

RAJALAKSHMI ENGINEERING COLLEGE CURRICULUM AND SYLLABUS

B. E. COMPUTER SCIENCE AND DESIGN REGULATION 2019

Vision

To promote highly Ethical and Innovative Computer Professionals through excellence in teaching, training and research.

Mission

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

PEO 3: To develop professionally ethical individuals enhanced with analytical skills, communication skills and organizing ability to meet industry requirements.

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Computer Science and Design Program will have an

PSO 1: Ability to understand, analyze and develop efficient software solutions using suitable algorithms, data structures, and other computing techniques.

PSO 2: Ability to independently investigate a problem which can be solved by a Human Computer Interaction (HCI) design process and then design an end-to-end solution to it (i.e., from user need identification to UI design to technical coding and evaluation). Ability to effectively use suitable tools and platforms, as well as enhance them, to develop applications/products using for new media design in areas like animation, gaming, virtual reality, etc.

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

PROGRAMME OUTCOMES (POs)

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

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

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

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: 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.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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.

CURRICULUM

B. E. COMPUTER SCIENCE AND DESIGN

Regulation 2019 | Total Credits: 165

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.	MA19156	Linear Algebra and Calculus	BS	4	3	1	0	4
LAB ORIENTED THEORY COURSES								
3.	CD19141	Design Drawing and Visualization	BS	5	3	2	0	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
6.	PH19241	Physics for Information Science	BS	5	3	0	2	4
NON CREDIT COURSES								
7.	MC19102	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
TOTAL				28	16	4	8	20

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA19255	Transforms and Partial Differential Equations	BS	4	3	1	0	4
2.	CD19201	Visual Design and Communication	ES	4	2	0	2	3
LAB ORIENTED THEORY COURSES								
3.	EE19242	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
4.	EC19243	Principles of Digital Electronics	ES	5	3	0	2	4
5.	CS19241	Data Structures	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	1	12	21

SEMESTER III								
SL NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA19154	Discrete Mathematics	BS	4	3	1	0	4
2.	GE19301	Life Science for Engineers	BS	3	3	0	0	3
3.	CD19301	Computer Design	HS	3	2	1	0	3
LAB ORIENTED THEORY COURSES								
4.	CB19343	Software Engineering	PC	5	3	0	2	4
5.	CD19342	Design Processes & Perspectives	PC	5	3	0	2	4
6.	CS19342	Object Oriented Programming Paradigm	PC	5	3	0	4	5
NON CREDIT COURSES								
7.	MC19301	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0
TOTAL				28	20	2	8	23

SEMESTER IV								
SL NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	MA19453	Probability and Statistics	BS	4	3	1	0	4
2.	CD19401	Strategic Design Management	HS	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	CS19441	Operating Systems	PC	7	3	0	4	5
4.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4
5.	CS19P06	Human Computer Interaction	PC	4	2	0	2	3
LABORATORY COURSE								
6.	CD19411	Python Programming for Design	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE19421	Soft Skills – I	EEC	2	0	0	2	1
TOTAL				29	14	1	14	22

SEMESTER V								
Sl. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	CS19501	Theory of Computation	PC	3	3	0	0	3
2.		Professional Elective-I	PE	4	2	0	2	3
3.		Open Elective – I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	CS19541	Computer Networks	PC	7	3	0	4	5
5.	CS19443	Database Management Systems	PC	7	3	0	4	5
6.	CD19541	Animation & Graphics	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
7.	GE19521	Soft Skills – II	EEC	2	0	0	2	1
TOTAL				31	17	0	14	24

SEMESTER VI								
Sl. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.	CD19601	Fundamentals of Artificial Intelligence	PC	3	3	0	0	3
2.		Professional Elective-II	PE	4	2	0	2	3
LAB ORIENTED THEORY COURSES								
3.	CD19641	Game Design and Development	PC	5	3	0	2	4
4.	CD19642	Data Visualization	PC	5	3	0	2	4
5.	CD19643	Web Essentials	PC	5	3	0	2	4
LABORATORY COURSES								
6.	CD19606	Mobile Application Design and Development Laboratory	PC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
7.	CD19651	Mini Project	EEC	4	0	0	4	2
8.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				30	14	0	16	22

SEMESTER VII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-III	PE	4	2	0	2	3
2.		Professional Elective-IV	PE	4	2	0	2	3
3.		Professional Elective-V	PE	4	2	0	2	3
4.	CD19701	Fundamentals of Video for Engineers	PC	3	3	0	0	3
5.	CD19721	Introduction to 3D Animation	PC	1	1	0	0	1
LAB ORIENTED THEORY COURSES								
6.	CD19741	3D Printing and Design	PC	7	3	0	4	5
LABORATORY COURSES								
7.	CD19711	Project-I	EEC	6	0	0	6	3
TOTAL				29	13	0	16	21

SEMESTER VIII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1.		Professional Elective-VI	PE	4	2	0	2	3
2.		Open Elective-II	OE	3	3	0	0	3
LABORATORY COURSES								
3.	CD19811	Project-II	EEC	12	0	0	12	6
TOTAL				19	5	0	14	12

TOTAL NO. OF CREDITS: 165

PROFESSIONAL ELECTIVES (PE)

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	CD19P01	Aesthetics and Art	PE	4	3	0	0	3
2.	CD19P02	Foundations of Digital story telling	PE	6	3	0	0	3
3.	CD19P03	Fundamentals of Image Processing	PE	4	2	0	2	3
4.	AI19P75	Information Retrieval	PE	4	2	0	2	3
5.	AI19P61	GPU Programming	PE	4	2	0	2	3
6.	CS19P09	C# and .Net Programming	PE	4	2	0	2	3
7.	AI19P62	Data Analysis and Data Mining	PE	4	2	0	2	3
8.	CS19P20	Social, Text and Media Analytics	PE	4	2	0	2	3

9.	CS19P19	Cognitive Science	PE	4	2	0	2	3
10.	CD19P04	Computer Vision and Image Analysis	PE	4	2	0	2	3
11.	CD19P05	UI and UX	PE	6	2	0	2	3
12.	AI19P82	Business Intelligence and Analytics	PE	4	2	0	2	3
13.	CS19741	Cloud Computing	PE	4	2	0	2	3
14.	CD19P15	Foundations of Machine Learning Concepts	PE	4	2	0	2	3
15.	CS19P06	Quantum Computing	PE	3	2	1	0	3
16.	CD19P07	Introduction to Motion Graphics	PE	4	2	0	2	3
17.	CD19P08	Design Thinking for Innovation	PE	3	1	0	4	3
18.	CD19P09	Immersive Technology-AR and VR	PE	4	2	0	2	3
19.	CD19P10	Foundations of Data Science	PE	4	2	0	2	3
20.	CD19P11	Digital Media Entrepreneurship	PE	3	3	0	0	3
21.	CD19P12	Visual Effects	PE	6	0	0	6	3
22.	AI19P52	AI for Game Programming	PE	4	2	0	2	3
23.	AI19P76	Cyber Security Systems	PE	4	2	0	2	3
24.	CD19P13	Film Making and Radio Podcasting	PE	4	2	0	2	3
25.	CD19P14	Wearable Applications	PE	4	2	0	2	3
26.	AI19P53	Mobile Technology	PE	3	3	0	0	3
27.	CD19P06	Spatial Computing	PE	4	2	0	2	3

SUMMARY OF ALL COURSES

B. E. COMPUTER SCIENCE AND DESIGN										
S.NO	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3		3	3					9
2	BS	12	4	7	4					27
3	ES	5	12							17
4	PC		5	13	14	17	16	9		74
5	PE				0	3	3	9	3	18
6	OE					3			3	6
7	EEC				1	1	3	3	6	14
8	MC	0	0	0						0
	Total	20	21	23	22	24	22	21	12	165

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

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

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

Course Outcomes:						
On completion of the course students will be able to						
□	Discuss and respond to the listening content.					
□	Read and comprehend different texts and appreciate them.					
□	Understand structures and techniques of precise writing.					
□	Analyze different genres of communication and get familiarized with new words, phrases, and sentence structures.					
□	Write and speak appropriately in varied formal and informal contexts.					

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

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

CO - PO – PSO matrices of course

PO/PSO CO	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
HS19151.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
HS19151.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
HS19151.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS19151.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
HS19151.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	1.0	1.7	1.0	1.3	1.0	1.0	1.0	1.0	2.0	2.8	1.0	1.8	2.0	2.0	1.0

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

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

No correlation : “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19156	LINEAR ALGEBRA AND CALCULUS	BS	3	1	0	4

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

UNIT-I	MATRICES AND QUADRATIC FORMS	12
Symmetric and skew – symmetric matrices, Hermitian matrix, Unitary matrix and Orthogonal matrices – Eigen values and Eigen vectors - Cayley – Hamilton theorem (statement only) and applications - Similarity transformation - Orthogonal transformation and quadratic forms to canonical forms - Nature of quadratic forms.		
UNIT-II	VECTOR SPACES	12
Vector spaces – Subspaces – Linear combinations and system of Linear equations – Linear independence and Linear dependence – Bases and Dimensions – Linear Transformation – Matrix representation of Linear Transformation - Null space, Range and dimension theorem.		
UNIT-III	INNER PRODUCT SPACES	12
Inner product and norms - Gram Schmidt orthonormalization process - Modified Gram Schmidt orthonormalization process - QR Factorization-Singular value decomposition.		
UNIT-IV	DIFFERENTIAL CALCULUS- FUNCTIONS OF SEVERAL VARIABLES	12
Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.		
UNIT-V	MULTIPLE INTEGRAL	12
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.		
Total Contact Hours		: 60

Course Outcomes:	
On completion of the course students will be able to:	
□	Apply the concept of Eigen values and eigen vectors, diagonalization of a matrix for solving problems.
□	Use concepts of basis and dimension in vector spaces in solving problems.
□	Construct orthonormal basis using inner products and decompose matrices.
□	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
□	Evaluate surface area and volume using multiple integrals.

Text Book(s):	
1	Grewal B.S., Higher Engineering Mathematics, 44th Edition, Khanna Publishers, New Delhi, 2015.
2	Gilbert Strang, Introduction to linear algebra, 6th Edition, Wellesley Publishers, 2016

Reference Books(s):	
1	Friedberg, A.H., Insel, A.J. and Spence, L., Elementary Linear Algebra, a matrix approach, 2 nd edition, Pearson, 2019.
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.
4	T Veerarajan, Engineering Mathematics –I, McGraw Hill Education, 2018
5	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19156.1	3	3	2	2	2	1	-	-	-	-	1	2	2	3	2
MA19156.2	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.3	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.4	3	3	2	2	3	1	-	-	-	-	1	2	2	3	2
MA19156.5	3	3	1	2	1	1	-	-	-	-	1	2	1	2	2
Average	3	3	1.9	2	2	1	-	-	-	-	1	2	2.2	2.8	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	Category	L	T	P	C
CD19141	DESIGN DRAWING AND VISUALIZATION	BS	3	2	0	4

Objectives:	
•	To enable drawing as a medium for observing, representing, conceptualizing, visualizing and communicating design ideas.
•	To develop an understanding of spatial concepts and the critical ability to think and visualize in three dimensions through the tactile nature of drawing.
•	To develop observational skills through the study of the environment and as a tool for visual representation, ideation/conceptualization, visualization and communication or presentation of design ideas through sketching and drawing from both observation and memory.

UNIT-I	INTRODUCTION TO DESIGN DRAWING	9
Introduction to Materials, Tools & Methods - different grades of pencils & exploring- Developing free finger, wrist, hand & arm movement and initiate muscle- Introduction to Observation – Scrutinize, Examine, Study, Inspect, Perceive, Sense, Feel, Notice, Identify, Understand- Training the eye to observe accurately to educate the visual sense- Introduction to Perception – View, Opinion, Insight, Discernment- Introduction to Perspective – Eye level, Vanishing Point		
UNIT-II	DRAWING OF CUBES and PERSPECTIVES	9
Introduction to Vanishing Points, View Point, Eye Level, Horizon, Parallel & Converging Lines-One Point Perspective- Two Point Perspective-Three Point Perspective-Perspective in the Environment, Interior Spaces and Objects.		
UNIT-III	OBJECT DRAWING and HUMAN FORM DRAWING	9
Introduction to other geometric forms like cylinder, cuboids etc.- Introduction to Object Drawing-How to observe – shape, proportions, effect of light on the objects etc.- Introduction to Human Form proportions-Human Form – Object Relationships		
UNIT-IV	GEOMETRY & STRUCTURE	9
Construction of Basic Polygons-Proportioning Systems: Golden Proportion- Interrelation of Polygons- Orthographic Projection of Planes and Solids-. Isometric Projection-Architectonic Drawing - Isometric Circles-Architectonic Planes with rounded surfaces, tube with square cross section with ellipse at different planes and tube with circular crosssection.		
UNIT-V	VISUALISATION DRAWING	9
Introduction to Mental Imagery- Compositions inclusive of human forms, object, perspective etc- Sketching a mini environment outside the campus from memory- Sketching a visualised composition from imagination		
		Total Contact Hours : 45

Course Outcomes:	
On completion of the course students will be able to	
□	Develop the skill & ability to observe and visually represent all the elements in their environment with a focus on human forms, objects and nature and the way they interact.
□	inculcate skills and develop the ability to explain the importance of precision in design through drawings using instruments/tools and concept of figures/configuration through basic geometrical patterns on 2D surfaces..
□	Develop the ability to discuss orthographic and isometric projections as fundamental tools of technical drawing and use technical drawings as a tool for visual communication.
□	Develop the ability to analyse visual structure of 3D forms on 2D surfaces with an exposure to the complexities of imagination and visualization.
□	Develop the ability to analyse complex images and in turn develop the ability to create mental imageries and visualise concepts.

Text Book(s):	
	1. Erik Olofsson, Klara Sjolen, Design Sketching, KEEOS Design Books.
	2. K . Morling, Geometric and Engineering Drawing, Third Edition, Graduate of the Institution of Mechanical Engineers, SI Units, Elsevier, 2010.

Reference Books(s):	
1	Flint, Tom, Anatomy for the Artist: The Dynamic of the Human Form, London, Arcturus Publishing.
2	Koos Eissen, Roselien Steur, Sketching: The Basics, BIS Publishers
3	Edwards, Betty, Drawing on the Artist Within : An Inspirational and Practical Guide to Increasing Your Creative Powers, Simon & Schuster Inc., New York
4	Michael Swan, Practical English Usage, Oxford University Press, 1995.
5	F.T. Wood, Remedial English Grammar, Macmillan, 2007.
6	William Zinsser, On Writing Well, Harper Resource Book, 2001.
7	Liz Hamp-Lyons and Ben Heasley, Study Writing, Cambridge University Press, 2006.
8	Exercises in Spoken English, Parts I-III, CIEFL, Hyderabad, Oxford University Press.

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

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

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

List of Experiments (Any 10 experiments)	
1	Determine the wavelength and angle of divergence of laser beam and numerical aperture using fiber cable.
2	Determine the wavelength of spectrum by using spectrometer.
3	Determine of refractive index of a given prism by using spectrometer.
4	Determine specific resistance of the material of given wires using metre bridge.
5	Verify Ohm's law - series and parallel.
6	Determine the value of Planck's constant using photo electric effect.
7	Determine the band gap of given semiconductor.
8	Determination of Hall coefficient of semiconducting materials.
9	Study the magnetic field produced by current carrying coils by using 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:				
☐	Apply the concepts of electron transport in nanodevices.			
☐	Analyze the physics of semiconductor devices			
☐	Analyze the properties of optical materials for optoelectronic applications.			
☐	Use the concepts of Laser and Fiber optics in communication.			
☐	Use the properties of magnetic and superconducting materials in data storage devices.			

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

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

CO - PO – PSO matrices of course

PO/PSO	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
CO															
PH19241.1	3	3	2	2	2	1	-	1	1	2	1	2	1	1	2
PH19241 .2	3	3	3	2	3	1	1	-	1	2	1	2	1	1	2
PH19241 .3	3	3	3	2	3	1	1	-	1	2	1	2	1	1	1
PH19241 .4	3	3	2	2	3	1	1	-	1	2	1	2	1	-	1
PH19241 .5	3	3	2	2	3	1	1	-	1	2	1	2	1	1	1
Average	3.0	3.0	2.4	2.0	2.8	1.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	1.0	1.4

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

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

No correlation: “-“

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
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	
□	Formulate simple algorithms for arithmetic and logical problems.
□	Implement conditional branching, iteration and recursion.
□	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
□	Use arrays, pointers and structures to formulate algorithms and programs.
□	Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Text Books:	
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India; 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 – PSO matrices of course

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

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

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

No correlation: “-“

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

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

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

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

REFERENCE						
1	Bawa H.S., Workshop Practice, Tata McGraw – Hill Publishing Company Limited, 2007.					
2	Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.					
3	Jeyapooan 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, Sree Sai Publication, 2002.					

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19122.1	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
GE19122.2	3	3	3	3	2	2	2	-	2	1	3	3	-	-	-
GE19122.3	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
Average	3	3	3	3	2.67	1.33	1.33	-	2	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 (Theory course)	Category	L	T	P	C
MC19102	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0

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

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

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

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

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

CO - PO – PSO matrices of course

PO/PSO CO	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
MC19102.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
Average	-	-	-	-	-	1.0	1.0	3.0	2.0	-	-	1.0	-	-	-

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

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

No correlation: “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19255	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	BS	3	1	0	4

Objectives:

☐	To introduce the effective mathematical tools for solving partial differential equations that model several physical processes.
☐	To introduce Fourier series which is central to many applications in engineering apart from its use in solving boundary value problems.
☐	To learn the techniques of solving problems using Laplace transforms.
☐	To acquaint the student with Fourier transform techniques used in wide variety of situations.
☐	To introduce Z transform techniques to solve problems involving discrete time systems.

UNIT-I	PARTIAL DIFFERENTIAL EQUATIONS	12
$f(p, q) = 0, f(z, p, q) = 0, z = px + qy + f(p, q), f(x, p) = f(y, q)$ Formation of partial differential equations – Singular integrals - Solutions of standard types of first order PDE: - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous type.		
UNIT-II	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-III	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.		
UNIT-IV	FOURIER TRANSFORMS	12
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application to boundary value problems.		
UNIT-V	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.		
Total Contact Hours		: 60

Course Outcomes:

On completion of course students will be able to

☐	solve different types of partial differential equations.
☐	construct Fourier series for different periodic functions and to evaluate infinite series.
☐	use Laplace transform and inverse transform techniques in solving differential equations.
☐	solve Engineering problems using Fourier transform techniques.
☐	solve difference equations using Z – transforms that arise in discrete time systems.

Text Book (s):

1	Erwin Kreyszig, " Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd.,New Delhi, Second reprint, 2012.

Reference Books(s):	
1	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
2	Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3	Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4	Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
5	Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt. Ltd, Delhi, 2013.

Subject Code	Subject Name	Category	L	T	P	C
CD19201	VISUAL DESIGN AND COMMUNICATION	ES	2	0	2	3

Objectives:						
□	To understand the principles of the visual language and their semantic use. A multi- disciplinary domain, design consists of, aesthetics, architecture, products, communication, processes, systems, technology, business/commerce, ramification on environment and society and demands					
□	To communicate more concisely and in a visually appropriate manner, it is necessary to use commonly understood principles, perspective and design layout standards.					
□	To understand the fundamentals of Typography and Photography.					

UNIT-I	INTRODUCTION TO VISUAL DESIGN	9
importance of understanding visual language-its relation in context to nature and environment-Exploring and understanding Dots, Lines, Forms, Space, Pattern, Texture and Colour as an elements of visual language		
UNIT-II	INTRODUCTION TO THE PRINCIPLES OF VISUAL LANGUAGE	9
Visual explorations and experiments with Form, Colour, and Space, Texture, in relation to the context and environments – Concepts of harmony, balance, contrast, proportion, order, symmetry, asymmetry, rhythm, tension, juxtaposition, proximity, size, scale, proportion, orientation, alignment, variety, gradation, dominance, subordination, transition etc.		
UNIT-III	. INTRODUCTION TO FUNDAMENTALS OF TYPOGRAPHY	9
Introduction to Type and its History-Type as a form and means of communication in our environment-Introduction to Indian type: Vernacular letter-forms-Classification of types: Typefaces, type families and type designers-Anatomy of the type: x-height, ascenders, descenders, counter, cap-height, baseline, etc-Typographic variables: Kerning, tracking, leading, spacing etc.-Semantics of type: Legibility & readability issues in type and meaning attributed to type. 4h. Expressive Typography-Introduction to printing techniques		
UNIT-IV	INTRODUCTION TO PHOTOGRAPHY	9
Introduction and Orientation: Art and Science of Photography. Drawing out parallels / differences between the EYE and the CAMERA-Camera: Understanding the various controls on a Digital SLR Camera Features and Details. Shooting Modes. Aperture and Depth of Field. Shutter Speed. Critical Shutter Speeds and Effects- Exposure: Exposure as function of Quantity of Light and Time. Getting used to shooting in Manual Mode and learning to measure light using the camera's built-in exposure meter-Film Speed/Sensor Sensitivity: Understanding the role of sensitivity in Exposure. ISO/ASA and Digital Noise-Lenses: Different Types of Lenses. Classification of Lenses by Focal Lengths. Angle of View. Fixed Focal Length and Zoom Lenses. Close up and Macro Lenses-Light and Color Temperature- Digital Post-Production: Introduction to File-Formats. RAW vs.JPG. Understanding resolution, resizing and basic image post processing using Photoshop. Exploring the software to visualize and create digital mosaics.		
UNIT-V	INTRODUCTION TO VIDEOGRAPY	9
Concept development 8b. Storyboarding-Video Shooting - Framing, Camera movement etc 8d. Video Editing- Defining communication-Sender, Channel and Receiver-Semiotics - Study of sign process (semiosis), meaningmaking and meaningful communication. 9c. Sign, Signifier, Signified-Denotation and Connotation-10a. Story, narrative and see different perspectives-Identifying problems, opportunities and improvements. 10c. Differentiating problem, need and conflict-Persona study-Scenario study		
		Total Contact Hours : 45

Course Outcomes:						
On completion of the course students will be able to						
□	Develop the ability to create visual compositions using basic elements and by appyling appropriate principles of visual composition to communicate					
□	Develop the ability to perceive, visualize, and communicate visual elements as visual narratives.					
□	Develop the ability to apply the dynamics of visual design in Typography and Photography.					
□	Develop the ability to address simple communication problems through a visualization process and construct mental imageries					
□	Demonstrate the ability to plan, develop, design and execute communication products					

Text Book(s):						
	Wallschlaeger, Charles, &Busic-Synder, Cynthia, Basic Visual Concepts and Principles for Artists, Architects and Designers, McGraw-Hill, (1992).					

