and its structures –The role of Natural Language Processing–Issues – Motivation – Theory Of Language – Words– Features of Indian Languages.		
UNIT-II	MORPHOLOGY AND PARTS-OF-SPEECH	9
Phonology – Computational Phonology- Words and Morphemes – Categorization and Lemmatisation – Word Form Recognition - Valency - Agreement - Regular Expressions and Automata- Morphological issues of Indian Languages – Transliteration.		
UNIT-III	PROBABILISTIC MODELS	9
Probabilistic Models of Pronunciation and Spelling - Weighted Automata – N- Grams - Corpus Analysis - Smoothing – Entropy - Parts-of-Speech – Taggers - Rule based – Hidden Markov Models – Speech Recognition.		
UNIT-IV	SYNTAX & CONTEXT FREE PARSING	9
Basic Concepts of Syntax- Parsing Techniques - General Grammar rules for Indian Languages - Context Free Grammar – Parsing with Context Free Grammars - Top Down Parser – Earley Algorithm - Features and Unification - Lexicalised and Probabilistic Parsing.		
UNIT-V	SEMANTICS AND PRAGMATICS	9
Representing Meaning – Computational Representation - Meaning Structure of Language – Semantic Analysis - Lexical Semantics – WordNet – Pragmatics - Discourse – Reference Resolution - Text Coherence – Dialogue Conversational Agents.		
		Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Comprehend the basic requirement of Computational Linguistics.
CO2	Understand the design of Phonological structures, generalization and Morphological Analyzers.
CO3	Evaluate the performance of different Probabilistic Models.
CO4	Use Context free languages to describe the syntactic structure of a language and parsing methods.
CO5	Understand the concept of Semantics ,Pragmatics and Language Modelling.

Reference Books:	
1	Daniel Jurafsky and James H. Martin “Speech and Language Processing”, Prentice Hall, 2000.
2	Ronald Hausser “Foundations of Computational Linguistics”, Springer-Verleg, 1999.
3	James Allen “Natural Language Understanding”, Benjamin/Cummings Publishing Co. 1995.
4	Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
5	Steve Young and Gerrit Bloothoof “Corpus – Based Methods in Language and Speech Processing”, Kluwer Academic Publishers, 1997.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-
CO2	2	-	-	-	1	-	-	-	-	1	-	-	1	-	-	-
CO3	2	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO (Avg)	1.80	-	-	-	1.00	-	0.00	0.00	-	1.00	-	0.00	1.00	2.00	-	0.00

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
CS19P12	DISTRIBUTED SYSTEMS	PE	2	0	2	3

Objectives: Broad objective of this course is
★ 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, Sur 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	
CO1	Gain knowledge about goals and types of Distributed Systems.
CO2	Ability to describe Communications and distributed web based system.
CO3	Clear knowledge about Distributed objects and File System.
CO4	Emphasize the benefits of using Distributed Transactions and Concurrency.
CO5	Gain knowledge about process and Security.

Text Books:	
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	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CO2	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CO3	3	3	3	3	3	2	2	2	2	2	3	2	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	2	2	2	2
CO5	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
CO (Avg)	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

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
IT19P78	SOFTWARE TESTING	PE	3	0	0	3

Objectives:	
★	Know what is software quality and various defect removal processes.
★	Know various testing terminologies and techniques.
★	Understand various levels and types of testing

★	Learn to manage automation in testing
★	Learn the Quality Metrics associated with software testing

UNIT-I	INTRODUCTION	9
Introduction to Software Quality - Challenges – Objectives – Quality Factors – Components of SQA – Contract Review – Development and Quality Plans – SQA Components in Project Life Cycle – SQA Defect Removal Policies – Reviews.		
UNIT-II	TESTING TECHNIQUES	9
Using White Box Approach to Test design - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs –Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing.		
UNIT-III	TEST LEVELS AND METHODOLOGIES	9
Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination- System Testing– System and Acceptance Testing – Testing Strategies – White Box and Black Box Approach- Compatibility testing-Performance Testing – Regression Testing - Internationalization Testing – Ad-hoc Testing – Website Testing –Usability and Accessibility Testing – Configuration Testing - Compatibility Testing - MC/DC Testing, Mutation testing, Case study for White box testing and Black box testing techniques.		
UNIT-IV	TEST AUTOMATION AND MANAGEMENT	9
Test plan – Management – Execution and Reporting – Software Test Automation – Test Automation framework - Agile Testing - End-to-end test automation - Automated Testing tools - Hierarchical Models of Software Quality – Configuration Management – Documentation Control.		
UNIT-V	SQA IN PROJECT MANAGEMENT	9
Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit, Software Process Assessment Cycle, SCAMPI.		
Total Contact Hours		: 45

