B.Tech. (Information Technology)

2022 Regulations, Curriculum & Syllabi

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University – Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

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CONTENTS

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Apply technical, analytical, and creative thinking skills to understand and meet the needs of industry, academia, and research.

II. Excel in leadership, teamspirit, and entrepreneurship skills to provide effective, user-friendly, and innovative solutions to real-world problems.

III. Practice work ethics with social and environmental responsibility to address the complex engineering and societally relevant problems.

IV. Pursue lifelong learning for professional development, use cutting-edge technologies, and involve in applied research to design optimal solutions.

PROGRAMME OUTCOMES (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
f. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
k. 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.

l. 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.

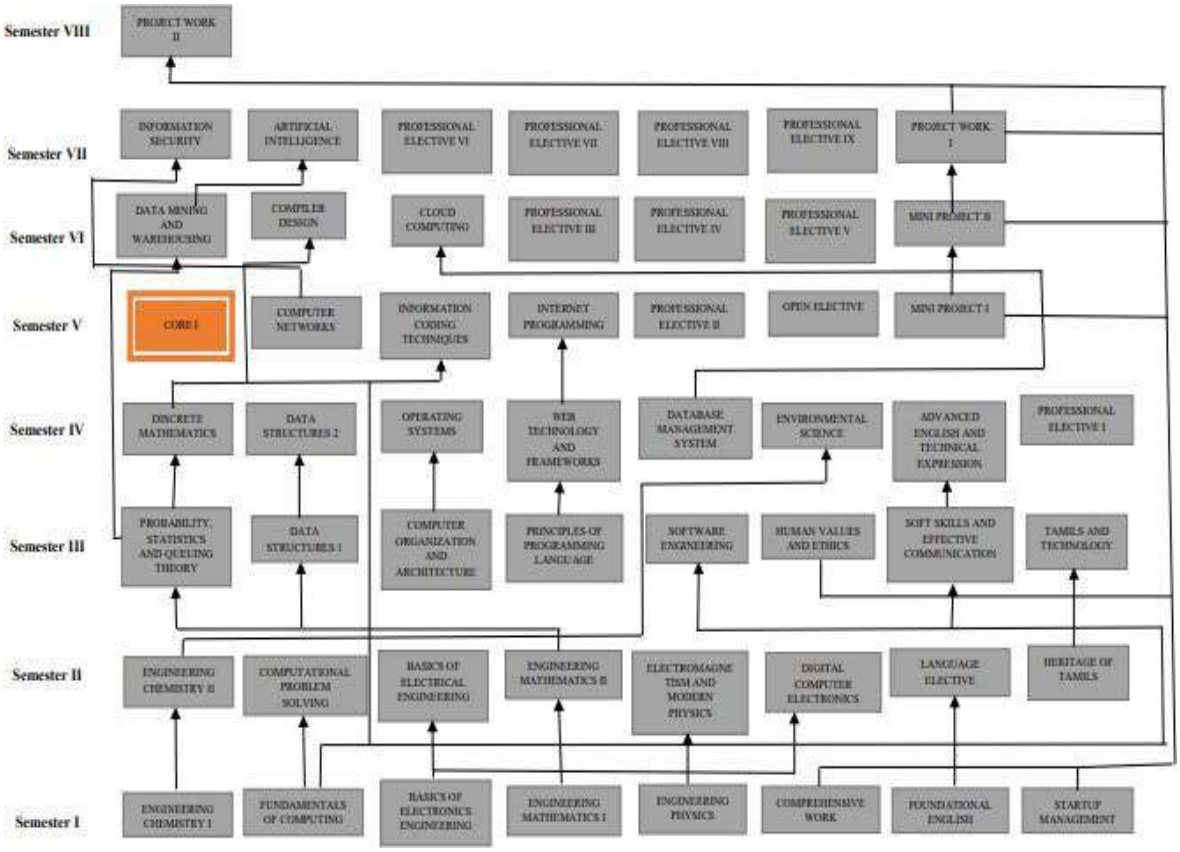
PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

MAPPING OF PEOs AND POs

PEO(s)	Programme Outcomes(s)											
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
I	X	X	X	X	X	X				X		
II		X	X	X		X		X		X	X	X
III			X		X	X	X		X		X	X
IV	X	X			X	X		X		X		X