Reference Books(s):	
9	Buxton, Bill, Sketching User Experience: Getting the Design Right and the Right Design (Interactive Technologies), Morgan Kaufmann, (2007).
10	Caplin, Steve; Banks, Adam, The Complete Guide to Digital Illustration, Publisher: Watson - Guptill Publications, (2003).

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

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

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

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

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

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

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

CO - PO – PSO matrices of course

PO/PSO	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
CO															
EE19242.1	2	2	2	3	3	2	1	-	-	-	-	3	2	2	2
EE19242.2	1	2	2	3	2	2	3	-	-	-	-	-	1	-	1
EE19242.3	2	3	2	1	2	2	2	-	2	-	-	1	2	2	2
EE19242.4	3	3	2	3	1	2	2	-	-	-	2	2	2	1	2
EE19242.5	3	3	2	2	2	1	2	1	2	1	2	1	2	3	2
Average	2.2	2.6	2.0	2.4	2.0	1.8	2.0	1.0	2.0	1.0	2.0	1.8	1.8	2.0	1.8

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

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

No correlation: “-“

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EC19243	PRINCIPLES OF DIGITAL ELECTRONICS	ES	3	0	2	4

Objectives:						
□	To learn the basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions					
□	To understand the design of various Combinational circuits.					
□	To extrapolate the design of Synchronous Sequential circuits using Flip-Flops.					
□	To know the design procedure of Asynchronous Sequential circuits and its problems.					
□	To understand the concept of Programmable Logic Devices for the design of digital circuits and Familiar with Verilog HDL.					

UNIT-I	BOOLEAN ALGEBRA AND LOGIC GATES	9
Fundamentals: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS). Minimization Techniques: Minimization of Boolean expressions using Boolean Laws, Karnaugh map, Quine McCluskey method of minimization, don't care conditions. Logic Gates: NAND– NOR implementations.		
UNIT-II	COMBINATIONAL CIRCUITS	9
Half adder, Full Adder, Half subtractor, Full subtractor, Carry Look Ahead adder, Parallel Binary Adder/Subtractor, BCD adder, Binary Multiplier, Parity generator, Parity checker, Magnitude Comparator, Encoder, Decoder, Multiplexer- Logic function implementation, Demultiplexer. Code converter- Binary to Gray and Gray to Binary		
UNIT-III	SYNCHRONOUS SEQUENTIAL CIRCUITS	9
Memory elements: Latches, Flip-flops: RS, JK, D, T, Master-Slave, Triggering of Flip Flops, Realization of one flip flop using other flip flop. Design: Synchronous and Asynchronous counters - Up/Down counter, Modulo-N counter. Shift Registers - SISO, SIPO, PISO, PIPO, Universal Shift Registers. Shift Register Counters - Ring counter, Shift counter. Design of synchronous sequential circuits using Moore and Mealy model		
UNIT-IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	9
Design and analysis of asynchronous sequential circuits using Fundamental and pulse mode, Problems in Asynchronous sequential Circuits- Races, Cycles and Hazards.		
UNIT-V	PROGRAMMABLE LOGIC DEVICES	9
Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of Combinational Logic Circuits using PROM, PLA, PAL. Implementation of basic combinational circuits using Verilog HDL.		
Contact Hours		: 45

List of Experiments				
1	Implementation of Binary to Gray and Gray to Binary code converters			
2	Logic function implementation of Multiplexer and De-multiplexer using logic gates.			
3	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- Flop.			
4	Design and Implementation of 4-bit Asynchronous and BCD Synchronous counters.			
5	Implementation of Adder and Subtractor using Verilog HDL.			
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS				
✦ IC Trainer Kit – 15 Nos				
✦ Bread Boards – 15 Nos				
✦ ICs each 50 Nos – 7400,7402, 7404, 7486, 7408, 7432, 7411, 74151, 74150, 7474, 7476				
✦ System with HDL				
		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:	
On completion of the course, the students will be able to	
□	Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization techniques.
□	Design and Implement Combinational circuits.
□	Construct Synchronous Sequential circuits using Flip-Flops.
□	Design Asynchronous Sequential circuits and analyse its problems.
□	Implement digital circuits using Programmable Logic Devices and Familiar with Verilog HDL.

Text Books:	
1	Morris Mano & Michael D Ciletti, “Digital Design: With an Introduction to Verilog HDL, 5th Edition, Pearson Education ,2013.
2	Charles H.Roth. “Fundamentals of Logic Design”, 7th Edition, Thomson Learning, 2014.

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

Web links for virtual lab:	
1	http://vlabs.iitkgp.ernet.in/dec/#

CO - PO – PSO matrices of course

PO/PSO	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
CO															
EC19243.1	2	2	1	2	2	-	-	-	-	-	-	1	1	2	-
EC19243.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.2	1.2	1.8	1.2	1.2	-	-	-	-	-	-	1.6	1.6	2.0	-

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

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

No correlation: “-“

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

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

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

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

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

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

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

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

CO - PO – PSO matrices of course

PO/PSO	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
CO															
CS19241.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19241.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

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

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

No correlation: “-“

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

Objectives:
<ul style="list-style-type: none"> To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

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

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

CO - PO – PSO matrices of course

PO/PSO CO	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
GE19121.1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.2	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.3	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.4	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	1.0	1.0	-	-	-	-	-	-

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

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

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

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

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

Reference Books(s):	
1	Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd, New Delhi, 2007.
2	ErachBharucha, "Textbook of Environmental Studies", 3rd edition, Universities Press, 2015.
3	G. Tyler Miller and Scott E. Spoolman, "Environmental Science", 15th edition, Cengage Learning India, 2014.
4	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", 3rd 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 – PSO matrices of course

PO/PSO	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
CO															
MC19101.1	3	2	3	2	1	3	3	2	1	1	1	1	1	1	1
MC19101.2	3	3	3	2	2	3	3	3	2	1	2	2	1	2	2
MC19101.3	3	3	3	2	2	3	3	3	2	1	2	1	1	2	1
MC19101.4	3	3	3	2	2	3	3	2	2	1	2	2	1	2	2
MC19101.5	2	2	3	1	1	3	3	1	1	2	1	1	1	1	1
Average	2.8	2.6	3.0	1.8	1.6	3.0	3.0	2.2	1.6	1.2	1.6	1.4	1.0	1.6	1.4

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

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

No correlation : “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
MA19154	DISCRETE MATHEMATICS	BS	3	1	0	4

Objectives:	
•	To extend student's Logical and Mathematical maturity and ability to deal with abstraction.
•	To understand discrete structures of many levels and to know the principle of counting.

UNIT-I	MATHEMATICAL LOGIC	12
Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness		
UNIT-II	COMBINATORICS	12
Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.		
UNIT-III	GRAPH THEORY	12
Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planar graph, independence number and clique number, chromatic number, statement of Four- color theorem.		
UNIT-IV	ABSTRACT ALGEBRA	12
Set, relation – Algebraic System: Groups, sub groups, homomorphism, cosets, Lagrange's theorem – Ring and Field (definition).		
UNIT-V	BOOLEAN ALGEBRA	12
Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.		
Total Contact Hours		60

Course Outcomes:	
On completion of the course, students will be able to	
•	Apply the concepts of logic to test the validity of a program and to arrive at inferences on logical structures.
•	Use the counting principles in implementing various programmes.
•	Handle a class of functions which transform a finite set into another finite set which relates to input and output
•	Apply the concepts and properties of algebraic structures such as semi groups, monoids and groups.
•	Apply the concepts of Boolean algebra in analyzing logic gates.

Text Books:	
1	M. Morris Mano, "Digital Logic & Computer Design", Pearson.
2	C. L. Liu, "Elements of Discrete Mathematics", (Second Edition) McGraw Hill, New Delhi

Reference Books / Web links:	
1	Gilbert Strang, "Introduction to linear algebra".
2	R. A. Brualdi, "Introductory Combinatorics", North-Holland, New York.
3	N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, Englewood
4	E. Mendelsohn, Van-Nostrand, "Introduction to Mathematical Logic", (Second Edition), London.
5	J. A. Bondy and U. S. R. Murty, "Graph Theory with Applications", Macmillan Press, London.
6	L. Zhongwan, "Mathematical Logic for Computer Science", World Scientific, Singapore.
7	I. N. Herstein, John Wiley and Sons, "Topics in Algebra"

CO - PO – PSO MATRICES OF THE COURSE

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19154.1	3	3	3	2	2	1	1	-	-	-	2	1	3	3	2
MA19154.2	3	3	3	2	2	1	1	-	-	-	2	1	3	3	2
MA19154.3	3	3	3	2	2	1	1	-	-	-	-	1	3	2	2
MA19154.4	3	3	3	2	1	1	1	-	-	-	-	1	3	2	2
MA19154.5	3	3	3	2	1	1	1	-	-	-	-	1	3	2	2
Average	3.0	3.0	3.0	2.0	1.6	1.0	1.0	-	-	-	2.0	1.0	3.0	2.4	2.0

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

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

No correlation:“-“

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

Objectives:

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

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

Course Outcomes:

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

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

Text Books:

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

Reference Books

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

Web links for Theory & Lab:

1	https://nptel.ac.in/courses/122103039/
---	---

CO - PO – PSO matrices of course

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

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

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

No correlation: “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CD19301	Computer Design	HS	2	1	0	3

• Learn Data Representation concept along with Register transfer and Micro-Operation
• Understand the Basic Computer Organization and its design
• Learn Micro Programmed control instructions, program and Different CPU Design
• Understand the Pipelining concept and how the computer arithmetic is carried out
• Learn the Input and output and Memory organization

UNIT-I	DATA REPRESENTATION & REGISTER TRANSFER AND MICRO OPERATIONS	9
Data Representation - Register Transfer and Micro operations -		
Data representation: Data types, Complements, Fixed Point Representation and Floating Point Representation.		
Register Transfer and Micro operations		
Micro operation, Register Transfer Language,- Register Transfer - Bus and Memory Transfer - Arithmetic Micro operations:. Logic Micro operations - Shift Micro operations:- , Arithmetic Shift Unit		
UNIT-II	BASIC COMPUTER ORGANIZATION AND DESIGN	9
Instruction Code – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle-Memory Reference Instruction – Input-Output Interrupt – Complete Computer Description – Design of Basic Computer- Design of Accumulator Logic		
UNIT-III	MICRO PROGRAMMED CONTROL AND CPU	9
Control Word - Address Sequencing: Conditional Branch, Mapping of Instructions, Subroutines- Micro program example: Microinstruction Format, Symbolic Microinstruction -. Design of Control Unit		
Central Processing Unit : General Register Organization – Stack Organization – Instruction Format – Addressing Modes – Data Transfer and Manipulation - Program Control –RISC		
UNIT-IV	PIPELINING & COMPUTER ARITHMETIC	9
Pipelining : Parallel Processing, Pipelining: - Arithmetic Pipeline - Instruction Pipelining: RISC Pipeline – Vector Processing – Array Processor		
Computer Arithmetic : Addition and Subtraction – Multiplication Algorithms- Division algorithms –Float Point Arithmetic Operations – Decimal Arithmetic Unit – Decimal Arithmetic Operations		
UNIT-V	INPUT OUTPUT AND MEMORY ORGANIZATION	9
Input Output Organization : Input-Output Interface: I/O Bus and Interface Modules, I/O vs. Memory Bus, Isolated vs. Memory-Mapped I/O - . Asynchronous Data Transfer: Strobe, Handshaking - Modes of Transfer: Programmed I/O, Interrupt-Initiated I/O, Direct memory Access - . Priority Interrupt: Polling, Daisy-Chaining, Parallel Priority Interrupt - Direct Memory Access, Input-Output Processor, DMA vs.IOP		
Memory Organization : Memory Hierarchy, Main Memory, RAM and ROM Chips, Memory address Map,Memory Connection to CPU, Auxiliary Memory (magnetic Disk, Magnetic Tape) - Associative Memory: Hardware Organization, Match Logic, Read Operation, Write Operation - Cache Memory: Locality of Reference, Hit & Miss Ratio, Mapping, Write Policies – Virtual Memory		
Contact Hours		: 60
Total Contact Hours		: 60

Course Outcomes:	
On completion of the course, the students will be able to	
•	Understand how the data is represented and how it is transferred via register and how microoperation is carried out.
•	Know the function of different part of the computer and also different instruction set.
•	Apply the Microinstruction to write the program and also different computer architecture instructions.
•	Know and apply the pipelining concept to write the program and also performs the computer arithmetic operation.
•	Understand the different mode of i/o operations and also memory organization and its related operations.

Text Books:	
1	Computer System Architecture, M.Morris Mono, Third Edition , 2016
2	Dr.M.Usha, T.S.Srikanth, “Computer System Architecture and Organization”, Wiley Publications.

Reference Books	
1	William Stallings, “Computer Organization and Architecture: Designing for the performance”, 10 th Edition, 2015 , Pearson Publication.
2	Dr. SPS Saini and Anish Saini, “Computer System Architecture and Organization”, SK Kataria & sons Publications, 2007.

Web links for eBook:	
1	https://www.pdfdrive.com/computer-system-architecture-3rd-edition-e184573355.html

CO-PO-PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CD19301.1	1	2	1	2	2	1	1	-	1	1	1	1	2	2	1
CD19301.2	2	2	2	2	2	1	1	-	1	1	1	1	2	3	1
CD19301.3	2	2	1	2	2	2	1	-	1	1	1	1	2	2	2
CD19301.4	2	1	2	1	1	2	1	-	1	1	1	1	2	2	2
CD19301.5	2	2	2	2	1	2	1	-	1	1	1	1	2	2	2
Average	1.8	1.8	1.6	1.8	1.8	1.6	1	0	1	1.6	1	1	2	2.2	1.8

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

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

No correlation: “**”

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CB19343	SOFTWARE ENGINEERING	PC	3	0	2	4

Objectives:	
•	Understand the phases in a software project.
•	Gain knowledge in fundamental concepts of software project management and quality.
•	Obtain knowledge on requirements engineering and Analysis Modelling.
•	Learn various testing and maintenance measures

UNIT-I	INTRODUCTION	9
Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.		
UNIT-II	SOFTWARE PROJECT MANAGEMENT	9
Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management. Agile Software Engineering: Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories		
UNIT-III	SOFTWARE QUALITY AND RELIABILITY	9
Software quality; Garvin's quality dimensions, McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability, reliability models and estimation.		
UNIT-IV	SOFTWARE REQUIREMENTS AND OO ANALYSIS, DESIGN AND CONSTRUCTION	9
Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality. Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.		
UNIT-V	SOFTWARE TESTING	9
Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.		
		Contact Hours : 30
		Total Contact Hours : 75
List of Experiments		
1	Development of requirements specification.	
2	Function oriented design using SA/SD.	
3	Object-oriented design using UML.	
4	Test case design.	
5	Implementation using JAVA.	
6	Testing.	
7	Use of CASE tools and other tools such as configuration management tools.	
8	Program analysis tools.	

LAB EQUIPMENT:	
1	Hardware: Standalone desktops with minimum desktop configuration.
2	Software: System loaded with windows or Linux to run Java, UML, CASE and Testing tools.

Course Outcomes:	
On completion of the course, students will be able to	
•	Work in software projects.
•	Identify the key activities in managing a software project.
•	Know the various quality models and reliability in software.
•	Make analysis, modelling and coding for software projects.
•	Perform the various testing methods for software projects

Text Books:	
1	Ian Sommerville, “Software Engineering “, Ninth edition, Pearson Education, 2010.
2	Roggers S. Pressman and Bruce R. Maxim., “Software Engineering A Practitioner’s Approach”, McGraw Hill Education, 2009.

Reference Books:	
1	Roger S. Pressman,” Software Engineering – A Practitioner’s Approach”, Seventh edition, 2010.
2	Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino,” Fundamentals of Software Engineering”, second edition, Pearson publication.
3	Michael Jackson,” Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices”, first edition, ACM Press.
4	Ivar Jacobson, Grady Booch, James Rumbaugh, “The Unified Development Process”, Addison-Wesley, 1999.
5	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design Patterns: Elements of Object-Oriented Reusable Software”, First edition.
6	Norman E Fenton, Shari Lawrence Pfleeger,” Software Metrics: A Rigorous and Practical Approach”, Second edition, International Thomson Computer Press, 1997.
7	Shari Lawrence Pfleeger and Joanne M. Atlee, “Software Engineering: Theory and Practice“, fourth edition, Pearson.
8	Bertrand Meyer, second edition,” Object-Oriented Software Construction”, Prentice-hall International Series, 1997.
9	Ivar Jacobson, “Object Oriented Software Engineering: A Use Case Driven Approach“, First edition, ACM Press.
10	Bertrand Meyer, “Touch of Class: Learning to Program Well with Objects and Contracts “, First edition, Springer-Verlag Berlin Heidelberg.
11	Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language “, Third edition, Addison Wesley, 2003.
12	Manoj Kumar Lal, “Introduction to Business Domains for Software Engineers”, Kindle Edition, 2021.
13	Manoj Kumar Lal, “Knowledge Driven Development – Bridging Waterfall and Agile Methodologies”, Kindle Edition, 2018.

CO - PO – PSO MATRICES OF THE COURSE

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CB19343.1	3	2	2	2	2	2	2	2	2	2	2	1	2	2	1
CB19343.2	2	2	2	2	2	2	1	1	3	2	3	1	2	1	1
CB19343.3	1	1	1	1	1	2	2	1	3	1	2	1	1	1	1
CB19343.4	2	2	3	2	2	1	1	1	3	3	2	1	2	2	1
CB19343.5	2	2	2	3	2	1	1	2	3	3	1	2	2	2	1
Average	2.0	1.8	2.0	2.0	1.8	1.6	1.4	1.4	2.8	2.2	2.0	1.2	1.8	1.6	1.0

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

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

No correlation: “-“

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	T	P	C
CD19342	DESIGN PROCESSES & PERSPECTIVES	PC	3	0	2	4

Objectives:

- Understand design thinking for visual communication
- Understanding to decide on visual compositions
- Learn the concepts to communicate created design
- Understand the Media Design and Digital Image Printing
- Learn the concepts of Design for Interactive Media.

UNIT – I	DESIGN THINKING FOR GRAPHICS	7
-----------------	-------------------------------------	----------

Role of Graphic Design in Society-Elements of Graphic design: Basic elements-relational elements- Intentional Elements– Principles of Graphic Design-Implications and Impact of Graphic Design –Graphic Design Process: Design thinking Definition – Design thinking stages

UNIT – II	INSPECTING AND DECIDING VISUAL ELEMENTS FOR DESIGN THINKING	10
------------------	--	-----------

Define the problem – Research the problem:Identifying drivers - Information gathering-Target groups – Idea Generation for the problem - Basic design directions-Questions and answers-Themes of thinking - BrainstormingDeciding elements to design - Sketching and Drawing - Lines, shapes, Negative space/white space, Volumes, Value, Color, Texture- Color: Colors Theories-Color wheel - Color Harmonies or Color Schemes- Color Symbolism – Font - Layout

UNIT – III	REFINEMENT AND PROTOTYPING DESIGN	8
-------------------	--	----------

Refinement of Design : Thinking in images - Thinking in signs - Appropriation - Humor- Personification - Visual metaphors - Modification - Thinking in words- Thinking in technology – Prototyping - Developing designs - ‘Types’ of prototype-Vocabulary – Risk management – Implementation: Format - Materials- Finishing – Case study

UNIT – IV	MEDIA AND DIGITAL IMAGE PRINTING	10
------------------	---	-----------

Digital Imaging and Printing - Advertising Design - Integrated Methods of Advertising -Visuals and Their Voice in Advertising - The Stages of Advertising Design - Logo, and Package Development - Campaign Design–Newspaper Design: Newspaper’s Role in Modern Advertising: When to Use Newspaper - The Effect of Newsprint on Design- Sizing Up Newspaper Columns -Say and look of newspaper - Magazine Design

UNIT – V	GRAPHIC DESIGN FOR INTERACTIVE MEDIA	10
-----------------	---	-----------

Graphic Design for Interactive Media - Graphic Design approach - The Design Components That Make Up a Website Breaking Down the Parts of a Website - Elements to develop website -Designing with HTML- Creating a simple page – Marking up text and tables – Adding links and images – Creating Forms - Basic concept of CSS: IntroductionFormatting text-colors-background – Responsive Web Design – Web Image Basics - SVG

	Contact Hours	:	45
--	----------------------	----------	-----------

List of Experiments

	Design the given experiments using five phases of design thinking principles. (Max 4 people in a group). Implement various Font, Color, Layout and Typographic design elements in each experiment.
--	--

1	Design an UI that can teach mathematics to children of 4-5 years age in school in Rural sector.
2	Design an UI that can help people to sell their handmade products in metro cities.
3	Design an UI for a social media website and chat.
4	Design a publication that support different languages.
5	Design a publication that tells comic stories
6	Design an advertisement for mobile company
7	Design an advertisement for any political party with images
8	Design an advertisement for electronic products
9	Design an advertisement for food products
10	Design anInteractive website for a new Institution.
11	Design a Blog that publish educational posts.
12	Design an interactive website for hospital management system.
13	Design an interactive website for food selling app.