Course Outcomes:	
On completion of course students will be able to	
CO1	Differentiate between different testing methodologies.
CO2	Apply suitable types of testing methodologies
CO3	Test the product with white and black box testing strategies.
CO4	Perform automated test and configuration management with documentation.
CO5	Understand various quality management standards

Text Book(s):	
1	Daniel Galin, “Software Quality Assurance from Theory to Implementation”, Pearson Education, 2009
2	Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
3	Srinivasan Desikan, Gopalaswamy Ramesh,” Software Testing – Principles and Practices”, Pearson Education, 2006
4	William Perry, “Effective Methods of Software Testing”, Third Edition, Wiley Publishing 2007
5	Automated Software Testing: Foundations, Applications and Challenges, <u>Ajay Kumar Jena</u> , <u>Himansu Das</u> , <u>Durga Prasad Mohapatra</u> , I Edition, Springer, 2020.
6	Agile Testing: A Practical Guide for Testers and Agile Teams, <u>Crispin Lisa</u> , <u>Gregory Janet</u> , Addison-Wesley Signature Series, 2008

Reference Books(s):	
1	Aditya Mathur, “Foundations of Software Testing”, Pearson Education, 2008
2	Ron Patton,”Software Testing” , Second Edition, Pearson Education, 2007
3	Robert Furtell, Donald Shafer and Linda Shafer, “Quality Software Project Management”, Pearson Education Asia, 2002.

CO/PO	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	PSO 4
CO1	2	2	3	-	2	-	2	-	2	2	-	2	1	3	-	2
CO2	2	3	-	2	2	1	-	1	-	1	2	-	-	2	-	-
CO3	2	-	1	-	1	1	-	-	1	1	-	1	2	-	-	2
CO4	2	2	-	2	-	2	1	-	-	2	2	-	-	-	1	-
CO5	2	-	-	1	1	-	1	-	-	1	1	-	2	1	-	2
CO(Avg)	2.00	2.33	2.00	1.67	1.50	1.33	1.33	1.00	1.50	1.40	1.67	1.50	1.67	2.00	1.00	2.00

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
IT19P79	COMPREHENSION	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To explain the concepts of computer organization and architecture					
★	To describe the concepts of programming, data structures and algorithms.					
★	To explore the concepts of compiler design					
★	To emphasize the concepts of operating systems and databases					
★	To explain the computer network concepts					

UNIT-I	COMPUTER ORGANIZATION AND ARCHITECTURE	6
Machine instructions and addressing modes, ALU, data-path and control unit, Instruction pipelining, pipeline hazards Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).		
UNIT-II	PROGRAMMING, DATA STRUCTURES AND ALGORITHMS	9
Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. Searching, sorting, hashing, Asymptotic worst case time and space complexity, Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths		
UNIT-III	COMPILER DESIGN	9
Lexical analysis, parsing, syntax-directed translation. Runtime environments, Intermediate code generation, Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination.		
UNIT-IV	OPERATING SYSTEM AND DATABASES	9
System calls, processes, threads, inter-process communication, concurrency and synchronization, Deadlock, CPU and I/O scheduling, Memory management and virtual memory, File systems, ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, normal forms, File organization, indexing (e.g., B and B+ trees), Transactions and concurrency control.		

UNIT-V	COMPUTER NETWORKS	12
OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.		
Total Contact Hours		: 45

Course Outcomes:	
On completion of course students will be able to	
CO1	be expert in computer organization and architecture concepts.
CO2	implement programming, data structures and algorithms
CO3	Explore the concepts of compiler design
CO4	explore operating systems and database concepts.
CO5	Design computer network concepts

Text Book(s):	
1	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002
2	Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988
3	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997
4	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John Wiley and Sons Inc., 2012
5	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
6	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	3	-	2	-	2	-	2	2	-	2	1	3	-	2
CO2	2	3	-	2	2	1	-	1	-	1	2	-	-	2	-	-
CO3	2	-	1	-	1	1	-	-	1	1	-	1	2	-	-	2
CO4	2	2	-	2	-	2	1	-	-	2	2	-	-	-	1	-
CO5	2	-	-	1	1	-	1	-	-	1	1	-	2	1	-	2
CO(Avg)	2.00	2.33	2.00	1.67	1.50	1.33	1.33	1.00	1.50	1.40	1.67	1.50	1.67	2.00	1.00	2.00

SEMESTER – VIII
PROFESSIONAL ELECTIVE - IV

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT19P81	BLOCK CHAIN ARCHITECTURE AND USE CASES	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To introduce basics of Block chain, structure and Merkle trees.					
★	To understand the process involved in mining and consensus.					
★	To learn about Hyper ledger framework and its component design.					
★	To introduce Bit coin network.					
★	To familiar with Block chain use cases.					