Connectivity Chart



DEPARTMENT OF INFORMATION TECHNOLOGY
Minimum Credits to be Earned : 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ES	Total	
22MA101	Engineering Mathematics I	3	1	0	4	4	40	60	100	BS
22PH102	Engineering Physics	2	0	2	3	4	50	50	100	BS
22CH103	Engineering Chemistry I	2	0	2	3	4	50	50	100	BS
22GE001	Fundamentals of Computing	3	0	0	3	3	40	60	100	ES
22HS001	Foundational English	1	0	2	2	3	100	0	100	HSS
22GE004	Basics of Electronics Engineering	2	0	2	3	4	50	50	100	ES
22HS002	Startup Management	1	0	2	2	3	100	0	100	EEC
22IS108	Comprehensive Work	0	0	2	1	2	100	0	100	EEC
Total		**14**	**1**	**12**	**21**	**27**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ES	Total	
22MA201	Engineering Mathematics II	3	1	0	4	4	40	60	100	BS
22PH202	Electromagnetism and Modern Physics	2	0	2	3	4	50	50	100	BS
22CH203	Engineering Chemistry II	2	0	2	3	4	50	50	100	BS
22GE002	Computational Problem Solving	3	0	0	3	3	40	60	100	ES
22GE003	Basics of Electrical Engineering	2	0	2	3	4	50	50	100	ES
22IT206	Digital Computer Electronics	3	0	2	4	5	50	50	100	ES
	Language Elective	1	0	2	2	3	100	0	100	HSS
22HS003	தமிழர் மரபு / Heritage of Tamils	0	0	2	1	2	100	0	100	HSS
Total		**16**	**1**	**12**	**23**	**29**	-	-	-	-

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT301	Probability, Statistics and Queuing Theory	3	1	0	4	4	40	60	100	ES
22IT302	Data Structures I	3	0	2	4	5	50	50	100	ES
22IT303	Computer Organization and Architecture	3	0	0	3	3	40	60	100	PC
22IT304	Principles of Programming Languages	3	0	2	4	5	50	50	100	PC
22IT305	Software Engineering	3	0	0	3	3	40	60	100	PC
22HS004	Human Values and Ethics	2	0	0	2	2	100	0	100	HSS
22HS005	Soft Skills and Effective Communication	0	0	2	1	2	100	0	100	EEC
22HS006	தமிழும் தொழில்நுட்பமும் / Tamils and Technology	0	0	2	1	2	100	0	100	EEC
Total		**17**	**1**	**8**	**22**	**26**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT401	Discrete Mathematics	3	1	0	4	4	40	60	100	ES
22IT402	Data Structures II	3	0	2	4	5	50	50	100	PC
22IT403	Operating Systems	3	1	0	4	4	40	60	100	PC
22IT404	Web Technology and Frameworks	2	0	2	3	4	50	50	100	PC
22IT405	Database Management System	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	3	0	0	3	3	40	60	100	PE
22HS007	Environmental Sciences	2	0	0	-	2	100	0	100	HSS
22HS008	Advanced English and Technical Expression	0	0	2	1	2	100	0	100	EEC
Total		**19**	**2**	**8**	**23**	**29**				-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT501	Principles of Communication	3	0	0	3	3	40	60	100	PC
22IT502	Computer Networks	3	0	2	4	5	50	50	100	PC
22IT503	Information Coding Techniques	3	1	0	4	4	40	60	100	PC
22IT504	Object Oriented Programming With cpp And Java	2	0	2	3	4	50	50	100	PC
	Professional Elective II	3	0	0	3	3	40	60	100	PE
	Open Elective	3	0	0	3	3	40	60	100	PE
22IT507	Mini Project I	0	0	2	1	2	100	0	100	EEC
Total		**17**	**1**	**6**	**21**	**24**	-	-	-	-
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT601	Data Mining and Warehousing	3	0	2	4	5	50	50	100	PC
22IT602	Compiler Design	3	1	0	4	4	40	60	100	PC
22IT603	Cloud Computing	3	0	2	4	5	50	50	100	PC
	Professional Elective III	3	0	0	3	3	40	60	100	PE
	Professional Elective IV	3	0	0	3	3	40	60	100	PE
	Professional Elective V	3	0	0	3	3	40	60	100	PE
22IT607	Mini Project II	0	0	2	1	2	100	0	100	EEC
Total		**18**	**1**	**6**	**22**	**25**	-	-	-	-