		Contact Hours	:	30
		Total Contact Hours	:	75

Course Outcomes:

On completion of the course students will be able to:

●	Understand the various graphic design thinking process and phases
●	Analyze and choose between various visual compositions
●	Designing and communicating visual components
●	Apply design concepts for media publishing and advertisement
●	Create website using different design concepts

LAB EQUIPMENT:

1	Hardware Requirements: Intel® or AMD processor with 64-bit support; 2 GHz or faster processor with SSE 4.2 or later - 8 GB RAM - Windows 10 64-bit (version 1909) or later - 1.5 GB of GPU memory-4 GB of available hard-disk space;
2	Software Requirements: Adobe Photoshop – Adobe Illustrator – HTML – CSS

Text Book(s):

1	Design Thinking for Visual Communication, Gavin Ambrose, Bloomsbury Publishing, Edition 1, 2017
2	Advertising Design by MediumA Visual and Verbal Approach, Robyn Blakeman, Taylor and Francis, Edition 1, 2022
3	Learning Web Design,Jennifer Niederst Robbins, O' Reilly, 5 th Edition,2018

Reference Book(s):	
1	David Raizman; History of Modern Design, Prentice Hall,2004
2	Handbook of Design Thinking, Christian Mueller-Roterberg, Amazon kindle, 2018

Web links for Theory & Lab:	
1.	https://www.aicte-india.org/sites/default/files/bvoc/Graphics%20&%20Multimedia.pdf
2.	https://www.interaction-design.org/literature/topics/visual-design https://www.interaction-design.org/literature/topics/design-thinking
3,	https://ncert.nic.in/textbook.php?kegd1=1-8 https://ncert.nic.in/textbook.php?legd1=0-12

CO-PO-PSO matrices of course

PO/PSO CO	P O 1	P O 2	P O 3	P O 4	P O 5	PO 6	P O 7	P O 8	P O 9	P O 10	PO11	PO12	P S O 1	P S O 2	PSO3
CD19341.1	3	1	3	2	3	2	3	1	1	1	1	3	1	3	1
CD19341.2	3	-	3	-	3	-	-	-	-	-	1	1	1	3	1
CD19341.3	3	3	3	2	3	-	-	-	-	-	-	1	1	3	2
CD19341.4	1	3	3	3	3	3	2	2	2	2	2	2	1	3	3
CD19341.5	1	3	3	3	3	3	2	2	2	2	2	2	1	3	3
Average	2.2	2	3	2	3	1.6	1.4	1	1	1	1.2	1.8	1	3	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
CS19342	OBJECT ORIENTED PROGRAMMING PARADIGM	PC	3	0	4	5

Objectives:

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

UNIT-I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9
Introduction to Object Oriented Programming – Basic concepts of OOP - An overview of Java - Java Architecture - Data Types - Variables- Arrays- Operators - Control Statements - Command Line Arguments.		
UNIT-II	CLASSES AND INHERITANCE	9
Defining Classes in Java: Methods, Constructors, Garbage Collection - Access Specifiers - Method Overloading – Inheritance: Super keyword, this keyword, Method Overriding, Abstract Classes – Static Members -Final Method and Class.		
UNIT-III	PACKAGES, EXCEPTION HANDLING AND STRINGS	9
Packages – Interfaces - Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions, User defined Exceptions, Stack Trace Elements – Strings - String Buffer.		
UNIT-IV	I/O AND COLLECTIONS	9
Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files – Collection Interfaces – Collection Classes.		
UNIT-V	GENERIC PROGRAMMING, MULTITHREADING AND EVENT DRIVEN PROGRAMMING	9
Generic Programming – Generic Classes – Generic Methods - Multithreading: Thread Life Cycle, Thread Creation, Thread Synchronization- Swings – Layout Management - Accessing Databases with JDBC.		
Total Contact Hours		: 45
List of Experiments		
1	Simple programs using command line arguments	
2	Programs using control structures	
3	Programs using arrays	
4	Programs using classes and objects.	
5	Programs using inheritance and interfaces	
6	Programs using packages and abstract class	
7	Programs to handle different types of exceptions	
8	Programs using strings and string buffer	
9	Programs using I/O streams	
10	Programs using files	
11	Programs using collections	
12	Programs using multithreading	
13	Programs using Generics	
14	Programs using swings	
15	Simple applications using database connectivity	
Contact Hours		: 30
Total Contact Hours		: 75

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

LAB EQUIPMENT:	
1	Hardware: Standalone desktops with minimum desktop configuration.
2	Software: System loaded with windows or Linux to run JAVA and JDBC. IDE like Netbeans, Eclipse etc., are preferable.

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

Reference Books(s):	
1	Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2	Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3	Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.
4	SCJP Sun Certified Programmer for Java 6 Study Guide. 6th edition, McGrawHill, 2008.

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

CO - PO – PSO matrices of course

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

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

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

No correlation: “-“

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

Objectives:

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

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

Course Outcomes:

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

●	Understand basic structure of the Indian Knowledge System.
●	Apply the basic knowledge of modern science and Indian knowledge system in practice.
●	Understand the importance Indian Philosophical tradition.
●	Appreciate the Indian Linguistic Tradition.
●	Understand the concepts of traditional Indian art forms.

Text Book (s):

1	V. Sivaramakrishnan (Ed.), “Cultural Heritage of India-course material”, BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014.
2	Swami Jitatmanand, “Modern Physics and Vedant”, BharatiyaVidyaBhavan.
3	Swami Jitatmanand, “Holistic Science and Vedant”, BharatiyaVidyaBhavan.
4	Fritzof Capra, “Tao of Physics”.
5	Fritzof Capra, “The Wave of life”.

Reference Books(s) :

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

CO - PO – PSO matrices of course

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

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

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

No correlation: “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19453	PROBABILITY AND STATISTICS	BS	3	1	0	4

Objectives:

•	To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.
•	To provide the required skill to apply the statistical tools in Engineering problems.

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 2	TWO – DIMENSIONAL RANDOM VARIABLE	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	DESIGN EXPERIMENTS	12
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design		
UNIT-V	STATISTICAL QUALITY CONTROL	12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance Sampling		
Total Contact Hours		: 60

Course Outcomes:

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

•	characterize standard probability distribution by employing basic techniques and methods of probability mass function and probability density function for discrete and continuous random variables.
•	develop skills to solve problems on correlation and regression
•	obtain statistical data from experiments and able to analyze the same using statistical test
•	design experiments using suitable ANOVA techniques and draw conclusions.
•	use control charts to study, analyze and interpret problems in statistical quality control

Text Book (s):

1	Veerarajan T, 'Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks', Mc Graw Hill, 2016
2	Johnson R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2017.

Reference Books(s) :

1	Devore J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012
2	Walpole R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2013.
3	Ross S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 4th Edition, Elsevier, 2009
4	Spiegel M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 4th Edition, 2013.

CO-PO-PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2	PSO3
MA19453.1	3	3	3	2	2	-	-	-	-	-	1	2	1	1	2
MA19453.2	3	3	3	2	2	-	-	-	-	-	1	2	1	1	2
MA19453.3	3	3	3	3	3	-	-	-	-	-	2	3	2	2	3
MA19453.4	3	3	3	3	3	-	-	-	-	-	2	3	2	2	3
MA19453.5	3	3	3	3	3	-	-	-	-	-	2	3	2	2	3
Average	3	3	3	2.6	2.6	-	-	-	-	-	1.6	2.6	1.6	1.6	2.6

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

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

No correlation: “”*

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CD19401	STRATEGIC DESIGN MANAGEMENT	HS	3	0	0	3

Objectives:

•	Learn the overview of strategic management.
•	Understand the functionality of external and internal assessment.
•	Study about various types of strategies and their analysis.
•	Know implementation steps in strategy and its problems.
•	Learn the steps in implementing strategy and its development issues

UNIT-I	OVERVIEW OF STRATEGIC MANAGEMENT	9
The nature of strategic management: strategic management, key terms in strategic management, strategic management model, benefits of strategic management model, pitfalls in strategic management, guidelines for effective strategic management, comparing business and military strategy, Strategy Formation: Business vision and mission, importance of vision and mission statement, characteristics, writing and evaluating mission statements.		
UNIT-II	EXTERNAL AND INTERNAL ASSESSMENT	9
The nature of external audit, Industrial organization view, Economic, social, cultural, demographic, natural environment, political, government, legal technological, and competitive forces, sources of external information, forecasting tools and techniques, competitive profile matrix (CPM) – assurance of learning exercises. Internal Assessment: nature of internal audit, resource-based view, integrated strategy and culture, management, marketing, finance, production, research and development, MIS, value chain analysis (VAC), Internal Factor Evaluation (IFE) matrix.		
UNIT-III	SWOT ANALYSIS	9
The critical theory – where to look for factors – how to create strategic responses to a plan – how to approach a swot assignment – avoiding. Usual mistakes – how to implement swot analysis in financial planning.		
UNIT-IV	STRATEGY IMPLEMENTATION	9
Implementing strategies: nature of strategy implementation, annual objectives, policies, resource allocation, managing conflict, matching structure with strategy, restructuring, reengineering, E-engineering, human resource concerns when implementing strategies, nature of strategic implementation, current marketing and finance issues, research & development issues, MIS issues.		
UNIT-V	STRATEGY EVALUATION AND CONTROL	9
Strategy Review, Evaluation and Control: Nature of strategy evaluation, strategy-evaluation framework, balanced scorecard, published sources of strategy-evaluation information, characteristics of an effective evaluation system, contingency planning, auditing, Global Issues: multinational organization, advantages and disadvantages of international operations, global challenge, worldwide tax rates, joint ventures in India.		
Total Contact Hours		: 45

Course Outcomes:

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

•	Understand the various functions of strategic management.
•	Evaluate external and internal assessment and value chain analysis.
•	Apply strategic action and its analysis in real world scenarios.
•	Apply strategy implementation in real life systems.
•	Learn and execute strategy evaluation and control in global scenarios.

Text Book (s):

1	Fred R. David, Strategic Management, Pearson Education, Limited, 15 th Student Manual/Study Guide Edition 2015.
2	Thomas L Wheelen, J.David Hunger Strategic Management and Business Policy: Toward Global Sustainability, 13 th Edition, Prentice Hall, 2011.
3	Hill W.L. Charles, Jones R. Gareth, Strategic Management: Theory: An Integrated Approach, Cengage Learning, 11 th edition, 2014.

Reference Book(s):	
1	Azhar Kazmi, Business Policy and Strategic Management, Tata McGraw Hill, 3 rd Edition
2	R. Srinivasan, Strategic Management – The Indian context, Prentice Hall of India, 2012.
3	Wheelen, Hunger, Kansal, Strategic Management and Business Policy, Pearson Education, 15 th Edition.

Web links for Theory:	
1.	https://pracownik.kul.pl/files/12439/public/3_David.pdf
2.	https://books.google.co.in/books/about/SWOT_Analysis.html?id=Yrp3DQAAQBAJ&redir_esc=y
3.	https://www.flipkart.com/financial-management-f-swot-analysis-techniques/p/itm3d43fe7bc75f?pid=9789391462376&lid=LSTBOK9789391462376RL28PD&marketplace=FLIPKART&mpid=content_book_15083003945_u_8965229628_gmc_pla&tgi=sem,1,G,11214002,u,,,556262839325,,,c,,,,,&gclid=CjwKCAjwzeqVBhAoEiwAOrEmzRnMxzq1P06DEFC2X1xIBwVNdhTcfleHUfwSx1YgEzIvA4HckmbwrhoCxZUQAvD_BwE

CO-PO-PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO1	PSO2	PSO3
CD19341.1	2	1	2	2	2	2	1	2	2	1	2	2	1	2	2
CD19341.2	1	2	2	1	2	1	1	1	2	2	1	2	1	2	1
CD19341.3	2	2	2	1	2	1	1	2	2	2	1	2	2	2	2
CD19341.4	1	1	2	2	2	2	1	2	1	1	2	1	2	1	2
CD19341.5	2	2	1	2	1	2	1	2	2	2	2	1	1	1	1
Average	1.6	1.6	1.8	1.6	1.8	1.6	1	1.8	1.8	1.6	1.6	1.6	1.4	1.6	1.6

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

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

No correlation: “*”

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

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

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

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

LAB EQUIPMENT:	
1	Hardware: Standalone desktops with minimum desktop configuration.
2	Software: System loaded with Linux to run C and invoke System calls. Equivalent configuration can also be used.

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

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

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

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

CO - PO – PSO matrices of course

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

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

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

No correlation: “-“

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

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

UNIT-I	INTRODUCTION AND ANALYSIS OF ALGORITHMS	9
Introduction –Algorithm Specification –Important Problem types- Performance Analysis: Space Complexity - Time Complexity - Asymptotic Notations - Using Limits for Comparing Orders of Growth – Basic Efficiency Classes- Solving Recurrence Relations: Substitution methods and Master Theorem Method.		
UNIT-II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9
Brute Force: Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem - Divide and Conquer Method: Analysis of Binary Search, Merge sort and Quick sort Algorithms, Integer Multiplication- Finding Minimum and Maximum.		
UNIT-III	GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING	9
Greedy Method – Minimum Spanning Trees: 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	
•	Analyze the time and space complexity of various algorithms and compare algorithms with respect to complexities.
•	Decide and apply Brute Force and Divide and Conquer design strategies to Synthesize algorithms for appropriate computing problems.
•	Apply Greedy and Dynamic Programming techniques to Synthesize algorithms for appropriate computing problems.

•	Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing problems.
•	Apply string matching algorithms in vital applications.

LAB EQUIPMENT:	
1	Hardware: Standalone desktops with minimum desktop configuration.
2	Software: System loaded with windows or Linux to run C.

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

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

CO - PO – PSO matrices of course

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

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

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

No correlation: “-“

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

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

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

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

Course Outcomes:	
On completion of the course, the students will be able to	
*	Describe the foundations of Human Computer Interaction.
*	Demonstrate with the design technologies and software process.
*	Apply the concepts of human interaction models and theories .
*	Design effective HCI for individuals and persons with disabilities.
*	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
Text Book(s):	
1	Jeff Johnson, “Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines”, Morgan Kaufmann, 2014.
2	Brian Fling, “Mobile Design and Development”, First Edition, O’Reilly Media Inc., 2009.
3	Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O’Reilly, 2009.
4	Ben Shneiderman , Catherine Plaisant, Maxine Cohen, Steven Jacobs,” Designing the User Interface: Strategies for Effective Human-Computer Interaction ”, Pearson, Edition 5, 2010
Reference Book(s)/Web link(s)	
1	Jeff Johnson, “Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines”, Morgan Kaufmann, 2014.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19P06.01	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS19P06.02	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS19P06.03	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS19P06.04	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS19P06.05	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3.0	3.0	2.75	2.6	2.25	2.8	2.75	3.0	3.0	2.67	3.0	2.67	3.0	3.0

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

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

If there is no correlation, put “-“

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CD19411.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
CD19411.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
CD19411.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
CD19411.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
CD19411.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	-	-	-	1	1	1.4	1	2.4	2.4	2

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

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

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

Description

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

Program Learning Goals :

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

Objectives:

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

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.
5	Debate	Is competition necessary in regards to the learning process?	The aim of this activity is to develop the 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.
13	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.
			Total Contact Hours :
			30

Course Outcomes:

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

•	Be more confident.
•	Speak in front of a large audience.
•	Be better creative thinkers.
•	Be spontaneous.
•	Know the importance of communicating in English.

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

CO - PO – PSO matrices of course

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

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

1: Slight (Low)

2: Moderate (Medium) Substantial (High)

No correlation: “-“

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

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

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

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

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

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

CO - PO – PSO matrices of course

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

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

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

If there is no correlation, put “-“

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

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

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

List of Experiments	
1	Configuration of Network in Linux Environment
2	Learning and Assignment of IP Address to computers
3	Implementation of Subnet mask in IP addressing
4	Write a socket PING program to test the server connectivity
5	Design, Build & Configure Networks using Cisco Packet Tracer tools

6	Study & Implement the different types of Network Cables (RS 232C)			
7	Implementation of setup of a Local Area Network (using Switches) – Minimum 3 nodes and Internet			
8	Write a socket program Remote Procedure Call using connection oriented / connectionless protocols (programs like echo, chat, file transfer etc)			
9	To Identify the various port & its usage using NMAP tool.			
10	To capture, save, and analyze network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DNS using Wireshark Tool.			
11	Write a code using Raw sockets to implement packet Sniffing			
12	Perform a case study using OPNET / NS3 tools about the different routing algorithms to select the Network path with its optimum and economical during data transfer			
13	Simulation of Link State routingalgorithm using OPNET or NS3 tool			
14	Simulation of Distance Vector Routingalgorithm OPNET or NS3 tool			
15	To Analyze the different types of servers using Webalizer tool			
		Contact Hours	:	60
		Total Contact Hours	:	105
Course Outcomes:				
On completion of the course, the students will be able to				
●	Choose the required functionality at each layer for given application			
●	Trace the flow of information from one node to another node in the network			
●	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.			
●	Monitor the traffic within the network and analyse the transfer of packets.			
●	Develop real time applications of networks using different tools			

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

Reference Book(s) / Web links:	
1	William Stallings, “SNMP, SNMPv2, SNMPv3 and RMON 1 and 2”, Third Edition, Pearson Edition, 2009.

2	James F. Kurose, Keith W. Ross,” Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2017.
3	Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, 5th Edition, Prentice Hall publisher, 2010.
4	William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2011.
5	Website reference: https://realpython.com/python-sockets/

CO - PO – PSO matrices of course

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

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19443	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5
Objectives:						
•	To understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.					
•	To construct simple and moderately advanced database queries using Structured Query Language (SQL).					
•	To know the importance of functional dependency and normalization, and what role it plays in the database design process.					
•	To familiarize with the concepts of a database transaction including concurrency control, backup and recovery, and data object locking and handling deadlocks.					
•	To work with the foundation for NoSQL technologies.					
UNIT-I	INTRODUCTION TO DATABASE SYSTEMS					10
Introduction – Purpose of Database Systems - View of Data –Database Architecture - Relational Databases – Database Schema – Keys – Codd’s Rule – Relational Algebra – Data Models – Entity Relationship Model – Constraints – Entity Relationship Diagram - Design Issues of ER Model – Extended ER Features – Mapping ER Model to Relational Model.						
UNIT-II	SQL AND QUERY PROCESSING					10
SQL: Data Definition – Domain types – Structure of SQL Queries - Modifications of the database – Set Operations – Aggregate Functions – Null Values – Nested Sub queries – Complex Queries – Views – Joined relations – Complex Queries – PL/SQL: Functions, Procedures, Triggers, Cursors -Embedded SQL – Query Processing – Heuristics for Query Optimization.						
UNIT-III	DEPENDENCIES AND NORMALFORMS					8
Motivation for Normal Forms – Functional dependencies – Armstrong’s Axioms for Functional Dependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF.						
UNIT-IV	TRANSACTIONS					7
Transaction Concept – State – ACID Properties – Concurrency control - Serializability – Recoverability – Locking based protocols –Timestamp Based Protocol - Deadlock handling.						
UNIT-V	NoSQL DATABASE					10
Introduction to NoSQL - CAP Theorem – Data Models - Key-Value Databases - Document Databases- Column Family Stores – Graph Databases –Working of NoSQL Using MONGODB/CASSANDRA.						
					Contact Hours	: 45

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

13	MINI PROJECT Database Connectivity with Front End Tools(Python/C/C++/JAVA)and Back End Tools(MySQL/SQLite/CASSANDRA/MONGO DB) For any problem selected, write the ER Diagram, apply ER mapping rules, normalize the relations, and follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include
	a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System i) Library Management System
	Contact Hours: 60
	Total Contact Hours: 105

Course Outcomes:

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

•	Understand the use of the Relational model, ER diagrams.
•	Apply SQL Queries to define and manipulate the database.
•	Comprehend the concept of normalization and apply as a case study.
•	Know concurrency control and recovery mechanisms.
•	relate the different models of NoSQL databases.

Text Books:

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

Reference Books:

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

Web Link for Virtual Lab

1.	https://livesql.oracle.com/apex
2.	https://www.jdoodle.com/online-mongodb-terminal/

CO PO PSO Matrices of course

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

Subject Code	Subject Name	Category	L	T	P	C
CD19541	ANIMATION & GRAPHICS	BS	3	0	2	4
Objectives:						
•	To enable animation as a medium for observing, representing, conceptualizing, visualizing and communicating design ideas.					
•	To develop an understanding of spatial concepts and the critical ability to think and visualize in three dimensions through the graphics					
•	To develop observational skills through the study of the environment and as a tool for visual representation, ideation/conceptualization, visualization and communication or presentation of design ideas through animation and graphics.					
UNIT-I	Introduction to 3D					9
Introduction to MAYA Interface ,Software and Hardware Requirement Understanding about View Ports, Tool bar & Menu bar Layers , Shortcut Keys, Understanding Primitive objects Channel Box & Hot Box Channel Attributes &Outline Editor.						
UNIT-II	Tools and techniques in Modeling & Texturing					9
Introduction to modeling with Primitive objects NURBS & polygon tools, Organic and Industrial designs, Editing Nurbs & Polygons, Learning Menus in Surfaces and Polygons Tabs & Shortcut. Introduction to Materials & Understanding Materials & Behavior, Understanding UV Texture Editor & Applying Single Color to object .Hyper shade Understanding different types of Maps ,Understanding, UV mapping & UV manipulation, Editing texture in Photoshop UV snap shot .Applying materials and textures to models and props Shortcuts .						
UNIT-III	Lighting & Rendering					9
Understanding Color Theory & Introduction to lighting ,Importance of light in Animation Basic Lighting Concepts types of lights, Change the color of the light light attributes rendering, Introduction to rendering & Knowing Renderers, Software Rendering & Hardware Rendering Vector Rendering & Mental Ray Rendering Selecting a Render Type & Interactive Photorealistic Rendering (IPR) Batch Rendering, Working with the Options in Render setting.						
UNIT-IV	Animation & Rigging					9
Introduction to Animation in MAYA & Time Codes Principles of animation (squash and stretch, timing....etc) Doing Object animation & Understanding the Behavior of Shapes of Objects Making play blasts Working with Animation Curves Graph Editor, Time Line Shortcuts, Camera Animation & Setting Resolution Gates. Knowing Deformers and there functionality (Linear & Non Linear Deformers) Knowing Constraints (Point, Or nt, Scale, Parent, Pole Vector, Aim...) introduction to Joints difference between Local Axis and World Axis for Joints						

UNIT-V	Graphic Designing Tools - Photoshop &Illustrator	9
Changing blending modes and opacity, Using and editing an opacity mask, Using layers to keep your art project organized, Creating clipping masks, Tracing a scanned image with Live Trace, Applying warp effects and the envelope feature, Understanding the Appearance panel, real ting effects and styles, Using multiple strokes and fills, Creating and manipulating type, Creating symbols and using the symbol tools, Understanding and creating the four kinds of custom brushes, Using the mesh tool for complex gradients, Applying 3D effects.		
		Total Contact Hours : 45
Lab Experiments		
LIST OF EXPERIMENTS:		
1. Making of layout for bgs and props 2. Making of 2d and 3d objects 3. Shadows, lighting experiments 4. Facial expressions 5. create interior lighting & environment lighting 6. Create character rigging 7. Human animation like walking, running, sitting, body movements, eye movements, 8. Create animation clip for one minute using Maya 9. Create logo design using Photoshop 10. Portfolio		
Contact Hours:45		
Total Contact Hours : 75		
Course Outcomes:		
On completion of the course students will be able to		
•	Enable students to understand a sound knowledge of colour, typography, images, and layout. They will be trained in the art of visual communication involving various digital formats.	
•	To implement the design principle and practices by using different digital design tools.	
•	Will get an understanding of basic concept of animation, different types/ style and their workflow.	
•	Able to create a complete promotional campaign using Animation and Graphics technique.	
•	Develop the ability to analyses complex images and in turn develop the ability to create mental imageries and visualize concepts.	
Text Book(s):		
1.	Tereza Flaxman. Maya 2015 Character Modeling and Animation. Focal Press..(unit-I, unit-II)	
2	Richard Williams”The Animator's Survival Kit”, Faber & Faber, 2010(unit-III, unit-IV)	
3	Chris Meyer, Trish Meyer “Creating Motion Graphics with After Effects, Essential and Advanced Techniques”, Taylor & Francis, 2013. (unit-v)	

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic

- Digital Art Creation
- Developing motion Animation
- Creating Presentations

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic

- Usage of elements
- Proper Transitions
- Time for generation of elements

Reference Books(s):

- | | |
|---|---|
| 1 | Michael Betancourt,” The History of Motion GraphicsFrom Avant-garde to Industry in the United States”, Wildside Press. 2013 |
| 2 | Ed Hooks “Acting for Animators 4”, Routledge, 2017 |
| 3 | Tom Sito “Timing For Animation, 40th Anniversary Edition”, CRC Press, 2021. |
| 4 | ADariush Derakhshani. Introducing Autodesk Maya 2016 . Paperback |
| 5 | Paperback. The Art of Maya An Introduction to 3D Computer Graphics . Autodesk |

HARDWARE	SOFTWARE
Processor: i7 / i9 / AMD Ryzen 7 / 9 series,	Autodesk MAYA 2020 TO 2024
OS: Windows 10 / 11.	Photoshop &Illustrator
RAM: 16 / 32 GB	
Storage: 256 / 512 GB SSD with 1 TB HDD,	
Graphic Card: RTX 2070 / 3060 6GB.	