UNIT-I	INTRODUCTION TO BLOCKCHAIN	9
Blockchain: Introduction-structure of block-block header-block identifiers-The Genesis block-linking blocks in the block chain-Merkle trees. (Text Book-1: Chapter 7)		
UNIT-II	MINING AND CONSENSUS	9
Introduction-Decentralized Consensus – Independent verification of transactions – Mining nodes-Aggregating transactions in to blocks-constructing the block header-Mining the block- successfully mining the block – Validating a new block (Text Book-1: Chapter 8).		
UNIT-III	HYPERLEDGER FABRIC	9
Hyperledger frameworks, tools and building blocks – Hyperledger fabric component design, Hyperledger fabric-The journey of a sample transaction- Hyperledger explored. (Text Book-3: Chapter 2)		
UNIT-IV	THE BITCOIN NETWORK	9
Peer to peer Network Architecture - Node types and roles – The extended Bitcoin Network – Network Discovery – Full nodes – Exchanging Inventory- Simplified payment verification nodes- Bloom filters – Bloom filters and Inventory updates – Transaction pools – Alert messages. (Text Book-1: Chapter 6)		
UNIT-V	BLOCKCHAIN FOR GOVERNMENT	9
Digital Identity verification-Digital art: Blockchain attestation services (Notary, Intellectual Property protection) – Blockchain government. (Text Book-2: Chapter 3)		
Contact Hours		: 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Learn the basics of Blockchain, structure and Merkle trees.
CO2	Infer the knowledge about the process involved in mining and consensus.
CO3	Learn about Hyperledger framework and its component design.
CO4	Understand the importance Bitcoin network
CO5	Apply the various Blockchain use cases.

Text Books:	
1	Andreas Antonopoulos “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”
2	Melanie Swan, O’Reilly “Blockchain - Blue print for a New Economy”
3	Nitin Gaur, Lucesrosiers, Venkataraman Ramakrishnan, PetrNovotny, Dr.Salman A.Baset, Anthony O’Dowd “Hands-On Blockchain with Hyperledger ”.

Reference Books:

- | | |
|---|---|
| 1 | Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html |
|---|---|

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	2	2	3	-	-	-	-	-	-	-	-	-	-	3
CO3	1	1	1	2	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	1	-	3	-	-	-	-	-	-	2	-	-	2	3
CO5	-	2	-	-	-	-	-	1	-	-	2	2	-	-	2	2
CO (Avg)	1.75	1.33	1.33	2.00	3.00	-	-	1.00	-	-	2.00	2.00	-	-	2.00	2.75

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
IT19P82	CYBER FORENSICS	PE	3	0	0	3

Objectives: Broad objective of this course is to
★ Understand the process of Digital Cyber Forensics.
★ Be aware of the Cyber forensics Environments and standards.
★ Study the data and evidence collection activities
★ Understand how to investigate digital evidence
★ Explore advanced techniques in Cyber Forensics.

UNIT-I	DIGITAL FORENSICS PROCESS	9
Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists, Forensic Science, Digital Forensics, Digital Evidence, Digital Forensics Process – Identification, Collection, Examination, Analysis, Presentation Phases. Cyber Crime Law- International Legal Framework of Cybercrime Law, Digital Crime, Investigation Methods for Collecting Digital Evidence.		
UNIT-II	FORENSICS ENVIRONMENTS & STANDARDS	9
Hardware and Software Environments – Storage Devices, Operating System, File Systems, Metadata, Locating evidence in file systems-Password security, Encryption, and Hidden files. Digital Evidence Examination Guidelines – ACPO – IOCE – SWGDE -DFRWS – IACIS –HTCIA - ISO 27037.		
UNIT-III	DATA AND EVIDENCE COLLECTION	9
Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks, Router Forensics. Cyber forensics tools and case studies.		
UNIT-IV	INVESTIGATING DIGITAL EVIDENCE	9
Applying Forensic Science to Computers- Preparation, Survey, Documentation, Preservation, Examination and Analysis, Reconstruction, Reporting Selecting and Analyzing Digital Evidence - Locating digital evidence, Categorizing files, Eliminating superfluous files, The Event Analysis tool, Cloud Analysis tool, The Lead Analysis tool, Volume Shadow Copy analysis tools, Validating the Evidence. Case study – illustrating the recovery of deleted evidence held in volume shadows.		
UNIT-V	ADVANCED CYBER FORENSICS	9
Windows Forensics Evidence Collection in Linux and Mac Operating system, Network Forensics Packet Capture using Wireshark, tshark and tcpdump, Memory Forensics Virtual Machine Forensics Use and Implementation of Virtual Machines in Forensic Analysis Cloud Forensics Forensic analysis of Cloud storage and data remnants, Examining Browsers, E-mails, Messaging Systems, and Mobile Phones, Internet and Cloud- Challenges in Digital Forensics.		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Identify the need for cybercrime forensics.
CO2 Examine the hardware, software components and standards responsible for seeking evidence.
CO3 Apply techniques for collecting data and evidences.
CO4 Analyze the methods for investigating digital evidences
CO5 Examine advanced techniques for Cyber Forensics.