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT701	Information Security	3	0	0	3	3	40	60	100	PC
22IT702	Artificial Intelligence	3	0	2	4	5	50	50	100	PC
	Professional Elective VI	3	0	0	3	3	40	60	100	PE
	Professional Elective VII	3	0	0	3	3	40	60	100	PE
	Professional Elective VIII	3	0	0	3	3	40	60	100	PE
	Professional Elective IX	3	0	0	3	3	40	60	100	PE
22IT707	Project Work I	0	0	4	2	4	50	50	100	EEC
Total		**18**	**0**	**6**	**21**	**24**	-	-	-	-
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
22IT801	Project Work II	0	0	20	10	20	50	50	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	-

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
18HSC01	CHINESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS

ELECTIVES										
PROFESSIONAL ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
VERTICAL 1 - DATA SCIENCE										
22IT001/ 22ITH01	EXPLORATORY DATA ANALYSIS	3	0	0	3	3	40	60	100	PE
22IT002/ 22ITH02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003 / 22ITH03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004 / 22ITH04	NEURAL NETWORKS AND DEEP LEARNING	3	0	0	3	3	40	60	100	PE
22IT005/ 22ITH05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
22IT006 / 22ITH06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	3	40	60	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DEVOPS	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE
22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	3	40	60	100	PE

22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE

VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	3	40	60	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY/VIRTUAL REALITY	2	0	2	3	3	40	60	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	3	40	60	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	3	40	60	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT033	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
22IT034	IOT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT035	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	3	40	60	100	PE
VERTICAL VII- DIVERSIFIED COURSES										
22IT036	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE

22IT037	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT039	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT040	HUMAN COMPUTER INTERACATION	3	0	0	3	3	40	60	100	PE
22IT041	E-COMMERCE	3	0	0	3	3	40	60	100	PE

22MA101 ENGINEERING MATHEMATICS I 3 1 0 4

Course Objectives

To impart mathematical modeling to describe and explore real-world phenomena and data.
To provide basic understanding on Linear, quadratic, power and polynomial, exponential, and multi variable models
Summarize and apply the methodologies involved in framing the real-world problems related to fundamental principles of polynomial equations

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Implement the concepts of mathematical modeling based on linear functions in Engineering.
2. Formulate the real-world problems as a quadratic function model
3. Demonstrate the real-world phenomena and data into Power and Polynomial functions
4. Apply the concept of mathematical modeling of exponential functions in Engineering
5. Develop the identification of multivariable functions in the physical dynamical problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	1	1												

UNIT I **9 Hours**

MATHEMATICS MODELING OF LINEAR FUNCTIONS

The geometry of linear equations - Formation of linear equations: Method of least squares and method of regression - Vector spaces: Basic concepts with examples - Linear combination - Eigen values and vectors

UNIT II **9 Hours**

MATHEMATICAL MODELING OF QUADRATIC FUNCTIONS

General form of a quadratic function - Basic relationships between the equation and graph of a quadratic function - Sum of squares error and the quadratic function of best fit - Quadratic forms: Matrix form - Orhtogonality - Canonical form and its nature

UNIT III **9 Hours**

MATHEMATICAL MODELING OF POWER AND POLYNOMIAL FUNCTIONS

Characteristics of the graphs of power and polynomial functions - Fitting of power and polynomial functions using the method of least squares - Local maxima and local minima of power and polynomial functions - Power series of functions with real variables, Taylors series, radius and interval of convergence - Tests of convergence for series of positive terms - comparison test, ratio test

UNIT IV **9 Hours**

MATHEMATICAL MODELING OF EXPONENTIAL FUNCTIONS

Concept of exponential growth - Graphs of exponential functions - Relationship between the growth factor and exponential growth or decline - Exponential equations have a variable as an exponent and take the form y= abx through least square approximation - Calculus of exponential functions - Exponential series - Characteristics