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

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

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

7	Debate	Does violence on the TV and Video games influence children negatively?	This activity aims at encouraging the students to debate on real life scenarios that most students spend a lot of time on.
8	Turn Tables	This is a speaking activity where the students need to speak for and against the given topics when the facilitator shouts out 'Turn Table'.	The aim of this activity is to make the participants become spontaneous and have good presence of mind.
9	Debate	Do marks define the capabilities of a student?	This debate activity aims at allowing the students to argue on this worrisome adage of marks.
10	FictionAD	The Participants are asked to create an Ad for a challenging topic only using fictional characters.	The activity aims at developing their creativity and presentation skills.
11	Debate	Are social networking sites effective, or are they just a sophisticated means for stalking people?	This activity aims at refining the students debating skills on a very real life situation
12	Talent Hunt	Talent Hunt is a fun activity where the students are selected at random and supported to present any of their own skills.	The aim of this activity is designed to evoke their inner talents and break the shyness and the fear of participating in front of a crowd
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits.	The aim is to do both give feedback to students as well as obtain feedback on the course from them.
		Contact Hours :	30

Course Outcomes:

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

•	Be more confident
•	Speak in front of a large audience without hesitation
•	Think creatively
•	Speak impromptu
•	Communicate in English

CO-PO-PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
GE19521.1	-	-	-	-	-	-	-	-	2	3	1	1	-	-	2
GE19521.2	-	-	-	-	-	-	-	-	2	3	2	-	-	-	2
GE19521.3	-	1	-	-	-	-	-	-	2	3	1	1	-	1	2
GE19521.4	-	-	-	-	-	-	-	-	2	3	-	-	-	-	1
GE19521.5	-	1	-	-	-	-	-	-	2	3	1	1	-	1	3
Average	-	1	-	-	-	-	-	-	2	3	1.25	1	-	1	2

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CD19601	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	PC	3	0	0	3

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

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

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

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

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

CO – PO – PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19341.1	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.2	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.3	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.4	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.5	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	2.0	2.0	2.0

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

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

No correlation: “-”

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CD19641	GAME DESIGN AND DEVELOPMENT	PC	3	0	2	4

Objectives:	
•	To understand the basic concepts in game.
•	To understand how to design a game.
•	To Learn how to coding the game.
•	To develop the 2D game using Unity Game Engine.
•	To develop the 3D game using Unity.

UNIT-I	Introduction	9
Introduction to Games- The Evolution of Games- Overview of Game Platforms-the Elements of Gameplay-Game AI Multithreading- Sprite Programming.		
UNIT-II	Game Design	9
Principles of game design, Game Design Theory, 8 type of Fun in Game, Visual style, Generate ideas for a game concept: Idea Development Process, Stimulus, Genre Market Research, Target platform, Creating Prototype: Creating physical Games: Board Game, Card Game, Party Games, Game Design Document.		
UNIT-III	Game Development	9
Game development Cycle, Game Production Cycle and Team, Coding, Visualizing and hearing the Game, Interface Design, Idea for Developing 2D and 3D interactive games, Game Engine.		
UNIT-IV	Unity for Developing 2D Games	9
Introduction to Unity Game Engine, Intro to 2D Game system in unity, Sprite Editor in Unity, Sprite Animation in Unity, 2D Physics in Unity, 2D Components, UI system in Unity, 2D Game Project		
UNIT-V	Developing 3D Game using Unity	9
Exporting Assets from 3D Software, Different Types of camera in Unity , Character Navigation, 3rd Person Camera movement, Creating Enemy characters runtime, Animation control in Unity , Graphic User Interface in Unity , Assigning Properties & Methods for player, Build Simple Artificial Intelligence for enemy character.		
Contact Hours		45

List of Experiments			
1	Create a simple sprite animation using an open source tool.		
2	Consider your favourite game and identify the game elements.		
3	Narrate a simple game using scratch 2.0 (Character narration).		
4	Study of Unity.		
5	Develop a simple 2D game using Unity.		
6	Develop a simple 3D game using Unity		
		Contact Hours	: 30
		Total Contact Hours	: 75

Course Outcomes:	
On completion of the course, the students will be able to	
•	Understand and Analysis the game world.
•	Understand designing of a game
•	Learn Coding the game
•	Develop the 2D game using Unity Game Engine
•	Develop the 3D game using Unity Game Engine
Text Books(s):	
1	Moore & Michael “Game Design and Development: Introduction to the Game Industry”, Pearson: Prentice Hall publication .
2	Jesse Schell “The Art of Game Design: A Book of Lenses”, Third Edition
3	Dr. Edward Lavieri “Getting Started with Unity 2018: A Beginner's Guide to 2D and 3D game Development with Unity”, 3rd Edition

Reference Book(s) / Web link(s):	
1	Jeannie Novak “Game Development Essentials: An Introduction”, 3rd edition. (2011).

Web links for virtual lab:	
1	https://www.gamedeveloper.com/
2	https://in.ign.com/
3	https://www.gameindustry.com/

CO – PO – PSO matrices of course

PO/PSO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3
CD19641.1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CD19641.2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CD19641.3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CD19641.4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CD19641.5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-
Average	2	2.5	2	1.8	2	-	1	2	3	2	2	2.2 5	2	2.4	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
CD19642	Data Visualization	PC	3	0	2	4

Course Objectives:
1. Understand the various types of data, apply and evaluate the principles of data visualization. Acquire skills to apply visualization techniques to a problem and its associated dataset.
2. Apply structured approach to create effective visualizations.
3. Learn how to bring valuable insight from the massive dataset using visualization.
4. Learn how to build visualization dashboard to support decision making.
5. Create interactive visualization for better insight using various visualization tools.

Unit 1: Introduction to Data Visualization and Visualization Techniques	9
Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation - Scalar and Point techniques – Color maps – Contouring – Height Plots - Vector visualization techniques – Vector properties – Vector Glyphs – Vector Color Coding – Matrix visualization techniques	
Unit 2: Visual Analytics Tools & Techniques	9
Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map Introduction to various data visualization tools: R –basics, Data preprocessing, Statistical analysis, Plotly and ggplot library, Tableau, D3.js, Gephi.	
Unit 3: Diverse Types of Visual Analysis	9
Time- Series data visualization – Text data visualization – Multivariate data visualization and case studies	
Unit 4 :Visualization of Streaming Data	9
Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.	
Unit 5 :Geo Spatial Visualization	9
Chloropleth map, Hexagonal Binning, Dot map, Cluster map, cartogram map Visualization Dashboard Creations - Dashboard creation using visualization tools for the use cases: Financemarketing-insurance-healthcare etc.,	
Total No. of Hours : 45 Hrs	

Text Book(s):
1. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.
2. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018

Reference Book(s):
1. Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.
2. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020
3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

List of Experiments :
1. Introduction to Tableau: Introduction to Tableau- Dataviz best practices- Getting started with Tableau Desktop- Connecting to the tutorial dataset- Creating the first charts-Filtering and sorting data
2. Common charts: Creating common visualizations (bar charts, line charts etc.)- Assembling a dashboard layout- Using dashboard filters
3. Transform the data: Dataviz best practices- Creating simple calculations in Tableau- Using table calculations
4. Interactions: Interactivity with text and visual tooltips- Interactivity with actions (filter, highlight, URL)- Drilldown between dashboards
5. Advanced visualizations: Dataviz best practices- Creating more advanced chart types- Using multiple source tables
6. Data Storytelling: Introduction to data storytelling- Creating a data story in Tableau- Overview of the Tableau ecosystem- Further learning opportunities
Total Laboratory Hours 30 hrs

System Requirements:
• System requirements are listed here under Tableau Desktop and Tableau Prep: https://www.tableau.com/products/techspecs
• The latest version of Tableau Desktop as well as Tableau Prep should be downloaded and installed from here: https://www.tableau.com/tft/activation

Course Outcomes:
After successfully completing the course the student should be able to
1. Identify the different data types, visualization types to bring out the insight. Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.
2. Design visualization dashboard to support the decision making on large scale data.
3. Demonstrate the analysis of large dataset using various visualization techniques and tools.
4. Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data.
5. Ability to create and interpret plots using R/Python/Tableau/Power BI

CO – PO – PSO matrices of course

PO/PSO CO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3
CD19642.1	3	2	3	2	2	-	-	-	2	2	-	3	3	3	2
CD19642.2	3	2	3	2	3	-	-	-	2	-	-	3	3	3	3
CD19642.3	3	2	3	2	3	-	-	-	2	-	-	3	3	1	3
CD19642.4	3	2	3	2	3	-	-	-	2	-	-	3	3	3	3
CD19642.5	3	3	3	3	3	-	-	-	2	3	-	3	3	3	3
Average	3	2.2	3	2.2	2.8	-	-	-	2	1	-	3	3	2.6	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 (Lab Oriented Theory Course)	Category	L	T	P	C
CD19643	WEB ESSENTIALS		3	0	2	4

Objectives:	
•	To understand the basic concepts in webTechnologies
•	To understand how to Build a dynamic web page using JavaScript
•	To learn how to develop server side programs using Servlets and PHP
•	To learn current tools and latest version of Bootstrap to build modern mobile friendly and responsive websites.
•	To develop the interactive web application using Angular 14

UNIT-I	Web Basics	9
Web Essentials: Clients, Servers, and Communication-Internet Overview-Basic Internet Protocols- The World Wide Web-Web 3.0 – HTML 5.0: Tables – Lists - Image - HTML5 control elements - Semantic elements - Drag and Drop - Audio - Video controls. CSS3.0: Inline, embedded and external style sheets - Rule cascading - Inheritance - Backgrounds - Border Images - Colors - Shadows - Text - Transformations - Transitions – Animations.		
UNIT-II	Client Side Scripting	9
JavaScript Introduction – Variables and Data Types - Statements - Operators – Literals - Expressions and Control Flow in JavaScript - JavaScript Functions, Objects and Arrays - Regular Expression- Document Object Model(DOM) -Event handling - Validation - JSON.		
UNIT-III	Server Side Scripting	11
Servlets: Java Servlet Architecture - Servlet Life cycle - Form GET and POST actions - Sessions - Cookies - Database connectivity - JDBC - Creation of simple interactive database applications. PHP: Introduction- Working principle of PHP -Variables - Constants - Operators - Flow Control andLooping - Arrays - Strings - Functions - File Handling -PHP and HTML - Simple PHP scripts - Databases with PHP.		
UNIT-IV	Bootstrap 5	7
Bootstrap Background and Features - Getting Started with Bootstrap - Grids - Components - Menus and Navigations Plugins - Flexbox& Layouts.		
UNIT-V	Angular 14	9
Introduction - Configuration Installation - Folder Structure - Component - Directives - Services - Routing - Interpolation - Pipes - Binding - Event Handling - Forms -State Management.		
	Contact Hours	: 30
	Total Contact Hours	: 75

List Of Experiments	
1	Create a web page to embed a map along with hot spot AND links.
2	Create a web page using an embedded, external, and inline CSS file.
3	Create a registration page along with validations.
4	Consider a Library Management System. Develop a JavaScript program that will validate the controls in the forms you have created for the application. State the assumptions you make (business logic you are taking into consideration). Note: Your application must access a database using servlet.
5	Write a PHP program for Employee Details, which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.
6	Develop an Attractive web pages using Bootstrap.
7	Design a Web page with Navigation menu, Inline editor, Order form, Instant Search & Switchable Grid.
8	Develop a Single Page Application using Angular 14
Course Outcomes: On completion of the course, the students will be able to	
•	Construct a basic website using HTML and Cascading Style Sheets.
•	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
•	Develop server side programs using Servlets and PHP.
•	Develop the responsive UI using Bootstrap 5
•	Develop a Single Page Application using Angular 14
Text Books(s):	
1	Robin Nixon, “Learning PHP, MySQL, JavaScript, CSS & HTML5” Third Edition, O’Reilly publishers, 2014.

2	Paul Deitel, Harvey Deitel, Abbey Deitel, “Internet & World Wide Web – How to Program”, 7th edition, Pearson Education, 2012.
---	---

Reference Book(s) / Web link(s):	
1	Jeffrey C. Jackson, “Web Technologies–A Computer Science Perspective”, Pearson Education, 2006.
2	Fritz Schneider, Thomas Powell, “JavaScript – The Complete Reference”, 3rd Edition, McGraw Hill Publishers, 2017
3	Steven Holzner, “PHP – The Complete Reference”, 1st Edition, Mc-Graw Hill, 2017
4	Matt Lambert, Learning Bootstrap 4, Second Edition, Packt Publishing, 2016
5	Nate Murray, Felipe Coury, Ari Lerner, and Carlos, ng-book The Complete Guide to Angular, Fullstack.io, 2020

Web links for virtual lab:	
1	https://getbootstrap.com/docs/5.0/getting-started/introduction/
2	https://angular.io/tutorial

Lab Equipment for a Batch of 30 Students: Hardware: Standalone desktops 30 Nos. Software: Web Browser, Eclipse, Visual Studio Code, MySQL or Equivalent, Apache Server, Servlet and PHP server, XWAMP, Node.js	
---	--

CO – PO – PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CD19643.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CD19643.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CD19643.3	3	3	3	3	3	-	-	2	2	-	2	2	3	3	3
CD19643.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CD19643.5	3	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average	3	3	3	3	3	1.8	1	1.2	1.4	0.4	1.8	2.1	3	3	2.4

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) No correlation: “-”

SubjectCode	Subject Name	Category	L	T	P	C
CD19606	Mobile Application Design and Development Laboratory	PC	0	0	2	1

Objectives:
<ul style="list-style-type: none"> To know the components and structure of mobile application development frameworks for android OS-based mobiles.
<ul style="list-style-type: none"> To understand how to work with graphical primitives and Intent, Fragments, and data storage.
<ul style="list-style-type: none"> To development the mobile applications with database connectivity.
<ul style="list-style-type: none"> To understand the different services like telephony, location, notification, etc.,
<ul style="list-style-type: none"> To understand the working Image View while capturing screenshot, Send/Receive SMS/Email

List of Experiments
1. Develop an application to change the font and color of the text and display toast message when the user presses the button.
2. Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [should contain +, *, /, =, cos, sin, tan, pow, sqrt, log, ln and mod].
3. Develop an android application to draw the circle, ellipse, rectangle, and some text using Android Graphical primitives.
4. Develop an android application to create Two activity named as Student Basic Details (name, age, address) and Student Mark (Marks, Total, Grade, Status). Write an android code to combine these two activities in single screen using android fragment.
5. Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks). Develop an android application to perform the following operation using SQLite developer classes. 1. Insert studentDetails
6. 2. Update the student Record 3. Delete a specified record. 4. View the details.
7. Develop an application to display the information of the telephony services and get the Latitude, Longitude of
8. the current location using android LocationManager and convert the Latitude/Longitude to address format using Geocoder Class.
9. 7. Implement an application to write the name and marks to SD card in text file format.
10. 8. Develop an android application to capture screen shot, store and displaying the image using imageView
11. 9. Develop an android application to perform Text to Speech and Speech to Text.
12. 10. Develop an application to send/receive SMS/Email
Total Contact Hours: 30

Course Outcomes:
<ul style="list-style-type: none"> Know the components and structure of mobile application development frameworks for android OS-based mobiles.
<ul style="list-style-type: none"> Able to work with graphical primitives and Intent, Fragments, and data storage.
<ul style="list-style-type: none"> Able to development the mobile applications with database connectivity.
<ul style="list-style-type: none"> Know the different services like telephony, location, notification, sensors etc.,
<ul style="list-style-type: none"> Able to work with Image View while capturing screenshot and Send/Receive SMS/Email
Lab equipment for a batch of 30 students:
Hardware: Standalone desktops with windows Android or Equivalent Mobile Application Development
Software: Tools with appropriate emulators and debuggers.

CO - PO – PSO Matrices of Course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CD19606.1	3	3	3	3	3	3	2	2	3	-	1	3	3	3	2
CD19606.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2
CD19606.3	3	3	3	3	3	-	-	2	2	-	2	2	3	2	3
CD19606.4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	3
CD19606.5	2	3	3	3	3	3	2	2	-	-	3	3	3	3	3
Average	2.8	3	3	3	3	1.8	1	1.2	1.4	0.4	1.8	2.1	3	2.8	2.4

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
----------------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	------------------	------------------	------------------	------------------	------------------	------------------

GE19621.1	2	2	2	2	1	1	-	-	-	-	1	1	2	2	2
GE19621.2	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
GE19621.3	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
Average Mapping	2.6 7	2.6 7	2	2.6 7	1	1	-	-	-	-	1	1	2	2	2

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

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

If there is no correlation, put “-“

Subject Code	Subject Name(LabOrientedTheoryCourse)	Category	L	T	P	C
CD19P01	AESTHETICS AND ART	PE	3	0	0	3

Objectives: This course will enable students

- To encounter and learn the major philosophical theories of art and aesthetics offered during specific historical periods.
- To study the classical, modern, and contemporary philosophical responses to questions and problems of aesthetics.
- To understand the ways in which art affects life on a personal, cultural, social, and global level.
- To learn several theories of what art is, including realism, expressionism, cognitivism, formalism, and postmodernism.
- To think reflectively and critically about artworks, developing philosophical virtues and employing skills that are crucial.

UNIT-I	Aesthetics	9
Definition of Aesthetics, Aesthetics: The Etymology and Evolution Aesthetics s Philosophy of Beauty and Art, The Contemporary Approach, Philosophical Approaches to Aesthetics.		
UNIT-II	Art	9
What is Art, The Relation of Art and Beauty, Meaning of Form and content in Different Arts, Visual Arts, Architecture, Sculpture, Painting, and Performing an Art.		
UNIT-III	Comparison of Arts	9
Fine Arts and Crafts(Similarities, Distinctions), Pure and Applied Arts, Comparisons of Fine Arts, Visual Arts (Architecture, Sculpture), Painting and Photography, Drama and Cinema.		
UNIT-IV	Art and Science	9
Applied Sciences and Applied Arts, Philosophy as theoretical Knowledge and its Relation to Fine Arts.		
UNIT-V	Indian Aesthetics and Rasa	9
Aesthetics as “SaundriyaShastra”, Beauty and Art in Vedic and in other Literary Works, Understanding about Theory of Rasa, Natyashastra.		
Total Contact Hours: 45		

Course Outcomes:

On completion of the course students will be able to

•	Learn different digital designing on a basic level to aid in easy illustration.
•	Understand image editing.
•	Develop competency in computer graphics to create their own art work and patterns.
•	Understand the relevance of design in relation to art and architecture.
•	Develop designs based on inspirations from art and architecture.

Text Book(s):	
1.	Aesthetics: A Comprehensive Anthology. Eds. Steven M. Cahn & Aaron Meskin. Malden (MA): Blackwell Publishing, 2008. ISBN 9781405154352
2.	Barrett, Terry. Why Is That Art?: Aesthetics and Criticism of Contemporary Art. Oxford: Oxford University Press, 2012, 2008. ISBN 978-0-19-975880-7

Reference Books(s):	
1	Palmer, Jerry, and Mo Dodson. Design and aesthetics: a reader. Psychology Press, 1996.
2	Folkmann, Mads Nygaard. The aesthetics of imagination in design. MIT Press, 2013.
3	Moffat, James Clement. An introduction to the study of aesthetics. Moore, Wiltach, Keys & co., 1856.
4	Heskett, John. Design: A very short introduction. Vol. 136. Oxford University Press, 2005.
5	Lidwell, William, Kritina Holden, and Jill Butler. Universal principles of design, Rockport Pub, 2010.
6	Puhalla, Dennis. Design Elements, Form & Space: A Graphic Style Manual for Understanding Structure and Design. Rockport Pub, 2011.

CO - PO – PSO matrices of course

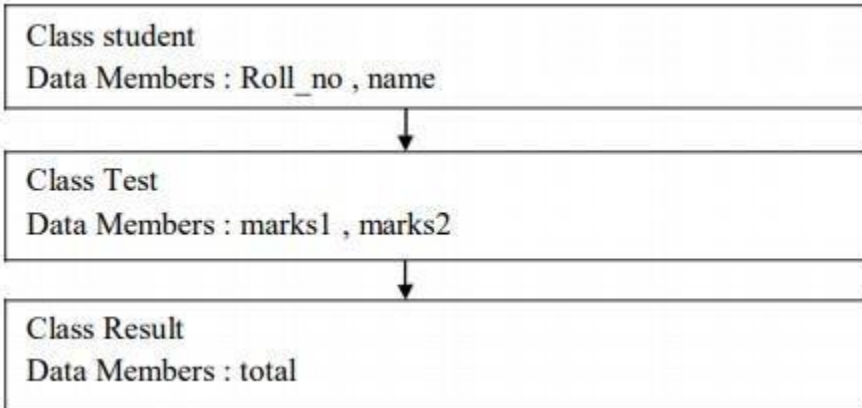
PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P01.1	0	1	2	2	2	3	1	1	1	2	1	3	0	0	3
CD19P01.2	0	1	2	2	2	3	1	1	1	2	1	3	0	0	3
CD19P01.3	0	1	2	2	2	3	1	3	1	2	1	3	0	0	3
CD19P01.4	0	1	2	2	2	3	1	1	1	2	1	3	0	0	3
CD19P01.5	0	1	2	2	3	3	1	1	1	2	1	3	0	0	3
Average	0	1	2	2	2.2	3	1	1.4	1	2	1	3	0	0	3

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

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

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

List of Experiments	
1	Write a console application that obtains four int values from the user and displays the product. Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a double; the equivalent command to convert from a string to an int is Convert.ToInt32().
2	Write an application that receives the following information from a set of students: Student Id: Student Name:

	<p>Course Name:</p> <p>Date of Birth:</p> <p>The application should also display the information of all the students once the data is Entered. Implement this using an Array of Structures.</p>
3	Write a program to declare a class “staff” having data members as name and post. Accept this data 5 for 5 staffs and display names of staff who are HOD.
4	<p>Write a program to implement multilevel inheritance from following figure. Accept and display data for one student.</p>  <pre> classDiagram class student { Roll_no name } class Test { marks1 marks2 } class Result { total } student < -- Test Test < -- Result </pre>
5	<p>Write a program to create a delegate called TrafficDel and a class called TrafficSignal with the following delegate methods.</p> <pre> Public static void Yellow(){ Console.WriteLine(“Yellow Light Signal To Get Ready”); } Public static void Green(){ Console.WriteLine(“Green Light Signal To Go”); } Public static void Red(){ Console.WriteLine(“Red Light Signal To Stop”); } </pre> <p>Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array.</p>
6	Write a program to accept a number from the user and throw an exception if the number is not an even number.
7	Create an application that allows the user to enter a number in the textbox named “getnum”. Check whether the number in the textbox “getnum” is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button “check”.