Text Books:	
1	Richard Boddington, Practical Digital Forensics, PACKT publishing, First Edition, 2016 ANDRÉ ÁRNES.

Reference Books:	
1	John R.Vacca, Computer Forensics, Second Edition, Cengage Learning, 2005.
2	Richard E.Smith, Internet Cryptography, Third Edition, Pearson Education, 2008
3	Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, Third Edition, Prentice Hall, 2013
4	Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.
5	Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Fourth Edition, Course Technology.
6	Angus M.Marshall, “Digital forensics: Digital evidence in criminal investigation”, John – Wiley and Sons, 2008.
7	Digital Evidence and Computer Crime, Eoghan Casey, Third Edition, 2011,Elsevier Inc.
8	Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, John R. Vacca, Charles River Media, 2005.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	1	-	-	2	-	-	-	-	-	-	-	1	2	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-	1
CO3	-	2	-	1	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	-	-	2	-	-	-	-	-	-	-	-	1	-	1
CO5	2	-	2	-	-	1	-	-	-	-	-	1	1	1	2	2
CO (Avg)	2.00	1.50	1.50	1.00	2.50	1.50	-	-	-	-	-	1.00	1.00	1.00	2.00	1.25

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
IT19P83	DATA WAREHOUSING AND MINING	PE	3	0	0	3

Objectives: Broad objective of this course is to
★ Learn the concepts of Data Warehousing and Business Analysis.
★ Familiar with the concepts of Data Mining.
★ Understand the concepts of Association and Correlations Algorithms.
★ Understand the concepts of Classification Algorithms.
★ Understand the concepts of Clustering and outlier Analysis.

UNIT-I	DATA WAREHOUSING	9
Data Warehouse: Basic Concepts, A Multitiered Architecture, Data Warehouse Models, Metadata Repository- Data Warehouse Modelling: Data Cube and OLAP, Data Cube: A Multidimensional Data Model: Schemas-Concept Hierarchies-OLAP Operations. (TB1-CH: 4)		
UNIT-II	DATA MINING AND VISUALIZATION	9
Introduction: Kinds of Data, Kinds of Patterns- Data Objects and Attribute Types- Data Visualization: Pixel-Oriented, Geometric Projection, Icon-Based, Hierarchical, Visualizing Complex Data and Relations- Data Pre-processing. (TB1-CH: 1&2)		
UNIT-III	ASSOCIATIONS AND CORRELATIONS	9
Basic Concepts: Frequent Itemsets , Closed Itemsets, and Association Rules - Frequent Item set Mining Methods: Finding Frequent Itemsets by Confined Candidate Generation , Growth Approach for Mining Frequent Itemsets , Mining Frequent Itemsets Using Vertical Data Format , Mining Closed and Max Patterns - Interesting Patterns: Pattern Evaluation Methods. (TB1-CH: 6)		
UNIT-IV	CLASSIFICATION	9
Basic Concepts- Decision Tree Induction: ID3- Bayes Classification Methods: Bayes' Theorem, Naive Bayesian Classification- Classification by Back propagation- Support Vector Machines-Techniques to improve classification accuracy-Prediction. (TB1-CH: 8)		
UNIT-V	CLUSTER ANALYSIS AND DATA MINING APPLICATIONS	9
Cluster Analysis- Partitioning Methods- Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering- Density-Based Methods: DBSCAN- Grid-Based Methods: STING: Statistical Information Grid-Outlier Detection-Data Mining Applications: Science and Engineering-Data Mining Tools: Weka & R -Web Mining-Emerging Trends in Data Mining. (TB1-CH: 10)		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Apply the Data Warehousing and Business Analytics concepts.
CO2 Apply the concepts of Data Mining to large data sets.
CO3 Make use of Association and Correlations Algorithms.
CO4 Compare and Contrast the various classifiers.
CO5 Apply Clustering and outlier Analysis and to solve Data Mining Case Studies.

Text Books:
1 Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

Reference Books:	
1	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2	K.P. Soman, Shyam Diwakar 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	Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	2	-	2	1	-	-	-	2	2	-	-	1	2
CO2	3	2	-	2	-	2	1	-	-	-	2	1	-	-	1	2
CO3	2	2	-	2	-	2	2	-	-	-	3	2	-	2	2	2
CO4	1	1	-	2	2	2	1	-	-	-	2	2	-	2	2	2
CO5	-	-	-	2	2	2	-	-	-	-	2	2	-	-	2	2
CO (Avg)	2.25	1.75	-	2.00	2.00	2.00	1.25	-	-	-	2.20	1.80	-	2.00	1.60	2.00

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
IT19P84	PARALLEL COMPUTING	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To study the scalability and clustering issues and the technology necessary for them.					
★	To understand the technologies enabling parallel computing.					
★	To study the different types of interconnection networks.					
★	To study the different parallel programming models.					
★	To study the software support needed for shared memory programming.					