UNIT V **9 Hours**

MATHEMATICAL MODELING OF MULTIVARIABLE FUNCTIONS

Graphing of functions of two variables -Partial derivatives - Total derivatives - Jacobians - Optimization of multivariable functions with constraints - Optimization of multivariable functions without constraints

Total: 60 Hours

Reference(s)

1. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016
2. B. S. Grewal, Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, Khanna, 2014
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics ,Sultan Chand & Sons2020
4. Thomas and Finney, Calculus and analytic Geometry, Fourteenth Edition, By Pearson Paperback, 2018

22PH102 ENGINEERING PHYSICS 2 0 2 3

Course Objectives

Understand the concept and principle of energy possessed by mechanical system
Exemplify the propagation and exchange of energy
Identify the properties of materials based on the energy possession

Programme Outcomes (POs)

Course Outcomes (COs)

1. Illustrate the concept and principles of energy to understand mechanical systems
2. Exemplify the types of mechanical oscillations based on vibrational energy
3. Infer the concept of propagation of energy as transverse and longitudinal waves
4. Analyze the exchange of energy and work between the systems using thermodynamic principles
5. Apply the concept of energy and entropy to understand the mechanical properties of materials

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1							2					
4	2	1							2					
5	2	1							2					

UNIT I **6 Hours**

CONSERVATION OF ENERGY

Concept of energy - types of energy-conservation of energy. Mechanical energy: - translation - rotation - vibration - Kinetic and potential energies - conservation - work and energy - laws of motion - minimization of potential energy - equilibrium - dissipative systems - friction

UNIT II **5 Hours**

VIBRATIONAL ENERGY

Periodic Motion - Simple Harmonic Motion - Energy of the SHM - Pendulum types - Damped oscillations - forced oscillations - natural frequency - resonance

UNIT III **6 Hours**

PROPAGATION OF ENERGY

Transfer of energy - material medium - Transverse wave - Longitudinal wave - standing wave - interference - Doppler effect. Sound waves and its types - characteristics - human voicere - reflection - refraction-beats

UNIT IV **7 Hours**

EXCHANGE OF ENERGY

Energy in transit - heat - Temperature - measurement - specific heat capacity and water - thermal expansion - Heat transfer processes Thermodynamics: Thermodynamic systems and processes - Laws of thermodynamics - Entropy - entropy on a microscopic scale -maximization of entropy

UNIT V **6 Hours**

ENERGY IN MATERIALS

Elastic energy - Structure and bonding - Stress - strain - Tension and compression - elastic limit - Elastic Modulus - Stress - strain diagram - ductility - brittleness - rubber elasticity and entropy

1 **5 Hours**

EXPERIMENT 1

Determination of resultant of system of concurrent coplanar forces-Parallelogram law of forces

2 **5 Hours**

EXPERIMENT 2

Determination of moment of inertia-Torsional pendulum

3 **5 Hours**

EXPERIMENT 3

Determination of thickness of a thin wire using interference of light-Air wedge method

4 **4 Hours**

EXPERIMENT 4

Determination of ac frequency using Meldes apparatus

5 **3 Hours**

EXPERIMENT 5

Determination of thermal conductivity of a bad conductor using Lees disc method

6 **4 Hours**

EXPERIMENT 6

wavelength of ultrasonics in a liquid medium
(ii) velocity of ultrasonic waves in the given liquid
(iii) compressibility of the given liquid using ultrasonic interferometer

7 **4 Hours**

EXPERIMENT 7

Determination of Youngs modulus of a given material- Non uniform bending method

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part I: Classical Mechanics and Thermodynamics, Cognella Academic Publishing, 2019.
2. 2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. 3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. 4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. 5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH103 ENGINEERING CHEMISTRY I 2 0 2 3

Course Objectives

Understand the origin of elements from the universe
Outline the properties of elements in the periodic table
Analyse the different types of bond formed during chemical reactions and its reaction thermodynamics
Summarize different states of matter based on atomic arrangement

Programme Outcomes (POs)
Course Outcomes (COs)

1. Understand nuclear transmutation reactions that lead to the formation of elements in the universe
2. Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
3. Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
4. Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
5. Analyse whether the given matter is a solid, liquid, gas, or plasma and interpret the arrangement of atoms