9	carbohydrate is 4 calories. Display the total calories of the current food item in a label. Use to other labels to display and accumulated some of calories and the count of items entered. The form food have 3 text boxes for the user to enter the grams for each category include label next to each text box indicating what the user is enter.
10	Database programs with ASP.NET and ADO.NET. Create a Web App to display all the Empname and Deptid of the employee from the database using SQL source control and bind it to GridView . Database fields are(DeptId, DeptName, EmpName, Salary).
11	Programs using ASP.NET Server controls. Create the application that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within
12	21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters. For the web page created for the display OF Employee data change the authentication mode to Windows.
Contact Hours: 30	
Total Contact Hours : 60	

Course Outcomes:

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

- Write various applications using C# language
- Write various applications using advanced C# concepts.
- Create window services, libraries and manipulating data using XML.
- Develop distributed applications using .NET Framework.
- Create mobile applications using .NET compact Framework.

UNIT-I	INTRODUCTION TO DESIGN DRAWING	6
--------	--------------------------------	---

Introduction to Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System, Representation of Digital Images, Image Sampling and Quantization, Basic relationship between pixels, Introduction to Mathematical tools used in Digital Image Processing, Arithmetic operations, Spatial operations, Image transforms, Probabilistic methods.		
UNIT-II	IMAGE FILTERING	6

Basics of Intensity Transformations and Spatial Filtering, Some basic Intensity Transformation functions, Histogram Processing: Histogram Equalization, Histogram Matching, Local Histogram Processing, Fundamentals of Spatial Filtering, Spatial Correlation and convolution, Smoothing Spatial Filters: Smoothing Linear Filters, Smoothing Spatial Filters: Order Statistics (Nonlinear) Filters, Sharpening Spatial Filters: Foundation, The Laplacian Operator, Unsharp Masking and Highboost Filtering, Using First-order Derivatives for Image Sharpening – The Gradient, Basics of Filtering in		
UNIT-III	OBJECT DRAWING and HUMAN FORM DRAWING 6	
Image smoothing using frequency domain filters, Ideal lowpass filters, butterworth low pass filters, Gaussian lowpass filters, Image sharpening using frequency domain filters, Ideal highpass filters, butter worth high pass filters, Gaussian high pass filters, Image Restoration: Introduction Image Degradation/Restoration Process, Noise models, Mean Filters, Order Statistics Filters		
UNITIV	IMAGE COMPRESSION	6
Image Compression models: Fundamentals, Coding Redundancy, Coding Redundancy, Basic compression Methods, Huffman coding, Arithmetic Coding, LZW coding, Bit-plane coding, Run-length coding		
UNIT-V	IMAGE SEGMENTATION	6
Image Segmentation: Fundamentals, Point Detection, Line and Edge Detection, Basic Edge Detection, Advanced Techniques for Image Segmentation: Marr hieldreth, Advanced Techniques for Image Segmentation: Canny Edge Detection, Advanced Techniques for Image Segmentation: Canny Edge Detection, Thresholding, Adaptive Thresholding, Region-Based Segmentation: Region Growing, Region Splitting.		
		Total Contact Hours : 30
Course Outcomes:		
On completion of the course students will be able to		
•	Acquire knowledge about the procedure of digital image data acquisition, processing, analysis, and their applications	
•	Identify appropriate image processing techniques for real time applications.	
•	Operate on images using the techniques of enhancement, smoothing and sharpening filters.	
•	Implement image compression techniques.	
•	To segment the objects in an image using segmentation techniques.	

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

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19P09.1	2	2	1	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.2	2	2	1	2	1	-	-	-	1	-	2	2	2	2	-
CS19P09.3	2	2	2	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.4	2	2	2	2	2	-	-	-	2	-	2	2	2	2	2
CS19P09.5	3	2	2	2	3	-	-	-	3	-	2	2	2	2	2
Average	2.2	2.0	1.6	1.6	1.6	-	-	-	1.6	-	2.0	1.6	2.0	1.6	2.0

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C	
CD19P03	FUNDAMENTALS OF IMAGE PROCESSING	PC	2	0	2	3	
Objectives: The student should be made to:							
•	To understand the basics of Digital Image Processing.						
•	To be exposed to simple image enhancement techniques.						
•	To learn the concepts of degradation functions and restoration techniques.						
•	To be familiar with image compression techniques						
•	To implement various Image segmentation techniques.						
UNIT-I	INTRODUCTION TO IMAGE PROCESSING					6	
Introduction to Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System, Representation of Digital Images, Image Sampling and Quantization, Basic relationship between pixels, Introduction to Mathematical tools used in Digital Image Processing, Spatial operations, Image transforms.							
UNIT-II	IMAGE SPATIAL FILTERING					6	
Basics of Intensity Transformations and Spatial Filtering, some basic Intensity Transformation functions, Histogram Processing: Histogram Equalization, Histogram Matching, Local Histogram Processing, Fundamentals of Spatial Filtering, Spatial Correlation and convolution, Smoothing Spatial Filters: Smoothing Linear Filters, Smoothing Spatial Filters: Order Statistics (Nonlinear) Filters, Sharpening Spatial Filters: Foundation, The Laplacian Operator, Unsharp Masking and High boost Filtering.							
UNIT-III	IMAGE FREQUENCY FILTERING					6	
Image smoothing using frequency domain filters, Ideal lowpass filters, butterworth low pass filters, Gaussian lowpass filters, Image sharpening using frequency domain filters, Ideal highpass filters, butter worth high pass filters, Gaussian high pass filters, Image Restoration: Introduction Image Degradation/Restoration Process, Noise models, Mean Filters, Order Statistics Filters.							
UNIT-IV	IMAGE COMPRESSION					6	
Image Compression models: Fundamentals, Coding Redundancy, Coding Redundancy, Basic compression Methods, Huffman coding, Arithmetic Coding, LZW coding.							
UNIT-V	IMAGE SEGMENTATION					6	
Image Segmentation: Fundamentals, Point Detection, Line and Edge Detection, Basic Edge Detection, Advanced Techniques for Image Segmentation: Marr hieldreth, Canny Edge Detection, Thresholding, Adaptive Thresholding, Region-Based Segmentation: Region Growing, Region Splitting.							
					Total Contact Hours	:	30
Course Outcomes: On completion of course, students will be able to							
•	Acquire knowledge about the procedure of digital image data acquisition, processing, analysis, and their applications.						
•	Identify appropriate image processing techniques for real time applications.						
•	Operate on images using the techniques of enhancement, smoothing and sharpening filters.						
•	Implement image compression techniques.						
•	To segment the objects in an image using segmentation techniques.						
List of Experiments							
1	Practice of important image processing commands – imread(), imwrite(), imshow(), plot() etc.						
2	Program to perform Arithmetic and logical operations						
3	Program to implement sets operations, local averaging using neighborhood processing.						
4	Program to implement Convolution operation.						
5	Program to implement Histogram Equalization.						
6	Program to implement Mean Filter.						
7	Program to implement Order Statistic Filters						
8	Program to remove various types of noise in an image						
9	Program to implement Sobel operator.						
					Contact Hours	:	30
					Total Contact Hours	:	45
Text Books:							
1	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2014.						
2	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing using MATLAB”, Third Edition Tata McGraw Hill Pvt.Ltd., 2011						
3	Anil Jain K. “undamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.						
Reference Books / Web links:							
1	Willliam K Pratt, “Digital Image Processing”, John Wiley, 2002.						
2	Jayaraman S, Esaki Rajan S, T.Veera Kumar, “Digital Image Processing”, Tata McGraw Hill Pvt. Ltd., Second Reprint, 2010.						
3	S.Sridhar, “Digital Image Processing”, Oxford University Press, 2011.						

Course Outcomes (COs)

After completion of the course the students would be:

CD19P03.1	Acquire knowledge about the procedure of digital image data acquisition, processing, analysis, and their applications.
CD19P03.2	Identify appropriate image processing techniques for real time applications.
CD19P03.3	Operate on images using the techniques of enhancement, smoothing and sharpening filters.
CD19P03.4	Implement image compression techniques.
CD19P03.5	To segment the objects in an image using segmentation techniques.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P03.1	3	3	1	2	0	2	0	0	1	0	0	3	2	2	2
CD19P03.2	3	3	2	1	0	0	0	0	1	0	0	3	2	2	2
CD19P03.3	3	3	2	2	2	0	0	2	0	0	0	3	1	1	2
CD19P03.4	0	1	2	2	2	0	0	0	2	0	0	3	1	1	2
CD19P03.5	0	2	2	2	2	0	0	0	2	1	0	3	1	1	2
Average	3	2.4	1.8	1.8	2	2	0	2	1.5	1	0	3	1.4	1.4	2

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

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

If there is no correlation, put “-“

-

-

SubjectCode	SubjectName(LabOrientedTheoryCourse)	Category	L	T	P	C
AI19P75	INFORMATION RETRIEVAL	PE	2	0	2	3

Objectives:	
•	Learn the information retrieval models.
•	Learn the process of retrieval
•	Learn the mathematics behind the ranking of the resultant pages
•	Understand the application probability in retrieval
•	Be familiar with Web Search Engine.

UNIT-I	Introduction to Information retrieval	6
Information retrieval process-Indexing-Information retrieval model-Boolean retrieval model Tokenization-Stop words-Stemming- Inverted index-Skip pointers- Phrase queries(Chapter1,2)		
UNIT-II	Tolerant Retrieval and Term Weighting and Vector Space Model	6
Dictionaries and tolerant retrieval- Wildcard queries- Permu term index- Bigram index- Spelling correction-Edit distance- Jaccard coefficient- Soundex Parametric and zone indexes Term frequency and weighting The vector space Model for scoring Variant tf-idf functions(chapter3,4,6)		
UNIT-III	Efficient scoring and ranking	6
Information retrieval system evaluation-Standard test collections-Evaluation of unranked retrieval sets-Evaluation of ranked retrieval results- Assessing relevance- A broader perspective: System quality and user utility- Relevance Feedback and pseudo relevance feedback -Query reformulation (Chapter8,9)		
UNIT-IV	XML retrieval using Probability Ranking Principle	6
XML retrieval- Challenges in XML retrieval- A vector space model for XML retrieval- Evaluation of XML retrieval - Text-centric vs. data-centric XML retrieval- The 1/0 loss case - The PRP with retrieval costs- The Binary Independence Model - Deriving a ranking function for query terms - Probabilistic approaches to relevance feedback An appraisal of probabilistic models- Tree-structured dependencies between terms- Okapi BM25: a non-binary model Bayesian network approaches to IR(chapter 10,11)		
UNIT-V	Web Search and web crawling	6
Overview - Features a crawler must provide- Features a crawler should provide - Crawling - Crawler architecture DNS resolution - The URL frontier- Distributing indexes - Connectivity servers-Link analysis – web as a graph Anchor text and the web graph-PageRank-Markov chains-The PageRank computation-Hubs and Authorities- Choosing the subset of the Web(chapter19,20,21)		
Contact Hours		: 30

List of Experiments	
1	Develop a system to do Document summarization
2	Develop a movie Title recommendation system
3	Develop a program for Spam mail detection
4	Develop a small search engine for wiki
5	Develop a classifier system for tweets classification
Contact Hours: 30	
Total Contact Hours: 60	

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Understand the fundamental of the Information Retrieval
<input type="checkbox"/>	Get the understanding of different Information retrieval model.
<input type="checkbox"/>	Evaluate methods of the information retrieval model.
<input type="checkbox"/>	Acquire knowledge of retrieval from XML
<input type="checkbox"/>	Familiarize with the working of search engines

Text Books:	
1	1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2	2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.

Reference Books:	
1	Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
2	Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.
3	Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
4	Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series", 2nd Edition, Springer, 2004.

Weblink:	
1	http://www.tartarus.org/martin/PorterStemmer/
2	http://www.searchenginewatch.com
3	http://www.google.ca/intl/en/corporate/tech.html

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		3
AI19P75.1	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-	1
AI19P75.2	-	1	-	2	-	1	1	-	2	-	1	2	-	-	-	1
AI19P75.3	3	3	-	3	-	2	1	2	2	-	3	3	3	3	3	3
AI19P75.4	3	3	-	3	-	3	3	3	3	-	3	3	3	3	3	3
AI19P75.5	2	3	-	3	-	3	3	3	3	-	3	3	3	3	3	3
CO (Avg)	2.7	2.5	-	2.4	-	2.3	1.8	2.7	2.5	-	2.5	2.4	3	3	3	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
AI19P61	GPU PROGRAMMING	PE	2	0	2	3

Objectives:						
<input type="checkbox"/>	To learn the basics of GPU architectures.					
<input type="checkbox"/>	To write programs for massively parallel processors.					
<input type="checkbox"/>	To understand the issues in mapping algorithms.					
<input type="checkbox"/>	To interpret different GPU programming models.					
<input type="checkbox"/>	To familiarize various algorithms for GPU programming.					

UNIT-I	GPU ARCHITECTURE	6
Evolution of GPU architectures – Understanding Parallelism with GPU – Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.		
UNIT-II	PROGRAMMING ISSUES	6
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.		
UNIT-III	OPENCL BASICS	6
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment, Memory Model, Basic OpenCL Examples.		
UNIT-IV	ALGORITHMS ON GPU	6
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.		
UNIT-V	CUDA PROGRAMMING	6
Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.		
Contact Hours		: 30

List of Experiments

1.	To write a c/c++ CUDA program to get introduced to heterogeneous computing.			
2.	To write a c/c++ CUDA program to do parallel computing using blocks.			
3.	To write a c/c++ CUDA program to get introduced to threads.			
4.	To write a c/c++ CUDA program to combine threads and blocks.			
5.	To write a c/c++ CUDA program to work on cooperating threads.			
6.	To write a c/c++ CUDA program to work on Asynchronous operation and Handling errors.			
7.	To write a c/c++ CUDA program to work on managing devices			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Explain the GPU architecture.
<input type="checkbox"/>	Implement programs using CUDA, identify issues and debug them.
<input type="checkbox"/>	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication.
<input type="checkbox"/>	Develop simple programs using OpenCL.
<input type="checkbox"/>	Identify efficient parallel programming patterns to solve problems.

Text Books:	
1	Shane Cook, CUDA Programming:—A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2	David R. Kaeli, Per haad Mistry, Dana Schaa, Dong Ping Zhang, —Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.

Reference Books:	
1	Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison– Wesley, 2013.
2	Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU Programming, Addison– Wesley, 2010.
3	David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors—A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4	http://www.nvidia.com/object/cuda_home_new.html

Weblink:	
1	https://nptel.ac.in/courses/106/105/106105220/
2	http://www.searchenginewatch.com
3	https://www.coursera.org/courses?query=gpu

CO -PO–PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P61.1	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19P61.2	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19P61.3	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19P61.4	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19P61.5	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	2.0	2.0	2.0

Correlation levels 1, 2 or 3 are defined below:

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

Substantial (High) No correlation: “-”

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CD19P02	Foundation of Digital Story Telling	PE	3	0	0	3
Common to	CSD					

Objectives:

- To learn writing and structuring story for different genres and why a script should be written in a particular format
- To consider the relationship between what is being communicated to target audience/viewer.
- To analyze and explore forms of communication and media through a variety of design disciplines and techniques
- To develop theoretical and practical knowledge of a range of media using problem- finding skills, culminating in design and production of a finished piece of work.
- To understand the various stages to a professional workflow.

UNIT-I	Introduction to storytelling –Types of stories – discussion of convention storytelling – Genre - Elements of Story - Theme & Plot, One line story, Story with a Message, Arch, Anti & Mini Plot - Story, storyline, plot, and treatment - Principles of suspense and surprise	9
UNIT-II	Role of Drama in Story Telling - Storytelling through Camera - Storytelling through Editing - Storytelling through use of Sound & Music - Storytelling in Cinema - Basics of film language: Sequence, Scene, shot, Frame, Types of shots, Camera angles, Camera movements, Editing, Continuity, Composition - The art of staging - Mis-en-scene.	9

UNIT-III	The ideation and creativity in binding a story - How to turn a small idea into a full story? - Carving well-rounded characters for a script - Write a synopsis for your screenplay - Build your synopsis into an outline - Screenwriting: 3 Act Structure - Setup, Confrontation and Resolution; Hero's Journey - Different stages of Hero's Journey; Conflict & Cliché - Elements of Screenwriting - Foreshadowing, Flash Back, Time Travel; Rise & Fall and Climax & Resolution - Managing Conflicts.	9
UNIT-IV	Creating Compelling Characters - Using Archetypes to Flesh Out Character - The Hero's Journey - Creating Treatments that Sell - Developing the Perfect Beginning and Ending - Making Your Theme Resonate - Crafting Dialogue that Rings True - Creating Action that Packs a Punch - Controlling Pacing.	9
UNIT-V	Screenplay Formatting - Formats and adaptation of a screenplay - Designing the Perfect Logline - Online Resources for Screenwriters - Art of reading a script - Understanding Script dynamics - Most used software's for writing the screenplay - Pitching your story to the production houses in few minutes - Marketing Your Screenplay.	9
Total Contact Hours: 45		

Course Outcomes:

- Effectively utilize relevant technical concepts and theories.
- Analyze and evaluate methods of communication and appropriateness of media within a specialist area and describe basic skills.
- Layout and present a script in a professional manner.
- Develop an idea into a workable story.
- Critique scripts, diagnose problems and find solutions.

Text Book(s):

1. Field, Syd, "Selling Screenplay: The Screenwriter's Guide to Hollywood", New York, Dell Publishing, 1989
2. Meyer, William, "Screen Writing for narrative film and TV", Collumbus Books, London, (1989)
3. Rib Davis, "Writing Dialogue for Scripts", Bloomsbury Academic, 2016
4. Robert McKee, "Story: Style, Structure, Substance, and the Principles of Screenwriting", It Books; 1 edition, 1997

Reference Books(s) / Web links:

1. Wood, Julia T, "Communication mosaics: An introduction to the field of Communication", 2001, Wards worth.
2. Emory A Griffin, "A first look at communication theory", 3rd edition, New York: McGraw-Hill, 1997.
3. Griffin, Em, "A First Look at Communication Theory", New York: McGraw-Hill, 2006.
4. Miller, K., "Communication Theories: Perspectives, processes, and contexts", 2nd edition, New York: McGraw-Hill, 2005.
5. Umberto Eco, "A Theory of Semiotics", Indiana University Press, 1975.

Website:

<https://www.masterclass.com/articles/how-to-tell-a-story-effectively>

<https://www.inc.com/paul-jarvis/the-5-common-elements-of-good-storytelling.html>

<https://hbr.org/2003/06/storytelling-that-moves-people>

PO/PSO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	PO 12	PS O 1	PS O 2	PS O 3
CO															
CD19P03.1	0	1	2	2	2	3	1	1	1	2	1	3	0	1	3
CD19P03.2	0	1	2	2	2	3	1	1	1	2	1	3	0	1	3
CD19P03.3	0	1	2	2	2	3	1	3	1	2	1	3	0	1	3
CD19P03.4	0	1	2	2	2	3	1	1	1	2	1	3	0	3	3
CD19P03.5	0	1	2	2	3	3	1	1	1	2	1	3	0	3	3
Average	0	1	2	2	2.2	3	1	1.4	1	2	1	3	0	1.8	3

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	I	T	P	C
AI19P62	DATA ANALYSIS AND DATAMINING	PE	2	0	2	3

Objectives:	
<input type="checkbox"/>	To learn the introduction of Data Ware house and Data Mining.
<input type="checkbox"/>	To understand the concepts of clustering analysis.
<input type="checkbox"/>	To learn the basics of mining text data.
<input type="checkbox"/>	To acquire the basics of mining spatial data.
<input type="checkbox"/>	To study the basic concepts of mining web data.

UNIT-I	INTRODUCTION TO DATA WAREHOUSE AND DATA MINING	6
Data Warehouse: Characteristics of Data Warehouse- Data Ware house Components- Designing the Data Warehouse - Data Warehouse Architecture -Getting Heterogeneous Data into the Warehouse- Getting Multi-dimensional Data out of the Warehouse. Data Mining: Definition–Architecture–data mining: on what kind of data? -Data mining functionalities. (T2: Chapter–1and2)		
UNIT-II	CLUSTERING ANALYSIS	6
Introduction–Features election for clustering–Representative based algorithms–Hierarchical clustering algorithms– probabilistic model-based algorithms–Grid based and density-based algorithms–Graph based algorithms–non Negative matrix factorization–clustering validation. (T1: Chapter–6)		
UNIT-III	MINING TEXT DATA	6
Document Preparation and Similarity computation–Specialized clustering methods for text–topic modeling– Specialized Classification Methods for Text–Novelty and First Story Detection. (T1:Chapter–13)		
UNIT-IV	MINING SPATIAL DATA	6
MiningwithContextualSpatialAttributes–Trajectorymining–EquivalenceofTrajectoriesandMultivariateTimeSeries–ConvertingTrajectorystoMultidimensionalData–TrajectoryPatternMining–TrajectoryClustering– Trajectory Outlier Detection–Trajectory Classification. (T1: Chapter–16)		
UNIT-V	MINING WEB DATA	6
WebcrawlingandResourceDiscovery–SearchEngineIndexingandQueryProcessing–RankingAlgorithm–Recommender Systems–Web Usage Mining.(T1:Chapter–18)		
		Contact Hours : 30

List of Experiments	
	In H2O implement the following
1	Perform the basic pre-processing operations on data relation such as removing an attribute and filter attribute Bank data
2	To predict the Numerical Values in the given Data Set is using Regression Methods.
3	To predict with the smallest to talerr or using rules based on One attribute
4	To understand the theoretical aspects and build a hierarchy of clusters using hierarchical clustering techniques
5	To Demonstrate Clustering features in Large Databases with noise

6	Generate association rule for the credit card promotion data set using a priori algorithm with the support range 40% to 100% confidence as 10% incremental decrease as 5% and generate 6 rules		
		Contact Hours	: 30
		Total Contact Hours	: 60

Course Outcomes: On completion of the course, the students will be able to	
<input type="checkbox"/>	Explain the introduction of Data Warehouse and Data Mining.
<input type="checkbox"/>	Apply the concepts of clustering analysis.
<input type="checkbox"/>	Analyze the basics of mining text data.
<input type="checkbox"/>	Integrate the concepts of mining spatial data.
<input type="checkbox"/>	Demonstrate the basic concepts of mining web data.