UNIT-I	SCALABILITY AND CLUSTERING	9
Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.		
UNIT-II	ENABLING TECHNOLOGIES	9
System Development Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.		
UNIT-III	SYSTEM INTERCONNECTS	9
Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.		
UNIT-IV	PARALLEL PROGRAMMING	9
Paradigms And Programmability – Parallel Programming Models – Shared Memory Programming.		
UNIT-V	MESSAGE PASSING PROGRAMMING	9
Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.		
		Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Analyze different methods used for Scalability and Clustering.
CO2	Study the Enabling Technologies of Parallel Computing.
CO3	Design various System interconnects using Network topologies.
CO4	Do the analysis and implementation procedures for Parallel programming.
CO5	Understand the concept of message passing programming.

Text Books:	
1	Kai Hwang and Zhi.Wei Xu, “Scalable Parallel Computing”, Tata McGraw-Hill, New Delhi, 2003.

Reference Books:	
1	David E. Culler & Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/Software Approach”, Morgan Kaufman Publishers, 1999.
2	Michael J. Quinn, “Parallel Programming in C with MPI & OpenMP”, Tata McGraw-Hill, New Delhi, 2003.
3	Kai Hwang, “Advanced Computer Architecture” Tata McGraw-Hill, New Delhi, 2003.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	3	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	3	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	3	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	3	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO (Avg)	3.00	2.60	2.75	2.80	-	-	-	-	-	-	3.00	#DIV/0!	3.00	3.00	3.00	-

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
IT19P85	SOCIAL NETWORKS	PE	3	0	0	3

Objectives:	
★	Understand the basics of Social Networks
★	Understand the ties and homophily
★	Understand the market and Strategic Interaction in Networks
★	Understand link analysis and searching
★	Understand the concepts of modeling networks

UNIT-I	INTRODUCTION	9
Aspects of Networks; Representing and Measuring Networks-Representing Networks-Statistics and Characteristics of Network; Graphs-Paths and Connectivity-Distance and Breadth First Search-Basic Graph Theory; Network Datasets: An Overview		
UNIT-II	EMPIRICAL BACKGROUND ON SOCIAL	9
Observations about the Structure of Networks; Strong and Weak Ties; Networks in Their Surrounding Contexts- Homophily-Mechanisms Underlying Homophily: Selection and Social Influence-Affiliation-Tracking Link Formation in On-Line Data-A Spatial Model of Segregation; Positive and Negative Relationships		
UNIT-III	MARKETS AND STRATEGIC INTERACTION IN NETWORKS	9
Matching Markets-Bipartite Graphs and Perfect Matchings-Valuations and Optimal Assignments-Prices and the Market-Clearing Property-Constructing a Set of Market-Clearing Prices; Network Models of Markets with Intermediaries: Bargaining and Power in Networks		
UNIT-IV	INFORMATION NETWORKS AND THE WORLD WIDE WEB	9
The Structure of the Web; 4 Link Analysis and Web Search; Growing Random Networks- Uniform Randomness: an Exponential Degree Distribution- Hybrid Models- Small Worlds, Clustering, and Assortativity; Cascading Behavior in Networks; Institutions and Aggregate Behavior- Voting		
UNIT-V	LEARNING AND GAME THEORETICAL MODELLING	9
Learning and Networks; Decisions, Behavior, and Games on Networks; Game-Theoretic Modeling of Network Formation; Allocation Rules, Networks, and Cooperative Games; Observing and Measuring Social Interaction- Specification and Identification- Community Structures, Block Models, and Latent Spaces		

	Total Contact Hours	:	45
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Course Outcomes:	
On completion of course students will be able to	
CO1	Remember the basics of Social Networks
CO2	Create the ties and homophily
CO3	Apply the market and Strategic Interaction in Networks
CO4	Perform link analysis and searching
CO5	Develop the model for social networks

Text Book(s):	
1	Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010.
2	Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

Reference Books(s):	
1	Peter Mika, "Social Networks and the Semantic Web", , First Edition, Springer 2007.
2	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010
3	Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.

CO/PO	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	PSO 4
CO1	3	2	-	2	-	2	1	-	-	-	2	2	-	-	1	2
CO2	3	2	-	2	-	2	1	-	-	-	2	1	-	-	1	2
CO3	2	2	-	2	-	2	2	-	-	-	3	2	-	2	2	2
CO4	1	1	-	2	2	2	1	-	-	-	2	2	-	2	2	2
CO5	-	-	-	2	2	2	-	-	-	-	2	2	-	-	2	2
CO(Avg)	2.25	1.75	-	2.00	2.00	2.00	1.25	-	-	-	2.20	1.80	-	2.00	1.60	2.00

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

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

PROFESSIONAL ELECTIVE - V

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
IT19P90	STARTUP MANAGEMENT	PE	3	0	0	3

Objectives: Broad objective of this course is
★ To understand the basic concepts of Entrepreneurship and Startups.
★ To learn and internalize the process of founding a startup.
★ To provide strategies for successful implementation of ideas.
★ To learn the processes of transforming the company.
★ To have exposure to startup supporting institutions and schemes in India.

UNIT-I	BASICS OF ENTREPRENEURSHIP	9
Evolution of Entrepreneurship –Entrepreneurs Characteristics, Functions, Qualities, and Types, Entrepreneurship in India- Role of Entrepreneurship in Economic Development - Growth and Problems of Entrepreneurship in India.		
UNIT-II	STARTUP IDEA	9
Entry strategies -New product, Franchising, Partial Momentum Sponsorship and Acquisition. Intellectual Property – Creation and Protection. Business Plan- Source of product for business, Market analysis, Feasibility study, Capital formation, Budgeting project profile preparation, Financial outlook and Evaluation criteria.		
UNIT-III	CREATING A MODERN COMPANY	9
Lean Startup Tools and Processes – Leap of Faith assumptions, Minimum Viable product, Validated learning, Build-Measure-Plan, Pivot or Persevere. Management for Innovation – Accountability, Process, Culture, People and Transformation outcome.		
UNIT-IV	TRANSFORMING THE COMPANY	9
Critical Mass, Scaling Up and Deep systems. Innovation Accounting – Simple Dashboard, Business case and Bet Present value. The Global View. Role of Public policy.		
UNIT-V	STARTUP SUPPORTING INSTITUTIONS & SCHEMES IN INDIA	9
Startup Supporting Institutions –SSIB, NABARD, SIDO, NSIC, SIDESI, NBMSME, KVIC, MGIRI, Coir Board, NISIET. Startup Schemes in India- MGS, M-SIPS, The Venture Capital Assistance Scheme, Credit Guarantee, Raw material assistance, Infrastructure development scheme, MSME Market Development Assistance, Credit Linked Capital Subsidy for Technology Up gradation, AIC, Bridge Loan Against MNRE Capital Subsidy.		
Contact Hours		: 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Understand the basic concepts of Entrepreneurship and Startups.
CO2 Write a business Plan.
CO3 Design strategies for successful implementation of ideas.
CO4 Apply the processes of transforming the organization.
CO5 Understand and remember the process and role of Startup Supporting Institutions and Schemes in India.

Text Books:
1 The Startup Way: How Modern Companies Use Entrepreneurial Management to Transform Culture and Drive Long-Term Growth -Eric Ries.
2 Entrepreneurial Development – S S Khanka S. Chand Publishing, 2006 TheDynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi.
3 Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.

Reference Books:	
1	Entrepreneurship: New Venture Creation by David H. Holt.
2	Entrepreneurship Development New Venture Creation by Satish Taneja, S.L.Gupta.

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	2
CO2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
CO3	-	-	-	-	-	2	-	-	-	-	2	-	-	-	-	1
CO4	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	1	-	2	-	3	2	-	-	-	-
CO (Avg)	-	-	-	-	-	1.50	1.33	-	2.00	-	2.50	2.00	-	-	-	1.33

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
IT19P86	LATERAL THINKING TECHNIQUES	PE	3	0	0	3

Objectives: Broad objective of this course is
★ To understand the types of thinking.
★ To understand the nature and application of Lateral Thinking.
★ To understand the techniques involved in Lateral Thinking.
★ To solve more Lateral Thinking puzzles of easy, medium and difficult levels.
★ To study various case studies where Lateral Thinking is used.

UNIT-I	INTRODUCTION	9
The way the mind works-five stages of thinking-Basic process in thinking-The need for innovation-Change,Creativity and Innovation-Lateral Thinking-Difference between Lateral and Vertical Thinking-Attitudes Towards Lateral Thinking.		
UNIT-II	LATERAL THINKING TECHNIQUES	9
Basic Nature of Lateral Thinking-Use of Lateral Thinking-Examples of Lateral Thinking- Lateral Thinking Techniques-The generation of Alternatives- Innovation-Suspended Judgment.		
UNIT-III	LATERAL THINKING DESIGN	9
Design-Dominant ideas and crucial factors-Fractionation-The reversal method and Brainstorming-Analogies.		
UNIT-IV	PROBLEM SOLVING	9
Ask Searching Questions-Choice of Entry point and Attention Area-Random Stimulation-Concepts/Divisions/Polarization-The new word PO-Blocked by openness-Description/problem solving/design.		
UNIT-V	CASE STUDY	9
How to solve Lateral Thinking puzzles?-Examples of Lateral Thinking puzzles-Easy, Hard and Difficult puzzlers. Case Study-Motorola Lateral Thinking Six Hats- Lateral Thinking Stimulates a \$300K Business Impact- ABB Case Studies Featured at Global Creativity & Innovation Seminar.		
Contact Hours		: 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Understand the different types of thinking and differences between them.
CO2 Demonstrate the Lateral thinking techniques.
CO3 Understand the challenging assumptions and design
CO4 Solve problems by applying lateral thinking techniques
CO5 Apply lateral thinking to find business Solutions.