Text Books:	
1	Charu C. Aggarwal, Data Mining: The Textbook, Springer 2015 Edition, Kindle Edition.
2	Sartaj Singh "Data Warehousing and Data Mining", Lovely Professional University, Phagwara.

Reference Books:	
1	Usama M. Fayyad, Gregory Piatetsky-Shapiro, Padhraí Smyth, and Ramasamy Uthrusamy, "Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.
2	N. J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 1980.

CO-PO– PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P62.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	1
AI19P62.2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	1
AI19P62.3	-	2	3	3	2	-	3	2	3	-	3	3	-	3	3
AI19P62.4	-	3	3	3	2	-	3	3	3	-	3	3	-	3	3
AI19P62.5	-	3	3	3	3	-	3	3	3	-	3	3	-	3	3
Average	1.2	2.8	2.2	1.8	1.4	-	1.8	1.6	1.8	-	1.8	1.8	1.2	1.8	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
CS19P20	SOCIAL, TEXT AND MEDIA ANALYTICS	PE	2	0	2	3

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

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

List of Experiments	
1	Collect the comments for any post in Tweet and classify the Tweet comments by using Random Forest algorithm
2	Apply Random Walk Algorithm to identify the insights present in the Medical Sector during a pandemic taking Instagram data as input

3	Collect the Tweets of a particular Movie and interpret the influence of the Movie providing the Positive/Negative Comments.			
4	Analyze emoticons feedbacks of consumable product and conclude whether to buy a product or not from enewspaper.			
5	Based upon the counts of share , like ,comments for a post in Facebook , analyze and comment the Post			
6	Consider the role of a marketing manager for an apparel software company develop a campaign for LinkedIn target audience			
7	Use Tabuleau to derive decision for knowledge worker from available previous data sets			
8	In a video frame sequence use snapchat to raise trigger to skip horror frames by analysing the video			
9	Create an ontology for news article in English contents that are good/bad to country			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:

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

1	Perceive the trends in recent years on online social networks.
2	Draw the graphical relation between the community
3	Know various social network algorithms.
4	Determine the relation between the participants
5	Understand Social Network Mining Tools and apply in real time problems

Text Books(s):

1	Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2011.
2	Ajith Abraham ,Aboul-Ella HassanienV´aclavSn´ařel,, "Computational Social Network Analysis Trends, Tools and Research Advances", Springer,2010

Reference Book(s) / Web Link(s):

1	Brian V. Carolan ,”Social Network Analysis and Education: Theory, Methods & Applications” ,Kindle Edition,2013
2	Song Yang, Franziska B Keller,”Social Network Analysis: Methods and Examples”,Kindle Edition,2016

CO- PO_PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
--------------	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------

CS19P20.1	2	-	1	-	2	-	-	-	-	-	-	-	2	-	-
CS19P20.2	2	1	1	2	2	-	-	-	2	-	-	-	2	2	2
CS19P20.3	2	2	2	1	2	-	-	-	2	-	2	-	2	-	-
CS19P20.4	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-
CS19P20.5	-	-	2	-	2	-	-	-	-	1	-	-	-	2	-
Average	2	1.5	1.5	1.5	2	1	2	0	2	1	2	0	2	2	2

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

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

If there is no correlation, put “-“

SubjectCode	SubjectName(LabOrientedTheoryCourse)	Category	L	T	P	C
CS19P19	COGNITIVE SCIENCE	PE	2	0	2	3

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

UNIT-I	INTRODUCTION	6
What is Cognitive Science?–Representations: Digital, Analog, The Dual-Coding Hypothesis, Propositional– The Interdisciplinary Perspective: Philosophical Approach, Psychological Approach, Cognitive Approach, Neuroscience Approach, Network Approach, Evolutionary Approach, Linguistic Approach, Artificial Intelligence Approach, Robotics Approach		
UNIT-II	THE COGNITIVE APPROACH I: HISTORY, VISION, AND ATTENTION	6
The Rise of Cognitive Psychology, The Cognitive Approach: Mind as an Information Processor, Modularity of Mind, Theories of Vision and Pattern Recognition, Template Matching Theory, Feature Detection Theory, A Computational Theory of Vision, Theories of Attention, Broadbent’s Filter Model, Treisman’s Attenuation Model, The Deutsch Norman Memory Selection Model, Theory of Pattern Recognition.		
UNIT-III	THE COGNITIVE APPROACH II: MEMORY, IMAGERY, AND PROBLEM SOLVING	6

Types of Memory: Sensory Memory, Working, Long-Term Memory, Memory Models: The Modal Model, The ACT* Model, The Working Memory Model and evaluations, Visual Imagery: The, Kosslyn and Schwartz Theory of Visual Imagery, Image Structures, Image Processes, Problem Solving: The General Problem Solver Model, The SOAR Model and its evaluation			
UNIT-IV	LANGUAGE AND COGNITIVE SCIENCE	6	
The Importance of Language, The Nature of Language, Language Use in Primates, Language Acquisition, Language Deprivation, Philosophy and Linguistics, Cognition and Linguistics, Neuroscience and Linguistics			
UNIT-V	COGNITIVE SCIENCE IN ACTION	6	
The vernacular vocabulary of remembering, Neisser's paradox and the Ebbinghaus paradigm, The problem of the workings of memory machines, Collective remembering, Individual remembering, Models for the psychology of remembering, Transforming a cognitive model into an artificial intelligence simulation			
		Contact Hours	30

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

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

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

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

CO-PO–PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19P19.1	1	2	-	-	-	-	-	-	-	-	-	1	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
CS19P19.1	1	1	1	1	-	-	-	-	-	-	-	-	2	1	1
CS19P19.1	1	2	2	2	1	1	-	-	1	-	1	1	2	1	1
Average	1	1.8	1.75	1.75	1.0	1.0	-	-	1.0	-	1.0	1.0	2	1	1

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

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

Subject Code	Subject Name	Category	L	T	P	C
CD19P04	Computer Vision and Image Analysis		2	0	2	3

Objectives:	
•	To review image processing techniques for computer vision.
•	To understand shape and region analysis.
•	To understand Hough Transform and its applications to detect lines, circles, ellipses.
•	To understand motion analysis.
•	To study some applications of computer vision algorithms.

UNIT-I	IMAGE PROCESSING FOUNDATIONS	6
Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.		
UNIT-II	SHAPES AND REGIONS	6
Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.		
UNIT-III	HOUGH TRANSFORM	6

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.				
UNIT-IV	3D VISION AND MOTION			6
Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.				
UNIT-V	APPLICATIONS			6
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.				
			Total Contact Hours	: 30
Course Outcomes:				
On completion of the course students will be able to				
•	Implement fundamental image processing techniques required for computer vision.			
•	Perform shape analysis.			
•	Apply chain codes and other region descriptors.			
•	Apply 3D vision techniques.			
•	Develop applications using computer vision techniques			

Experiments:	
1.	Practice Image processing techniques on an image.
2.	Implement a program to detect shapes and boundaries.
3.	Program for implementing boundary descriptor.
4.	Program for Implementing RANSAC Algorithm.
5.	Program to draw line and ellipse using Hough Transform.
6.	Program to recognize object from an image.
7.	Program to recognize and detect faces from camera.
8.	Program to perform foreground and background separation.
Text Book(s):	
1	D. L. Baggio et al., —Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.
2	E. R. Davies, —Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
3	Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.
Reference Books(s):	
1	Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
2	R. Szeliski, —Computer Vision: Algorithms and Applications, Springer 2011.
3	Simon J. D. Prince, —Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

CO-PO– PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P04.1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CD19P04.2	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CD19P04.3	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CD19P04.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CD19P04.5	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average	3	2.8	2.8	2.6	2.6	2	2	1.8	2.4	1.8	3	2	2.8	2.4	2.8

Correlation levels 1, 2
or 3 areas defined below:

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

Subject Code	Subject Name (Lab Integrated Theory course)	Category	L	T	P	C
CD19P05	UI and UX	PE	2	0	2	3

Objectives:

- To learn the fundamentals of User Interface Design.
- To learn the fundamentals of User Design Elements.
- To study the principles of heuristic evaluation for interactive design.
- To familiarize the facets of User Experience (UX) Design, particularly as applied to the digital artifacts.
- To understand the appreciation of user research, solution conceptualization and validation as interwoven activities in the design and development lifecycle of a product.

UNIT-I	THE USER INTERFACE— AN INTRODUCTION AND OVERVIEW	6
Basics of User Interface-Importance of User Interface-Principles of UI-User Interface Design Process-Understand the Principles of Good Design: What screen user wants, what screens users do, Interface Design Goals-Technological Considerations in Interface Design, User Centered Design Basics.		
UNIT-II	THE USER INTERFACE DESIGN ELEMENTS	6
Introduction to Menus: Structure of Menus, Functions of Menus, Contents of Menus, Formatting of Menus, Selecting and Navigating Menus, Kinds of Graphical Menus-Windows: Window Characteristics, Types of windows, window Management, Organizing Window Functions-Device and Selection-Based Controls.		
UNIT-III	EVALUATION OF INTERACTIVE DESIGN	6
Introduction to Interactive Design process – Interactive design in practice – Introducing evaluation – Evaluation: Inspection, Methods, Usability in Design, Analysis and Models – Inspection: Heuristic Evaluation: 10 Heuristic Principles, Examples – Case study: A Heuristic Evaluation of Big basket application.		
UNIT-IV	INTRODUCTION TO USER EXPERIENCE	6
Basics of UX design Process-Elements of UX-Design Thinking Techniques: Scenarios, Brainstorming, Design Tools-Techniques for Contextual Enquiry, User Interviews, Competitive Analysis for UX, Wire-Framing and Prototyping Techniques		
UNIT-V	UX RESEARCH TECHNIQUES	6

Research planning: Goals of Research, The Format of the plan-Competitive Research: Methods, Focus Groups, Card Sorting, Usability testing, Iterative Product Development, Concept Development - User review and Feedback, UX Case study of Sport360.fit app			
	Total Contact Hours	:	30
List of the Experiments			
1. Develop and design a mobile or web application to change background color and menus.			
2. Redesign canteen menu to increase the ease of use and ease of functionality (Grid and Menu Views)			
3. Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.			
4. Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Booking, Music) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle: Discovery Define Design Implement (Design Prototype) Usability Testing The below design methods and techniques will be imparted w.r.t. the group project selected by the students.			
5. Persona Creation for the group project			
6. Task flow detailing for the project.			
7. Project Prototyping Iteration 1 and 2.			
8. Pick your favourite design agency. Redesign their contact page in a more user-friendly way.			
	Contact Hours	:	30
	Total Contact Hours	:	60

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> Understand the fundamentals and importance of User Interface Design.
<ul style="list-style-type: none"> Learn and able to design the fundamentals of User Design Elements
<ul style="list-style-type: none"> Perform design evaluation by applying the heuristic principles.
<ul style="list-style-type: none"> Develop an application focusing on the design aspects based on the user Experience.
<ul style="list-style-type: none"> Understanding research on user requirements and Iterative Product Development.

Text Book(s):
1. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley & Sons,2nd Edition, 2001.
2. Jenny Preece, Helen Sharp and Yvonne Rogers, “Interaction Design: Beyond Human-Computer Interaction”, 3rd Edition, 2004.
3. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2nd Edition, 2010.

Reference Books(s) / Web links:
<ul style="list-style-type: none"> Alan Cooper and Robert Reimann, “About Face”, John Wiley, 4th Edition.
<ul style="list-style-type: none"> Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, “Observing the User Experience: A Practitioner's Guide to User Research”, 2nd Edition, 2012.
<ul style="list-style-type: none"> Jonny Schneider, “Understanding Design Thinking, Lean, and Agile”, 1st Edition, 2020.

Web links for virtual lab (if any)
<ul style="list-style-type: none"> https://uxdesign.cc/designing-better-links-for-websites-and-emails-a-guideline-5b8638ce675a
<ul style="list-style-type: none"> https://bootcamp.uxdesign.cc/100-weblinks-for-ux-ui-designers-31884d1f0140
<ul style="list-style-type: none"> https://www.tutorialspoint.com/mobile-ui-and-ux-design/index.asp

CO-PO– PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P05.1	2	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CD19P05.2	2	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CD19P05.3	1	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CD19P05.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CD19P05.5	2	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average	2	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 areas 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
AI19P82	BUSINESS INTELLIGENCE AND ANALYTICS	PE	2	0	2	3

Objectives:	
☐	To understand the framework for Business Intelligence
☐	To explore the phases of the Decision-making process
☐	To adopt the Data warehouse technology platform
☐	To understand the best practices for successful Business Intelligence
☐	To visualize the future of Business Intelligence

UNIT-I	Business Analytics	6
Terminology-Business Analytics Process-Relationship of Business Analytics process and Organization Decision-making process-A framework for Business Intelligence-Brief history of Business Intelligence-Architecture of Business Intelligence (CHAPTER 1 from T1 and CHAPTER 2 from T2)		
UNIT-II	Decision Making	6
Characteristics of Decision Making-Decision style and Decision Makers-Models-Benefits of Models-Phases of the Decision-Making Process-Decision Making: The Intelligence phase, Design phase, Choice phase, Implementation phase (CHAPTER 2 from T2)		
UNIT-III	Components of a Business Intelligence Architecture	6
Operational and Source Systems-Data Transfer: From Operational to Data Warehouse-The Data Warehouse Data Warehouse Tables-The Data Warehouse Technology Platform -The Business Intelligence Front-End: Business Query and Reporting-Production Reporting-Online Analytical Processing (OLAP)-Microsoft Office-Dashboards-Scorecards-Performance Management-Analytic Applications-Emerging BI Modules-Best Practices for Successful Business Intelligence (CHAPTER 2 and 3 from T3)		
UNIT-IV	Data Quality	6
Data Quality-Successful Data Architectures-Master Data Management (MDM)-Right-Time Data-Data Quality's Chicken and Egg-Best Practices for Successful Business Intelligence-Agile Development: Waterfall Development process, Agile Development techniques, Sharper BI at 1-800 contacts (CHAPTER 7 and 10 from T3)		
UNIT-V	Future of Business Intelligence	6
The importance of BI tools-The role of BI standardization-The right tool for the right user-The most successful BI Module-Emerging Technologies-Predicting the future-BI search & Text Analytics-Advanced Visualization Rich reportlets-The future beyond technology. (CHAPTER 12 and 14 from T3)		
Contact Hours		: 30

List of Experiments	
1	Import the legacy data from different sources such as (Excel, Sql Server, Oracle etc.) and load in the target system.
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server / Power BI.
3	Data Visualization from ETL Process

4	Creating a Cube in SQL server 2012			
5	Apply the what-if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.			
6	Implementation of Classification algorithm in R Programming.			
7	Practical Implementation of Decision Tree using R Tool			
8	k-means clustering using R			
9	Prediction Using Linear Regression			
10	Data Analysis using Time Series Analysis			
11	Data Modelling and Analytics with Pivot Table in Excel			
12	Data Analysis and Visualization using Advanced Excel			
		Contact Hours	:	30
		Total Contact Hours	:	60

Course Outcomes:

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

☐	Understand the framework for Business Intelligence
☐	Plan the phases of Decision-making phases
☐	Appreciate the Data warehouse technology platform
☐	Appreciate the Agile Development techniques
☐	Understand the future beyond technology

Text Books:

1	Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications with SAS What, Why, and How", Pearson Education, 2015.
2	Efraim Turban, Ramchandra Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th edition.
3	Cindi Howson, "Successful Business Intelligence - Secrets to making BI a killer App", McGraw Hill, 2008.

Reference Books:

1	Rick Sherman, "Business Intelligence Guidebook: From Data Integration to Analytics", 1st Edition, Kindle Edition.
2	Ahmed Sherif, "Practical Business Intelligence Kindle Edition".
3	Cindi Howson, "Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data", 2nd Edition, Kindle Edition.

CO -PO-PSO matrices of course

PO/PSO	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
CO															
AI19P82.1	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.2	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3

AI19P82.3	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.4	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.5	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
CO (Avg)	1	2	3	3	3	3	3	3	3	2	3	3	3	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 Course)	Category	L	T	P	C
CS19741	CLOUD COMPUTING	PC	2	0	2	3

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

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

Cloud Security Thread-Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Mobile Cloud Computing, Edge and Fog Computing.			
	Contact Hours	:	30

List of Experiments			
1.	Virtualization		
A	Find procedure to run the virtual machine of different configuration using virt-manager.		
B	Virtualize a machine and check how many virtual machine can be utilized at a particular time.		
C	Create a VM clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.		
2	Public Cloud		
A	Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.		
B	Test how a SaaS applications scales in response to demand.		
C	Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.		
3	Private Cloud		
A	Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.		
B	Perform Creation, Management and Termination of a CirrOS instance in OPENSTACK.		
C	Show the virtual machine migration based on certain conditions from one node to the other.		
4	Hadoop - Map Reduce		
A	Setup a Single Node Hadoop cluster and show all the process through WEB UI.		
B	Demonstrate the MAP REDUCE programming model by counting the number of words in a file. Implement the procedure to interact with Hadoop API for Accessing HDFS from local file system.		
		Contact Hours	: 30
		Total Contact Hours	: 60

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

TEXT BOOKS

1	Michael J. Kavis“Architecting the Cloud: Design Decisions for Cloud Computing Service Models(SaaS, PaaS, and IaaS)”, First Edition, Wiley,2014.
2	Tom White, “Hadoop: The Definitive Guid”. Yahoo Press, 2014.
3	RajkumarBuyya, ChristainVecchiola, and ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.
4	John W. Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
Thomas Erl, ZaighamMahood, Ricardo Puttini- “Cloud Computing, Concept, Technologyand Architecture”, 1 Prentice Hall, First Edition, 2013.	
Kai Hwang, Geoffery C, Fox and Jack J, Dongarra,” Distributed and Cloud Computing:Clusters, Grids, Clouds and the Future of Internet”, First Edition, Morgan Kaufman Publisher, an Inprint of Elsevier, 2012.	

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19741.01	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS19741.02	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CS19741.03	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CS19741.04	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS19741.05	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average	3	2.8	2.8	2.6	2.6	2	2	1.8	2.4	1.8	3	2	2.8	2.4	2.8

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CD19P15	FOUNDATIONS OF MACHINE LEARNING CONCEPTS	PE	2	0	2	3

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

UNIT-I	INTRODUCTION AND REGRESSION MODELS	6
The Machine Learning Landscape – Types of Machine Learning – Main Challenges of Machine Learning – Testing and Validating – End to End Machine Learning Project – Regression: Linear Regression – Training Models - Polynomial Regression – Other Regression Models: Lasso/Ridge regression/ElasticNet - Logistic Regression.		
UNIT-II	LINEAR MODELS	7
Revisiting Core ML concept: Bias-variance trade-off. Classification using support vectors: – Linear SVM classification –Nonlinear SVM classification. Probabilistic classifier: Classification using Naïve Bayes. Decision trees: Training and Visualizing a Decision Tree - Making Predictions - Estimating Class Probabilities - The CART TrainingAlgorithm - Computational Complexity - Gini Impurity or Entropy - Regularization Hyperparameters.		
UNIT-III	UNSUPERVISED LEARNING AND TREE MODELS	7
Unsupervised Learning Techniques: Clustering: K-Means - Limits of K-Means - Using Clustering for Image Segmentation- Using Clustering for Pre-processing - Using Clustering for Semi-Supervised Learning - DBSCAN - Other ClusteringAlgorithms. Ensemble learning and Random Forests: Voting Classifiers - Bagging and Pasting - Random Forests - Extra-Trees - Feature Importance – Boosting AdaBoost - Gradient Boosting		
UNIT-IV	INTRODUCTION TO NEURAL NETWORKS	6
Introduction to Artificial Neural Networks with Keras - Biological Neurons - Logical Computations with Neurons - ThePerceptron - The Multilayer Perceptron and Backpropagation Regression MLPs - Classification MLPs - Fine-Tuning Neural Network Hyperparameters - Number of Hidden Layers - Number of Neurons per Hidden Layer - Learning Rate,Batch Size, and Other Hyperparameters		
UNIT-V	FEATURE TRANSFORMATION	4
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis		
Contact Hours		: 30

List of Experiments			
1	A python program to implement linear and polynomial regression		
2	A python program to implement decision tree		
3	A python program to implement sentiment analysis to implement classification.		
4	A python program to implement regression.		
5	Do a data exploratory analysis to develop deep insights from a dataset.		
6	A python program to perform pre-processing on tabular, text and Image data.		
7	A python program to analyse between perceptron vs logistic Regression		
8	A python program to do Face Recognition using Support Vector Machines		
9	A python program to implement neural networks using Keras.		
10	Implement the learnt techniques in a mini project.		
		Contact Hours	: 30
		Total Contact Hours	: 60

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

Text Book(s):	
1	AurélienGéron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, 2nd Edition. September 2019, O'Reilly Media, Inc., ISBN: 9781492032649.
2	Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

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

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19643.01	3	3	1	0	2	1	1	1	1	0	2.2	1	2	1	1
CS19643.02	2	2	1	0	2	1	2	0	0	0	2	2	1	1	1
CS19643.03	3	3	1	0	3	0	1	0	0	0	3	1	2	3	2
CS19643.04	2	3	0	0	2	1	1	1	0	0	2	2	2	2	3
CS19643.05	2	2	2	2	3	0	1	2	0	0	3	3	3	3	3
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	0.0	2.0	1.8	2.0	2.0	2.0

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (Theory Course)	Category	L	T	P	C
CS19P06	QUANTUM COMPUTING	PE	2	1	0	3

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

UNIT-I	FUNDAMENTALS OF QUANTUM COMPUTING	9
Fundamental Concepts: Introduction and Overview – Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information. Problems on Qubits		
UNIT-II	QUANTUM COMPUTATION	9

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

Course Outcomes:

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

- | | |
|---|---|
| ☞ | Basics of Quantum computing and its Applications. |
| ☞ | Solve various problems using quantum algorithms. |
| ☞ | Methodology for quantum computers and their principles |
| ☞ | Comprehend quantum noise and operations. |
| ☞ | Gain knowledge about different quantum error correction techniques. |

Text Books(s):

- | | |
|---|--|
| 1 | Chris Bernhardt ,”Quantum Computing for Everyone”, (The MIT Press) Hardcover – Illustrate ,September 2020, |
| 2 | Willi-Hans Steeb; “Problems and Solutions in Quantum Computing and Quantum Information”, Yorick Hardy Academic Consulting and Editorial Services (ACES) Private Limited, January 2020. |
| 3 | M.A. Nielsen and I.Chuang, “Quantum Computation and Quantum Information”, Cambridge University Press 2010. |

Reference Book(s)/Web link(s):

- | | |
|---|---|
| 1 | Parag K. Lala ,Quantum Computing: A Beginner’s Introduction Paperback” , McGraw Hill November 2020. |
| 2 | V. Sahn, “Quantum Computing”, Tata McGraw-Hill Publishing company,2007. |

3	Nayak, Chetan; Simon, Steven; Stern, Ady; Das Sarma, Sankar, “Nonabelian Anyons and Quantum Computation”, 2008.
---	---

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS19P06.1	3	2	1	1	0	1	0	0	1	0	0	3	2	2	2
CS19P06.2	3	3	2	2	1	0	0	0	1	0	0	3	2	2	2
CS19P06.3	3	3	2	1	2	0	0	2	0	0	0	3	1	1	2
CS19P06.4	0	1	2	1	2	0	0	0	0	0	0	3	1	1	2
CS19P06.5	0	2	2	2	2	0	0	0	0	0	0	3	1	1	2
Average	1.8	2.2	1.8	1.4	1.4	0.2	0.0	0.4	0.4	0.0	0.0	3.0	1.4	1.4	2.0

Note: Enter correlation levels 1, 2 or
as defined below:
1: Slight (Low) 2: Moderate (Medium)
3: Substantial (High)

If there is no correlation, put “-“

CD19P08	Design Thinking for innovation	PE	1	0	4	3

Objectives:
<ul style="list-style-type: none"> To familiarize the engineering process and products developments To Understand the historical and current application of design thinking To perform immersion activity in empathize and define stages of design thinking To ideate and develop a prototype and to perform testing. To understand the role of innovation in design thinking

Theory:

- Engineering product development life cycle, (PDLC) ,
- Software development life Cycle (SDLC),
- Process in product development, process in service sectors
- Innovative products and services,
- non-linear thinking, divergent and convergent thinking
- Design Thinking approach- Empathises, Define, Ideation
- Prototype, Testing, developing innovative products and services
- problem definition and framing, ideation

Mini-Project

- Case studies of Past, Present and future of Engineering products, process services
- Developing an innovative products or services or process

Course Outcomes:
<ul style="list-style-type: none">• Execute the end-to-end design thinking process to various social, organizational, and business challenges;
<ul style="list-style-type: none">• Familiarizing the phases of design thinking process.
<ul style="list-style-type: none">• Conduct an immersion activity in empathise and define stages
<ul style="list-style-type: none">• Apply the ideation phase steps to develop a prototype for testing
<ul style="list-style-type: none">• Explain and support for design thinking in a team

Text Book(s):
1. Clive L. Dym and David C. Brown, "Engineering Design: Representation and Reasoning", 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Bengt-Arne Vedin, "The Design-Inspired Innovation Workbook", World Scientific, 2011.

Reference Books(s) / Web links:
<ul style="list-style-type: none">• https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
<ul style="list-style-type: none">• https://www.ideo.com/pages/design-thinking

CO - PO – PSO matrices of course

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO															
CD19P08.1	2	3	-	3	3	3	3	3	3	3	-	3	3	1	2
CD19P08.2	2	3	-	3	3	3	3	3	3	3	2	3	3	1	2
CD19P08.3	3	-	3	-	3	3	2	3	3	3	3	3	1	3	2
CD19P08.4	3	-	3	3	3	3	2	3	3	3	3	3	1	3	2

CD19P08.5	3	-	3	2	3	3	2	3	3	3	3	3	1	3	2
Average Mapping	2.6	3.0	3.0	2.75	3	3	2.4	3	3	3	2.75	3	1.8	2.2	2

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (LabOrientedTheoryCourse)	Category	L	T	P	C
CD19P09	IMMERSIVE TECHNOLOGY	PE	2	0	2	3

Objectives: The students will be able to
<ul style="list-style-type: none"> To understand geometric modelling .
<ul style="list-style-type: none"> To study about Virtual Hardware and Software
<ul style="list-style-type: none"> To develop Virtual Reality applications
<ul style="list-style-type: none"> To familiar with Virtual Environments
<ul style="list-style-type: none"> To Compare and contrast AR/VR Experiences.

UNIT-I	Introduction	6
The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.		
UNIT-II	Input and Output Devices	5
Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays & haptic feedback.		
UNIT-III	Augmented and Mixed Reality	7
Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality. wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments.		
UNIT-IV	Modeling	6
Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management		

UNIT-V	Human Factors and Applications	6
Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. Applications: Medical applications, military applications, robotics applications, Engineering, Entertainment, Science, Training.		
	Contact Hours	: 30

List of Experiments:			
1	Create a 3D object and Apply different geometric Transformations using Mouse/Keyboard		
2	Create animation for a 3D object (transformation, color, texture, etc.)		
3	Bouncing ball on multiple 2D/3D platforms		
4	Develop First Person Controller to a Scene		
5	Create a 3D Character movement		
6	Create a menu driven interface for adding and removing objects from a Scene		
7	Build a cubic room, whose sides are made out of six planes. The room should be 15x15x15 Unity units. At the center of the roof of the room, place a point source of light. This light should change color by pressing the Tab key.		
8	Finding target using 2D Ray-caster		
9	Create a loading bar (health bar, progress bar, start bar)		
10	Create and show motion effect using time scale and scripts for 2D images.		
	Contact Hours	:	30
	Total Contact Hours	:	60

Course Outcomes: After completing the course, the students will be able to
<ul style="list-style-type: none"> Adopt various principles and concepts of virtual reality and its application.
<ul style="list-style-type: none"> Apply appropriate method of geometric modeling
<ul style="list-style-type: none"> Formulate virtual environment for a given engineering problem and VR simulation for problem situation.
<ul style="list-style-type: none"> Analyze various VR software in a structured manner and prepare report as per the technical standards.
<ul style="list-style-type: none"> Comparing the experiences of AR and VR.

Text Book(s):
1. Virtual Reality Technology, Gregory C. Burdea& Philippe Coiffet, John, 2 nd Edition, 2013 Wiley & Sons, Inc., ISBN: 978-0-471-36089-6
2. Alan B. Craig, “Understanding Augmented Reality”, Concepts and Applications, Morgan Kaufmann,1 st Edition, 2013 ISBN: 9780240824086

Reference Books(s) / Web links:
--

<ul style="list-style-type: none"> Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, 2nd Edition, 2006. ISBN: 978-0-471-36089-6
<ul style="list-style-type: none"> Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005. ISBN 1-56881-230-2
MOOC Courses: https://www.coursera.org/learn/augmented-reality https://www.coursera.org/specializations/unity-xr

CO - PO – PSO matrices of course

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO															
CD19P09.1	3	3	3	1	3	3	3	3	3	3	-	3	3	1	2
CD19P09.2	3	3	3	1	3	3	3	3	3	3	2	3	3	1	2
CD19P09.3	3	-	3	1	3	3	2	3	3	3	3	3	1	3	2
CD19P09.4	3	-	3	1	3	3	2	3	3	3	3	3	1	3	2
CD19P09.5	3	-	3	1	3	3	2	3	3	3	3	3	1	3	2
Average Mapping	3	3	3	1	3	3	2.4	3	3	3	2.75	3	1.8	2.2	2

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

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

If there is no correlation, put “-“

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
CD19P11	Digital Media Entrepreneurship	PE	3	0	0	3
Common to						

Objectives:
<ul style="list-style-type: none"> To introduce the possibilities of digital media entrepreneurship as an idea.
<ul style="list-style-type: none"> To study and comprehend the dynamics of establishing digital service firms and the factors associated with it

<ul style="list-style-type: none"> • To facilitate the students with client approaching and convincing skills, which can enable them to brand themselves.
<ul style="list-style-type: none"> • To comprehend the dynamics of the global and local digital markets, and their applicability to specified niches.

UNIT-I	Introduction to Entrepreneurship	9
Introduction to Entrepreneurship, Definitions and Types of entrepreneurs, Characteristics/traits associated with entrepreneurs, Entrepreneurial Environment and Motivation, Role of entrepreneurship in the developing society, The media entrepreneur		
UNIT-II	Introduction to Media Management	9
Different Schools of Management, Difference between Entrepreneurs and Managers, The Media Industry today and its emerging trends, The Indian entertainment and media business Concepts of strategic Media Management, Customer Relationship Management in Media Industries.		
UNIT-III	Introduction to Media Economics	9
Introduction to Media Economics, Basic concepts of Financial Management, Personnel management in Media Organisations, Issues in Audience Management, Digital Media Management,		
UNIT-IV	Introduction to Corporate Social Responsibility	9
Introduction to Corporate Social Responsibility, Convergence, Globalisation and Media Management		
UNIT-V	Media Event Management	9
Identifying core concepts behind the event, Strategic planning, Group Sustainability, Introduction to Resource Mobilisation, Event Marketing, Event documentation and evaluation		
Total Contact Hours:		45

Course Outcomes:
<ul style="list-style-type: none"> • Students will have explored the possibilities of taking up digital media entrepreneurship with guided understanding of the dynamics of it.
<ul style="list-style-type: none"> • They will be well aware and trained in the aspects of establishment of entrepreneurial firms in their specified area.
<ul style="list-style-type: none"> • They will be capable of branding and sustaining their own brand identity based on effective client pitches and approaches.
<ul style="list-style-type: none"> • Students will have comprehended the global and national standards of digital media entrepreneurship, industrial expectations and the possibilities they have ahead of them.

Text Book(s):
1. The Strategic Digital Media Entrepreneur John Wiley & Sons; Illustrated edition (30 October 2018) 2. Marketing Management. New jersey, Pearson Education Inc.

CO - PO – PSO matrices of course

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO															
CD19P11.1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CD19P11.2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CD19P11.3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CD19P11.4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CD19P11.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average Mapping	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

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

Subject Code	Subject Name	Category	L	T	P	C
CD19P12	VISUAL EFFECTS	PE	0	0	6	3

Objectives:	
♦	To gain a comprehensive understanding about the VFX pipeline.
♦	To create convincing and photo real renders.
♦	To understand concepts such as 3D modelling.
♦	To Learn Texturing, Lookdev.

❖	To Learn Match Moving and Compositing.
---	---

List of Experiments (If applicable)			
1	Recording the raw footage.		
2	Introduction to After effects.		
3	Introduction to 3D software.		
4	Modeling in Blender.		
5	Texturing.		
6	Effects.		
7	Match moving.		
8	Lighting and Rendering.		
9	Compositing and Color correction.		
10	Mini Project		
			Total Contact Hours : 90

Course Outcomes:	
On completion of the course, the students will be able to	
•	Bring the textures into Blender.
•	Create a 3D model
•	Create visual effects like smoke, fire.
•	Have the skills as a 3D artist, Lookdev Artist, Matchmover, FX Artist, Technical Artist.
•	Create a portfolio.

Web links

<ul style="list-style-type: none"> • Fundamentals of VFX Udemy • VFX Production On-Set: Becoming a Visual Effects Supervisor Udemy • VFX Keying: Master Course (linkedin.com) • Visual Effects: Online Courses, Training and Tutorials on LinkedIn Learning • Creating a Short Film: 10 VFX Effects (linkedin.com) • After Effects CC: Beginner's Guide to VFX Visual Effects Udemy • https://en.wikipedia.org/wiki/Rule_of_thirds • https://www.youtube.com/watch?v=Rzc-luz9cns&ab_channel=vfxexpert • https://www.youtube.com/playlist?list=PLB0wXHrWAmCwnqWfKdGEmbtSKN2Ez vLrY
--

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P12.1	-	2	1	2	2	1	1	-	3	1	3	2	3	2	3
CD19P12.2	-	3	3	3	3	2	2	-	3	2	-	2	3	3	3
CD19P12.3	-	3	2	3	3	2	3	-	2	-	3	2	3	1	3
CD19P12.4	-	3	1	3	3	3	2	2	2	2	3	2	2	-	2
CD19P12.5	-	3	2	2	2	2	2	2	2	2	3	2	3	2	3
Average	-	2.8	1.8	2.6	2.6	2	2	2	2.4	1.75	3	2	2.8	2	2.8

Correlation levels 1, 2 or 3 are defined below:

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

Subject Code	Subject Name	Category	L	T	P	C
AI19P52	AI FOR GAME PROGRAMMING	PE	2	0	2	3

Objectives:	
<input type="checkbox"/>	To learn the fundamentals of Game programming.
<input type="checkbox"/>	To understand the 3D Graphics, vertex and pixel shader.scenes.
<input type="checkbox"/>	To learn the various PyGame Development process and its design attributes.
<input type="checkbox"/>	To interpret working knowledge in various game platforms.
<input type="checkbox"/>	To familiarize various games using reinforcement learning.

UNIT-I	INTRODUCTION	6
Elements of Game-Game Architecture-Application Layer-Game Logic-Game View for the Human Player-Game View for AI agents-Networked Game Architecture-Remote Game View-Remote Game Logic.(Text Book 1: Chapter 2)		
UNIT-II	3D GRAPHICS	6

3D Graphics Basics- Pipeline-3D MATH 101-Vector Classes-Matrix Mathematics-Quaternion Mathematics. 3D Vertex and Pixel Shader : Vertex Shader Syntax-Compiling the vertex shader-The pixel shader-Rendering the shader Helper Classes. 3D Scenes: Graph Basics-Special Scene Graph Nodes.(Text Book 1: Chapter 14,15,16)			
UNIT-III	PYGAME AND 3D AND PYPLATFORMERS		6
Installing Packages-Getting started with OpenGL-Adding the Pygame Library-Drawing the openGL-Basic Collision Detection Game-An introduction to Game Design-Introducing Pymunk-Building a Game Framework-Developing Pyplatformers.(Text Book 2 : Chapter 5 & 6)			
UNIT-IV	AUGMENTING A BOARD GAME WITH COMPUTER VISION		6
Planning the checker application-setting up OpenCV and Other dependencies-Supporting multiple version of Open CV- Configuring Cameras-Working With Colors-Building the analyser-Converting OpenCV images for wxPython-Building the GUI Application-Troubleshooting the projects.(Text Book 2 : Chapter 7)			
UNIT-V	REINFORCEMENT LEARNING AND GAMES		6
Intelligence and Games- Reinforcement Learning - Heuristic Planning - Adaptive Sampling-Deep Supervised Learning- Deep Reinforcement Learning.(Text Book 3:Chapter 2, 3,4, 5 and 6)			
			Contact Hours : 30

List of Experiments (can be implemented using any tools: Play Canvas, jMonkey Engine, Direct 3D 11, Scratch , Python or Unity.)			
1.	Texture the Triangle using Direct 3D 11.		
2.	Programmable Diffuse Lightning using Direct3D 11.		
3.	To Implement Make Bouncing Ball Game.		
4.	To Implement " virtual pet" game.		
5.	To Implement " treasure hunt " game.		
6.	To Implement Shooting games.		
7.	To Implement Tynker games.		
8.	Introduction about PyGame, Unity software.		
9.	Learning 2D Game Development with Unity.		
Contact Hours			: 30
Total Contact Hours			: 60

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Explain the need for Game programming.
<input type="checkbox"/>	Integrate various concepts and techniques of 3D Game design.
<input type="checkbox"/>	Design and model interactive game.
<input type="checkbox"/>	Explain the need for advanced game development platforms.
<input type="checkbox"/>	Design and develop games using reinforcement learning.
Text Books:	
1	Mike “MrMike” McShaffry and David “Rez” Graham, “Game Coding Complete,Fourth Edition”, Course Technology PTR, A part of Cengage Learning.
2	Alejandro Rodas de Paz,Joseph Howse, “Python Game Programming By Example”, Packt Publishing,2015.
3	Learning to Play (Springer),Reinforcement Learning and Games by Aske Plaat,2020.

Reference Books:	
1	Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 2nd 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.

Web link:

1. <https://docplayer.net/62131747-Python-game-programming-by-example.html>
2. <https://www.3dgep.com/introduction-opengl/>
3. https://link.springer.com/chapter/10.1007/978-3-642-27645-3_17

CO - PO – PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P52.1	1	2	2	2	2	-	-	-	-	-	-	-	1	1	-
AI19P52.2	2	2	3	2	2	-	-	-	-	-	-	-	2	2	-
AI19P52.3	2	2	3	3	3	-	-	-	-	-	2	-	3	3	-
AI19P52.4	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
AI19P52.5	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
Average	1.8	2	2.8	2.6	2.6	-	-	-	-	-	1.2	-	2.4	2.4	0.8

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(LabOrientedTheoryCourse)	Category	L	T	P	C
CD19P13	FILM MAKING AND RADIO PODCASTING	PE	2	0	2	3

Objectives:	
•	To demonstrate the critical study of cinema, inform their filmmaking and that the study and practice of film production enhance their work as film scholars and analysts. ce
•	To demonstrate and understand the pre-production, production, and postproduction filmmaking process.
•	To identify relationship between film form and aesthetic effect through both film analysis and the creation of motion pictures.

	To conduct film research and compose cogent, persuasive, and ● valid essays about film.
--	--

UNIT-I	INTRODUCTION TO FILMS/CINEMA	5
History of films -Types of films process of filmmaking - Various departments in films: Pre-production, Production, PostProduction - Film Language (Shot, Scene, Camera Movements) Basic thought, Story, Screenplay – Shooting - Script, Basic thought, Story, Screenplay, Shooting Script - Revisualization (Shot Division, Story Boarding) Project Designing & Planning Scheduling (Creating grid, arranging scenes, characters & crew needed, Budgeting.		
UNIT-II	DIRECTION AND CINEMATOGRAPHY	5
Direction - Introduction - work of director Types of directors & duties of each Break downs, Camera - Photography And Cinematography - Types of cameras, Intro to cameras & their function Types of lenses Lighting for films Basic lighting techniques & equipment's - Types of lights Light accessories Interior & Exterior lighting - creative cinematography - Characterization through Camera		
UNIT-III	SOUND AND AUDIO PRODUCTION	5
Sound/Audio - Introduction - Work of Sound recordist & boom operator - Recording equipment's, - Types of microphones & headphones, their qualities, mic techniques Terminologies & aspects of audiographer - Sound recording/Dubbing & voice over techniques		
UNIT-IV	EDITING AND COLOUR CORRECTION	5
Editing - Introduction - Editing basics, Equipment's, creating rough cut, Fine cutting - applying transitions, synchronization of scenes - color correction - titling Digital Integration - Creating Final output For Cinema Theatres &Tv - Art Direction Introduction - Production designing Basic concepts - Techniques Dressing a Set - Arranging property Location alternation		
UNIT-V	RADIO PODCASTING	6
Basics of communication. Characteristics, strengths & limits of audio; The physics of sound; History of broadcast, AM, FM, All India Radio - Podcasting and internet radio, community radio - layout, recording equipment, microphones, mixers and transmitters - Introduction to various radio formats - news and entertainment. Public service advertisements - Voice modulation, presentation skills, vocal dynamics and live compering. Podcasting styles, Recording /production techniques. Editing principles. Creating sound effects. Sound concerning visuals. The function of sound, silence and music on the radio. Technology and software used.		
	Total Contact Hours	: 30
Course Outcomes: On completion of the course students will be able to		
•	Identify, formulate and solve complex media design challenges using fundamental principles involved in technology, design and storytelling.	
•	Use Modern Tool / Techniques, Select, adapt, and apply appropriate tools, techniques, resources to various activities, with an understanding of their boundaries.	
•	Conduct Investigations of complex production and distribution problems: Use research-based knowledge and research methods, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	
•	Apply knowledge of storytelling, develop interesting plots, subplots, in fiction and non-fiction space.	
•	Create content in live action medium with requisite CG essentials.	

	List of Experiments
1	Design a Music track by rearranging available music.

2	Record a voice and Remove background noise and equalize the sound.		
3	Create a New Podcast Project I.		
4	Create a New Podcast Project II.		
5	Write a new script for a short story.		
6	Design a storyboard using the script.		
7	Handle various lenses and camera for shooting the short film.		
8	Shoot required sequences for the story.		
9	Edit the videos and order them in a sequence.		
10	Add Sound effects and video effects to the film.		
11	Render the film in various formats.		
12	Final Project.		
	Contact Hours	:	30
	Total Contact Hours	:	60

Text Book(s):	
	1. Hollywood Producers Directory, J. Douma& D. Perez, 2016. 2. Making Movies, Sidney Launet, 1996. 3. In the Blink of an Eye, Walter Murch, 2001. 4. Storytelling in Radio and Podcasts: A Practical Guide, Sven Preger, 2021.
Reference Books(s):	
1	The Filmmaker's Handbook: A Comprehensive Guide for the Digital Age: Fifth Edition, 27 November 2012
2	On Directing Film, David Mamet, 1992.

CO-PO– PSOMatricesof course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CD19P13.1	3	2	1	2	2	1	1	3	3	1	3	2	3	2	3
CD19P13.2	3	3	3	3	3	2	2	3	3	2	-	2	3	3	3
CD19P13.3	3	3	2	3	3	2	3	3	2	-	3	2	3	1	3
CD19P13.4	3	3	1	3	3	3	2	2	2	2	3	2	2	-	2
CD19P13.5	3	3	2	2	2	2	2	2	2	2	3	2	3	2	3
Average	3	2.8	1.8	2.6	2.6	2	2	2.6	2.4	1.75	3	2	2.8	2	2.8

Correlation levels 1, 2 or 3 are defined below:

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

Substantial (High) No correlation: “-”

Subject Code	Subject Name	Category	L	T	P	C
AI19P53	MOBILE TECHNOLOGY	PE	3	0	0	3

Objectives:	
<input type="checkbox"/>	To understand the basic concepts of mobile computing.
<input type="checkbox"/>	To learn the basics of mobile telecommunication system.
<input type="checkbox"/>	To study the basic evolution of Modern Mobile Wireless Communication Systems.
<input type="checkbox"/>	To be familiar with the network layer protocols and Ad-Hoc networks.
<input type="checkbox"/>	To gain knowledge about different mobile platforms and application development.

UNIT-I	INTRODUCTION	9
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA (Chapter 1, 2 and 3 of T1)		
UNIT-II	MOBILE COMMUNICATION SYSTEMS	9
GSM-System architecture-DECT - System architecture-TETRA-UMTS and IMT-2000-Broadcast systems-Digital audio broadcasting -Digital video broadcasting-Convergence of broadcasting and mobile communications (Chapter 4 and 6 of T1)		
UNIT-III	4G NETWORKS	9
Personal Area Networks: PAN - Public wide-area Wireless Networks -First Generation (1G) Wireless Networks - Second Generation-GSM architecture and protocol(2G) Wireless Cellular Networks - Third Generation (3G) Wireless Networks - Vision for 4G- Cellular Mobile Wireless Network- Description of cellular system- Channel Assignment Schemes in cellular networks- Cellular Communication Principle-Radio Resource Management (Chapter 2, 3, 6, 8, and 11 of R2)		
UNIT-IV	WIRELESS NETWORKS	9
Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security. (Chapter 8 of T1)		
UNIT-V	MOBILE PLATFORMS AND APPLICATIONS	9
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(Chapter 9, 10 and 11 of T2) and (Link 1, 2, 3 and 4)		
Contact Hours		: 45

Course Outcomes: On completion of the course, the students will be able to	
<input type="checkbox"/>	Explain the basic concepts of mobile communication.
<input type="checkbox"/>	Apply the concepts of mobile telecommunication systems.
<input type="checkbox"/>	Apply different generation of mobile technology.
<input type="checkbox"/>	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
<input type="checkbox"/>	Develop a mobile application using android/blackberry/ios/Windows SDK.