Text Books:
1 Dr.Edward de Bono “ Lateral Thinking Creativity step by step” Phoenix books publisher.
2 Paul Sloane “The Leader's Guide to Lateral Thinking Skills” 3 rd Edition.
3 Paul Sloane “Lateral Thinking Puzzlers” Puzzle Wright Press.

Web Link	
1	https://www.udemy.com/course/master-lateral-thinking/
2	https://www.lyndacurtin.com/index.php/services/case-studies/96-lateral-thinking-stimulates-a-300k-business-impact
3	https://www.slideshare.net/jaydeepchaurasia/motorolalateralthinkingsixhatscasestudy

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	-	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-
CO3	-	2	-	-	-	1	-	-	-	-	-	-	-	1	1	-
CO4	-	3	-	2	-	-	-	-	-	-	-	-	2	2	-	-
CO5	-	2	-	3	-	2	-	-	2	-	3	2	2	2	-	2
CO (Avg)	-	2.00	-	2.50	-	1.50	-	-	1.50	-	3.00	2.00	1.75	1.67	1.00	2.00

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
IT19P87	TOTAL QUALITY MANAGEMENT	PE	3	0	0	3

Objectives: Broad objective of this course is						
★	To understand the concept of Quality.					
★	To provide leadership in shaping a culture for quality within an organization and determining the effectiveness of quality.					
★	To learn the concept of quality tools, management tools and statistical fundamentals to improve quality.					
★	To provide a clear understanding to apply TQM tools as a means to improve quality.					
★	To have exposure to challenges in Quality Improvement Programs.					

UNIT-I	INTRODUCTION	9
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.		
UNIT-II	TQM PRINCIPLES	9
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.		
UNIT-III	TQM TOOLS AND TECHNIQUES I	9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.		
UNIT-IV	TQM TOOLS AND TECHNIQUES II	9
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.		
UNIT-V	QUALITY MANAGEMENT SYSTEM	9
Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000— ISO 9001 Requirements—Implementation— Documentation— Internal Audits—Registration- ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001— Benefits of EMS.		
		Contact Hours : 45 Periods

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Understand quality concepts and philosophies of TQM
CO2	Apply TQM principles and concepts of continuous improvement
CO3	Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO4	Understand the TQM tools as a means to improve quality
CO5	Remember and understand the quality systems and procedures adopted

Text Books:	
1	Dale H.Besterfield, Carol B.Michna, Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwarshie and Rashmi Urdhwarshie, —Total Quality Management, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

Reference Books:	
1	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8 th Edition, First Indian Edition, Cengage Learning, 2012.
2	Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3	Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006
4	ISO9001-2015 standards.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1	1
CO2	-	-	-	-	-	2	2	-	-	-	-	-	-	1	2	1
CO3	1	1	-	-	2	-	1	1	-	-	-	-	-	1	2	1
CO4	2	1	-	1	2	-	1	1	-	-	-	-	-	1	2	1
CO5	2	-	-	1	1	2	-	-	-	-	-	-	-	1	1	1
CO (Avg)	1.67	1.00	-	1.00	1.67	1.67	1.25	1.00	-	-	-	-	-	1.00	1.60	1.00

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
IT19P88	PROFESSIONAL ETHICS	PE	3	0	0	3

Objectives: Broad objective of this course is to learn
★ To understand the concept of Human Values.
★ To create an awareness on Engineering Ethics.
★ To learn about engineering as social experiments.
★ To create awareness on Safety, Risk and Rights of others.
★ To have exposure on Global Issues.

UNIT-I	HUMAN VALUES	10
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.		
UNIT-II	ENGINEERING ETHICS	9
Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		
UNIT-III	ENGINEERING AS SOCIAL EXPERIMENTATION	9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.		
UNIT-IV	SAFETY, RESPONSIBILITIES AND RIGHTS	9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.		
UNIT-V	GLOBAL ISSUES	8
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.		
		Contact Hours : 45 Periods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Understand the concepts of Human values.
CO2 Apply ethics in society.
CO3 Discuss the ethical issues related to engineering.
CO4 Realize the responsibilities and rights in the society.
CO5 Gain Knowledge on Global Issues.