Text Books:	
1	Jochen Schiller, —Mobile CommunicationsI, PHI, Second Edition, 2003
2	Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile ComputingI, PHI Learning Pvt.Ltd, New Delhi – 2012.

Reference Books:	
1	Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005
2	Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH, 2009, 2013 by the McGraw Hill Education (India) Private Limited
3	William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital SystemsI, Second Edition,TataMcGraw Hill Edition ,2006.
4	Principle of wireless Networks by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson 2002.

Web link:

1. Android Developers : <http://developer.android.com/index.html>
2. Apple Developer : <https://developer.apple.com/>
3. Windows Phone DevCenter : <http://developer.windowsphone.com>
4. BlackBerry Developer : <http://developer.blackberry.com>

CO - PO – PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
AI19P53.1	-	2	-	2	-	-	-	-	-	-	-	2	2	1	1	
AI19P53.2	2	2	3	2	2	1	-	-	2	1	-	2	1	2	1	
AI19P53.3	1	2	2	3	2	2	1	1	-	-	-	3	2	3	2	
AI19P53.4	1	2	3	2	3	1	-	2	1	-	-	1	-	-	-	
AI19P53.5	1	2	3	2	3	1	-	2	1	-	2	2	-	-	-	
Average	1.2	2	2.8	2.2	2.5	1.2	1	1.8	1.3	1	2	2	1.5	2.5	1.5	

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		L	T	P	C
CD19701	FUNDAMENTALS OF VIDEO EDITING FOR ENGINEERS	PC	3	0	0	3

Objectives:	
<input type="checkbox"/>	To develop learners’ skills in, and understanding of, moving image post-production processes. To explore the professional practice of editing, and developing their own technical and creative skills.
<input type="checkbox"/>	To develop an understanding of how their work can affect the final outcome of a production.
<input type="checkbox"/>	This subject would cover the techniques and methodology of Video Editing, it would focus on the techniques used for video and sound reinforcement, to fulfil the present day designing needs

UNIT-I	HISTORY OF VIDEO EDITING	3
Video editing pipeline, Workspace of Software, Metadata, Playback menus, Sequences design, Team Projects Pipeline, Bit and color theory. Introduction to Adobe Premiere Working with Timeline Adding Transitions Adding Sound Clips Introduction to Editing (Adobe premiere).		
UNIT-II	ANALYZE THE PURPOSE OF TAKING A SHOT	3
To take a shot(Analyze the purpose of taking a shot), Shot to shot transition, keying ,Basic techniques of building a scene, Pace & Time, Rough cut. Frame rate frame dimension, Windows Shortcut keys, Camera Trimming, Title toll Working with effects, Freeze frame.		
UNIT-III	PRODUCE AN ANIMATIC	3
The art of voiceover, how to lend voice to a short film, Multi cam editing, Dub matching and track lying. Color correction for a final project or a movie. Trim to fill, fit to fill, Nesting effects, Load filer, fade, effects, Capturing.		
UNIT-IV	PRINCIPLES OF VIDEO EDITING	3

Stages of editing, selection of shots, assembly and fine cut, principles of continuity editing. creating transitions, basic transitions, cut, dissolve, types of editing fade in, and fade out, intercut, cross cut, jump cut, Color boors, create tone media, Multi camera Presets			
UNIT-V	TITLES AND EFFECTS		3
WORKING WITH SOUND Non liner editing Techniques, Capturing Importing footage Organizing footage, in bins Developing sequences and exporting Video Capture and Import. Green & blue mat effects. Color corrections.			
		Total Contact Hours	: 15

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Describe the Historical development of editing.
<input type="checkbox"/>	Explain stages of editing, selection of shots, assembly & fine cut, principles of continuity editing.
<input type="checkbox"/>	Create basic transitions like cut, dissolve, fade in, fade out, and intercut, cross cut, jump cut.
<input type="checkbox"/>	Do the titles and credits using linear, on linear, offline, online editing through final cut pro and avid.
<input type="checkbox"/>	Do the sound editing using nonlinear editing techniques, capturing & importing footage
<input type="checkbox"/>	Describe the Historical development of editing.

Text Books(s):	
1	T1. Video Production VasukiBelavadi Oxford press 2023 1 st edition
2	T2. Adobe Premiere Pro CC Classroom in a Book Maxim jago Adobe 2022 16th edition

Reference Book(s) / Web link(s):	
1	Sound Design: The Expressive Power of Music, Voice and Sound Effects in Cinema - <u>David</u> Sonnenschein. 2018.
2	Sound Systems: Design and Optimization: Modern Techniques and Tools for Sound System 2019

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-”

Subject Code	Subject Name		L	T	P	C
CD19721	INTRODUCTION TO 3D ANIMATION	PC	1	0	0	1

Objectives:	
<input type="checkbox"/>	This course aims to give sufficient knowledge for students to evaluate principals of animation along with history of animation with animation methods.
<input type="checkbox"/>	This subject provides students technical skills needed and support character animations effectively for all 3D Animation classes.
<input type="checkbox"/>	The main objective of this subject is to impart the knowledge of the techniques used for compositing in films.
<input type="checkbox"/>	To understand poses and camera angles
<input type="checkbox"/>	To understand weight shift and work on centre of gravity of body mechanics

UNIT-I	HISTORY OF ANIMATION	3
Introduction to the history of Animation. Technical conceptual and Aesthetic landmarks from the early 1900's to the present. History of Disney Animation Studio Pixar Animation studio. Three dimensional computer, Generated animation.		
UNIT-II	INTRODUCTION TO 2D& 3D ANIMATION	3
Introduction to fundamentals of Animation. Traditional Animation. Computer Animation. Types of computer Animation Challenges and the future of computer animation 2D Animation Pipe Line, 3D Animation Pipe Line, 2D Animation techniques, sensitivity to timing.		
UNIT-III	INTRODUCTION TO CHARACTER ANIMATION (MAYA)	3
Explaining gestures, Role of expression, emotion in acting and, animation. Introductory exercises: creativity ideas, inspiration for stories, acting methods		
UNIT-IV	GETTING INTO CHARACTER	3
Acting exercises that illustrate personality and character. Situations & character-driven scenarios. Focus on Shape, Postures, Gestures & key poses. Accents, dialects, mouth movements & facial expressions: characterization & performance choices dialogue in Animation.		
UNIT-V	ACTING FOR ANIMATION	3
Understanding Classical Animation, Doing Cell Animation, Understanding the Light Board Designing the Layout, Preparing the Rough Sketch for Animation, Drawing Key Poses for Animation, Shade and Color Filling. Doing Animation Human Walk, Doing Animation Animal Walk.		
Total Contact Hours		15

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Identify the history of Animation
<input type="checkbox"/>	Compare the Traditional and Computer generated Animation
<input type="checkbox"/>	Compare in which way the 2D,3D Animation pipe line works
<input type="checkbox"/>	Describes the History of Disney & Pixar Animation studios
<input type="checkbox"/>	Creates advance flip card animation, building models, lighting

Text Books(s):	
1	Parent Rick and Kauffman Morgan, (2020). Computer Animation Algorithm and Techniques.
2	Roberts Steve (2023). Character Animation 3D. Focal Press.

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CD19741	3D PRINTING AND DESIGN	PC	3	0	4	5

Reference Book(s) / Web link(s):

1	The Animator's Survival Kit / Richard Williams .2001
2	Cartoon Animation /by Preston Blair 2020
3	The Illusion of Life / Frank Thomas and Ollie Johnston
4	Timing for Animation –First published 1981 by Harold Whitaker and John Halas Updated by Tom Sito
5	Timing for Animation by John Halas, Harold Whitaker

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-“

Objectives:	
• To study the basics computer graphics in modeling.	
• To familiarize the assembly modeling and data exchange standard in modeling.	
• To understand various software tools, techniques, file formats and importance of Reverse Engineering.	
• To familiarize the development of Additive Manufacturing, various business opportunities and applications.	
• To be familiar with solid, liquid and powder based processes.	

UNIT-I	FUNDAMENTAL OF COMPUTER GRAPHICS	9
CAD/CAM- Output Primitives- 2 Dimensional and 3 Dimensional Transformation – Translation, Scaling and Rotation- Constructive Solid Geometry- Boundary Representation- User Interface for Solid Modeling.		
UNIT-II	ASSEMBLY OF PARTS AND PRODUCT EXCHANGE	9
Assembly Modeling - Graphics and Computing Standards - Open GL Data Exchange standard- IGES, STEP.		
UNIT-III	REVERSE ENGINEERING	
Reverse Engineering- Steps in reverse Engineering. Design for additive manufacturing- CAD model preparation- Model slicing and software's –File formats in AM.		

UNIT-IV	3D PRINTING	9
Fundamentals of Additive and digital Manufacturing- Advantages and Applications- Comparison of Additive Manufacturing with traditional Manufacturing- Additive Manufacturing process chain –Materials used in AM Process – Process and Printing Parameters.		
UNIT –V	ADDITIVE MANUFACTURING PROCESSES	9
Liquid, Solid and Powder Based Additive Manufacturing Process - Stereo lithography apparatus - Fused Deposition Modeling - , Laminated Object Manufacturing - Principle, Process, Machine parameters, Process parameters, Materials used, Strength and weakness, Applications.		
Total Contact Hours		: 45

Course Outcomes:

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

- | | |
|--------------------------|--|
| <input type="checkbox"/> | Get familiarized with the computer graphics application in design. |
| <input type="checkbox"/> | Get familiarized with the various data exchange format. |
| <input type="checkbox"/> | Ability to explain the process of transforming a concept / existing product into 3D model used in AM technology. |
| <input type="checkbox"/> | Ability to explain the development of AM technology and how AM technology propagated into various businesses. |
| <input type="checkbox"/> | Ability to explain the Liquid, Solid and Power based AM processes. |

Text Books(s):

- | | |
|---|--|
| 1 | Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007. |
| 2 | Donald Hearn and M. Pauline Baker. “Computer Graphics”, Prentice Hall, Inc., 2012. |
| 3 | Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and |

References:

- | | |
|---|---|
| 1 | William M Neumann and Robert F.Sproull. “Principles of Computer Graphics”, Mc Graw Hill Book Co. Singapore, 2001. |
| 2 | Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003. |
| 3 | Ibrahim Zeid and Subramanian R "CAD/CAM --Theory and Practice" - McGraw Hill, International Edititon, 2009. |
| 4 | Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press.,United States, 2015. |
| 5 | Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser |

Lab Experiments

1. Introduction to 3d geometric modelling
2. Exercise on extrude command
3. Exercise on revolve command
4. Exercise on edit (cut, fillet etc.)
5. Exercise on creating bracket
6. Slicing software in additive manufacturing process
7. 3d printing by various layer height
8. 3d printing by varying infill pattern
9. 3d printing by varying infill density
10. 3d printing by varying orientation

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-“

Subject Code	Subject Name	PC	L	T	P	C
CD19P10	FOUNDATIONS OF DATA SCIENCE		2	0	2	3

Objectives	
<input type="checkbox"/>	Understand the Evolution and Scope of Data Science:
<input type="checkbox"/>	Master Data Collection and Preprocessing Techniques:
<input type="checkbox"/>	Conduct Exploratory Data Analysis (EDA):
<input type="checkbox"/>	Build and Evaluate Predictive Models:
<input type="checkbox"/>	Address Data Security and Ethical Considerations:

UNIT-I	Introduction	6
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.		
UNIT-II	Data Collection and Data Pre-Processing	6
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.		
UNIT-III	Exploratory Data Analytics	6
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots –Pivot Table – Heat Map – Correlation Statistics – ANOVA.		

CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-“

List of Experiments:

1. Python program to display details about the operating system, working directory, files and directories in the current directory, lists the files and all directories, scan and classify them as directories and files.
2. Python program to convert an array to an array of machine values and vice versa.
3. Python program to get information about the file pertaining to the file mode and to get time values with components using local time and gm time.
4. Python program to connect to Google using socket programming.
5. Python program to perform Array operations using Numpy package.
6. Python program to perform Data Manipulation operations using Pandas package.
7. Python program to display multiple types of charts using Matplotlib package.
8. Python program to perform File Operation on Excel Data Set.
9. Python program to implement with Python Sci Kit-Learn & NLTK.
10. Python program to implement with Python NLTK/Spicy/Py NLPI.

Subject Code	Subject Name	PE	L	T	P	C
CD19P14	WEARABLE APPLICATIONS		2	0	2	3

Objectives:	
<input type="checkbox"/>	To know the hardware requirement of wearable system
<input type="checkbox"/>	To understand the communication and security aspects in the wearable devices
<input type="checkbox"/>	To know the applications of wearable devices in the field of medicine
<input type="checkbox"/>	To understand wearable mechanics
<input type="checkbox"/>	To understand weight shift and work on center of gravity of body mechanics

UNIT-I	INTRODUCTION TO WEARABLE SYSTEMS AND SENSOR	6
Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Impedance plethysmography, Wearable ground reaction force sensor.		
UNIT-II	SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES	6
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles		
UNIT-III	WIRELESS HEALTH SYSTEM	6
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.		
UNIT-IV	SMART TEXTILE	6
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study smart fabric for monitoring biological parameters - ECG, respiration.		
UNIT-V	APPLICATIONS	6
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.		
Total Contact Hours		: 30

LAB EXPERIMENTS

LIST OF EXPERIMENTS:

1. Introduction to Wearable Computing
2. Understanding Components (30 minutes)- Introduce the components that will be used in the exercise (Arduino board, sensors, LEDs/displays, etc.). Explain the role of each component and how they interact to create a wearable computing system.
3. Designing the Prototype (60 minutes)- Divide students into small groups. Task each group with designing a simple wearable computing prototype. Examples could include a step counter, gesture- controlled LED display, or temperature monitoring brace. Encourage creativity in design and functionality while considering the limitations of the components available.
4. Implementing the Prototype. Provide students with the necessary materials and tools. Guide them through the process of connecting sensors, LEDs/displays, and other components to the Arduino board. Assist students in writing the code to read sensor data, process it, and control the output (LEDs/displays). Emphasize the importance of testing and troubleshooting during the implementation phase.
5. Testing and Presentation. Once the prototypes are complete, allow each group to test their wearable computing device. Encourage students to observe how their device performs under different conditions and identify any potential improvements. Each group presents their prototype to the class, explaining its design, functionality, and potential applications.
6. Discussion and Reflection. Lead a discussion on the challenges faced during the design and implementation process. Reflect on the potential real-world applications of wearable computing and its impact on various industries. Encourage students to share their insights and ideas for future development in the field.

Contact Hours: 30

Total Contact Hours : 45

Text Books(s):	
1	Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
2	Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

Course Outcomes:	
On completion of the course, the students will be able to	
<input type="checkbox"/>	Describe the concepts of wearable system.
<input type="checkbox"/>	Explain the energy harvestings in wearable device.
<input type="checkbox"/>	Use the concepts of BAN in health care
<input type="checkbox"/>	Illustrate the concept of smart textile
<input type="checkbox"/>	Compare the various wearable devices in healthcare system

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

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

If there is no correlation, put “-“

Subject Code	Subject Name		L	T	P	C
CD19P14	Introduction to Motion Graphics	PC	2	0	2	3

Objectives:

•	To become visually literate, including competence with the non-verbal languages of art and design.
•	To develop visual, verbal, and written responses to visual phenomena, and organize perception and conceptualizations both rationally and intuitively.
•	To learn the basic principles of storyboarding and project mapping.
•	To educate the concept of tracking.
•	To understand the usage of 3D in live action

UNIT-I	INTRODUCTION TO GRAPHICS	6
General principles of motion graphics, - Different software's used for motion graphics, Photoshop, Final cut pro, Premier Pro, After effects, Combustion, Nuke. - Create Pipeline for production. - Exercise for each software differently. - Creating a story board		
UNIT-II	KEYING, ROTO AND TRACKING	6
Blue and Green Screens – Keyers for Compositing – Create Masks – Tracking and Stabilizing a Shot – Time warp - Rotoscopy – Colour Grading – Mattes – Scene Salvage.		
UNIT-III	GRADING	6
Working with RGB, colour waveform, colour histogram, Curves Understanding the alpha value, Colour grading of Computer generated objects, Adding the lights and shadow Matching light space and adjusting for brightness and colour Mask the region Working with layer and node based software's.		
UNIT-IV	3D GRAPHICS	6
Camera tracking in different software's - Combining of graphics elements into the live action Create and modify 3D objects, Importing 3D materials to various software, Create a 3D title		
UNIT-V	AUDIO	6
Understanding audio properties, Working with different levels of audio, Different type of audio formats, Working with multi track audio, Rendering the final mix down audio, Lip sync with the visual, Export the final output.		
Total Contact Hours		: 30

Lab Experiments

1. To implement Line, Circle and ellipse Attributes
2. To implement line drawing algorithms DDA line algorithm, Bresenham's line algorithm
3. To perform 2D and 3D transformations
4. To perform animation using any Animation software (Create Frame by Frame Animations using multimedia authoring tools)
5. To perform basic operations on image using any image editing software
6. To develop a presentation for a product using techniques like Guide Layer, masking and onion Skin using authoring tools.
7. To create a Jpeg image that demonstrates the various features of an Image editing tool.

Course Outcomes:

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

- Students will able to shoot the graphics video on their own.
- understand the concept of grading.

•	assemble the green /blue mate footage.
•	work with the 3D environment digitally.
•	understand the concept of rendering.

Text Books(s):	
1	Blazer L. Animated storytelling: Simple steps for creating animation and motion graphics. Peachpit Press; 2015.
2	Ian Crook, Peter Beare, Motion Graphics: Principles and Practices from the Ground Up, Bloomsbury Publishing, 2017.

Reference Book(s) / Web link(s):	
1	Jackson C. After Effects for Designers: Graphic and Interactive Design in Motion. Focal Press; 2018.
2	Jon Krasner, Motion Graphic Design: Applied History and Aesthetics Focal press, 2013.

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-“

Subject Code	Subject Name		L	T	P	C
CD19P06	Spatial Computing	PC	2	0	2	3

Objectives:	
•	Understand the theoretical foundations of spatial computing.
•	Develop proficiency in spatial data structures and algorithms.

•	Explore various applications of spatial computing in diverse domains.
•	Gain hands-on experience in building spatial computing applications.
•	Critically evaluate the societal implications and ethical considerations of spatial computing technologies.

UNIT-I	INTRODUCTION TO SPATIAL COMPUTING	6
Overview of spatial computing concepts and applications-Historical context and evolution of spatial computing-Importance of spatial data in modern computing Spatial indexing techniques (e.g., Quadtree, Rtree)-Voronoi diagrams and Delaunay triangulations-Spatial hashing and grid-based methods.		
UNIT-II	SPATIAL ALGORITHMS	6
Point-in-polygon testing and spatial queries-Nearest neighbor search-Line intersection and polygon clipping algorithms Geographic Information Systems (GIS) Introduction to GIS and its components-Spatial analysis techniques (buffering, overlay, proximity analysis)-GIS data formats and standards		
UNIT-III	AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)	6
Principles of AR and VR systems-Spatial tracking techniques (marker-based, markerless, SLAM)-Building AR/VR applications with spatial computing Applications of Spatial Computing Urban planning and smart cities-Location-based services (navigation, geocoding)-Environmental monitoring and natural resource management		
UNIT-IV	ETHICAL AND SOCIETAL IMPLICATIONS	6
Privacy concerns in spatial computing-Bias and fairness in spatial data analysis-Regulation and policy considerations		
UNIT-V	PROJECT PRESENTATIONS AND WRAP-UP	6
Students present their spatial computing projects-Reflection on course learnings and future directions		
Total Contact Hours		: 30

Lab Experiments

1. Introduction to Spatial Data Handling, Introduction to GIS software (e.g., QGIS, ArcGIS) Importing and displaying spatial data layers Basic spatial operations (e.g., buffer, clip) Lab Exercise: Create a simple map using provided spatial data layers
2. Spatial Data Models and Structures Understanding vector and raster data models Introduction to spatial data formats (e.g., Shapefile, GeoTIF Lab Exercise: Convert between vector and raster data formats
3. Spatial Queries and Analysis Performing spatial queries (e.g., point-in-polygon) Spatial analysis techniques (e.g., proximity analysis) Lab Exercise: Analyze spatial relationships between different features
4. Spatial Databases Introduction to spatial database management systems (e.g., PostgreSQL/PostGIS) Creating spatial databases and table Lab Exercise: Store and query spatial data in a spatial database
5. Geospatial Visualization Techniques for visualizing spatial data (e.g., choropleth maps, heatmaps) Customizing map symbology and layout Lab Exercise: Create thematic maps to visualize spatial patterns.
6. Spatial Statistics Introduction to spatial statistics concepts (e.g., spatial autocorrelation) Performing basic spatial statistical analysis Lab Exercise: Calculate and interpret spatial statistics for given datasets.
7. Web Mapping and GIS Services Introduction to web mapping frameworks (e.g., Leaflet, OpenLayers) Consuming GIS services (e.g., WMS, WFS) Lab Exercise: Develop a simple web map application using provided GIS services.
8. Spatial Programming Introduction to spatial libraries in programming languages (e.g., GeoPandas in Python) Writing scripts for spatial data processing and analysis Lab Exercise: Implement spatial analysis algorithms using programming

Course Outcomes:	
On completion of the course, the students will be able to	
•	Students will be able to understand spatial computing
•	understand the concept of spatial data and computing
•	Understand various applications in spatial domain
•	work with spatial applications
•	understand the concept of AR VR

Text Books(s):	
1	Spatial Computing: An Introduction" by Michael Worboys and Matt Duckham, 2016
2	Matt Duckham," Decentralized Spatial Computing: Foundations of Geosensor", 2018

Reference Book(s) / Web link(s):	
1	Erin Pangalin" Creating Augmented and Virtual Realities: Theory and applications, Wiley, 2018
2	Robin Lovalece, "Geocomputation with R", Wiley 2019

CO - PO – PSO matrices of course

CO vs PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO1	3	3	3	2	2	1	3	2	1	2	3	1	1
CO2	3	3	2	1	3	3	3	2	2	1	3	1	1
CO3	3	3	3	3	3	3	3	3	3	3	3	1	1
CO4	3	3	1	2	2	2	3	3	2	2	3	1	1
CO5	3	3	1	2	2	2	3	3	2	1	3	1	1
Target	1	2.2	2	1.8	2.4	1.6	2.4	2.6	2.4	1.6	1.8	1	2

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

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

If there is no correlation, put “-“