Text Books:
1 Mike W. Martin and Roland Schinzinger, —Ethics in Engineering Tata McGraw Hill, New Delhi, 2003.
2 Govindarajan M, Natarajan S, Senthil Kumar V. S, —Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

Reference Books:	
1	Charles B. Fleddermann, —Engineering Ethics, Pearson Prentice Hall, New Jersey, 2004.
2	Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, —Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.
3	John R Boatright, —Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003.
4	Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
5	Laura P. Hartman and Joe Desjardins, —Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013. 6. World Community Service Centre, = Value Education', Vethathiri publications, Erode, 2011.

Web Link	
1	www.onlineethics.org
2	www.nspe.org
3	www.globalethics.org
4	www.ethics.org

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	-	-	-	-	2	3	2	-	-	3	-	-	3	-
CO2	-	-	-	-	-	-	3	3	-	-	-	3	-	2	3	-
CO3	-	-	-	-	-	-	3	3	-	-	-	3	-	2	3	-
CO4	-	-	-	-	-	-	3	3	2	-	-	3	-	-	3	-
CO5	-	-	-	-	-	-	3	3	2	-	-	3	-	-	3	-
CO (Avg)	-	-	-	-	-	-	2.80	3.00	2.00	-	-	3.00	-	2.00	3.00	-

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
IT19P89	SOFTWARE PROJECT MANAGEMENT	PE	3	0	0	3

Objectives:	
★	To understand the outline activities of software Project Management
★	To Learn the Metrics for Software cost and effort estimation
★	To show the activity planning and risk management activities
★	To exhibit the project management activities and learn the usage of tools
★	To evaluate the recruitment of Project Personnel

UNIT-I	PROJECT EVALUATION AND PROJECT PLANNING	9
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Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.		
UNIT-II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION	9
Software process and Process Models – Choice of Process models - Incremental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COCOMO Model - A Parametric Productivity Model - Staffing Pattern.		
UNIT-III	ACTIVITY PLANNING AND RISK MANAGEMENT	9
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.		
UNIT-IV	PROJECT MANAGEMENT AND TOOLS	9
Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management - Gantt Chart - MS Project - Reporting Dashboards - Timesheets		
UNIT-V	STAFFING IN SOFTWARE PROJECTS	9
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.		
		Total Contact Hours : 45

Course Outcomes:

On completion of course students will be able to

CO1	Implement Project Management principles during software development.
CO2	Apply Cost and effort estimation metrics for real projects
CO3	Use activity planning templates and practice risk management
CO4	Practice project management activities and learn the usage of project management tools
CO5	Adopt best practices for recruitment and employee motivation

Text Book(s):

1	Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
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Reference Books(s):

1	Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
2	Walker Royce: “Software Project Management”- Addison-Wesley, 1998.
3	Gopalswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013.
4	The Project Management Tool Kit: 100 Tips and Techniques for Getting the Job Done Right, <u>Tom Kendrick</u>

CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	-	-	2	-	2	-	2	-	-	2	1	3	-	2
CO2	2	3	-	2	2	1	-	1	-	1	2	-	-	2	-	-
CO3	-	-	1	-	1	1	-	-	1	-	-	1	2	-	1	2
CO4	2	2	-	3	-	2	1	-	-	2	-	-	-	1	-	-
CO5	-	-	-	1	-	-	1	-	-	1	1	-	1	1	-	-
CO (Avg)	2.00	2.50	1.00	2.00	1.67	1.33	1.33	1.00	1.50	1.33	1.50	1.50	1.33	1.75	1.00	2.00

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

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

OBJECTIVE:

- To enable the students to do analysis and design of the industry- relevant and real-time projects on various core domains of information technology.

Course Outcomes	Course Outcome Statements
CO1	Analyze complex Engineering problems related Information Technology to reach substantiated conclusions by applying knowledge of Mathematics, Engineering fundamentals and Engineering specialization.
CO2	Create research based solutions for complex computer Engineering or multidisciplinary problems, and design system components or processes by applying appropriate techniques, resources, and modern IT tools.
CO3	Apply contextual computer science engineering solutions in the sustainable development towards environmental, societal, health, safety, legal, cultural issues and needs
CO4	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
CO5	Perform effectively as an individual, and as a member or leader in diverse teams, Communicate effectively and write effective reports and design documentation, ability to engage themselves in life-long learning

OBJECTIVE:

- To enable the students to do the implementation of the industry- relevant and real-time projects on various core domains of information technology.

Course Outcomes	Course Outcome Statements
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CO5	Perform effectively as an individual, and as a member or leader in diverse teams, Communicate effectively and write effective reports and design documentation, ability to engage themselves in life-long learning