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

UNIT I **5 Hours**

ORIGIN OF ELEMENTS

Hydrogen - Elements and Sun - fusion - hypernova - supernova - dying stars - man-made elements

UNIT II **7 Hours**

ATOMIC STRUCTURE AND PERIODICITY

Atomic Structure - Electronic configuration - Periodic Table - Periodic trends in properties of elements - Anomalous behaviour in periodicity

UNIT III **6 Hours**

CHEMICAL BONDING

Octet rule & its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

UNIT IV **6 Hours**

REACTION THERMODYNAMICS

Conservation of energy - Endothermic reactions & exothermic reactions - Exchange of energy involved in chemical reactions

UNIT V **6 Hours**

STATES OF MATTER

Solid - liquid - gas - plasma - arrangement of atoms/ions/molecules in different phases

1 **1 Hours**

EXPERIMENT 1

Lab safety rules and guidelines for students - OSHA Guidelines

2 **3 Hours**

EXPERIMENT 2

Estimation of dissolved oxygen content in water sample(s) by Winkler's method

3 **3 Hours**

EXPERIMENT 3

Estimation of chloride present in the given water sample by argentometric method

4 **3 Hours**

EXPERIMENT 4

Determination of nitrogen content in the given soil sample using kjeldahl method

5 **3 Hours**

EXPERIMENT 5

Conductometric titration of strong acid (HCl) Vs strong base (NaOH)

6 **2 Hours**

EXPERIMENT 6

Preparation of salt of fatty acid by saponification process

7 **3 Hours**

EXPERIMENT 7

Determination of variation in melting point of the given sample(s)

8 **3 Hours**

EXPERIMENT 8

States of matter - Recrystallization of aspirin from water/ethanol

9 **3 Hours**

EXPERIMENT 9

Estimation of magnesium ions in given solution by EDTA method

10 **3 Hours**

EXPERIMENT 10

Determination of Fe(II) in a sample using spectrophotometer

11 **3 Hours**

EXPERIMENT 11

Determination of rate constant of acid catalysed hydrolysis of ester

Total: 60 Hours

Reference(s)

1. Peter Atkins, Physical Chemistry, Oxford university press, 2019
2. Rose Marie Gallagher and Author Paul Ingram, Complete Chemistry Cambridge IGCSE, Oxford university press, 2020
3. P L Soni, Text book of inorganic chemistry, Chand publishers, New Delhi, 2017
4. J.D. Lee, Concise inorganic chemistry, Blackman Science Ltd, France, Wiley-India, 5th edition (Reprint), 2016
5. Gareth Price, Thermodynamics of chemical processes, Oxford university press, 2019
6. D Tabor, Gases, liquids and solids and other states of matter, Oxford University press, 2018

22GE001 FUNDAMENTALS OF COMPUTING 3 0 0 3

Course Objectives

Understand the fundamental digital logics behind computations of computer systems.
Develop simple assembly language programs with respect to arithmetic operations.
Understand the program execution process and basics of software development methodologies.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Interpret the organizational and architectural issues of a digital computer with concepts of various data transfer techniques in digital computers and the I/O interfaces.
3. Analyze programming problems and apply assembly instructions to solve simple problems.
4. Infer the fundamentals of operating system and System programs basics.
5. Apply the software development methodologies to various real life scenarios.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1										
2	3	3	3	1										
3	2	2	2	1										
4	2	2	2	1										
5	2	2	2	1										

UNIT I **8 Hours**

CODES AND COMBINATIONS

Communication using Mores and Braille binary codes - Digitizing letters, numbers and objects using binary codes - Performing simple operations: addition through binary codes.

UNIT II **9 Hours**

COMPUTATION USING COMPUTER

Communication to computing devices through various input sources - Computational operation - its flow, functions and control - communication to output devices - Basic communication protocol.

UNIT III **11 Hours**

ASSEMBLY LANGUAGE PROGRAMMING

Little Man Computing (LMC) Model - Instruction Set - Labels - Calculation -Branching - Input- Output - Loops - Simple programs.

UNIT IV **9 Hours**

OPERATING SYSTEM AND APPLICATION GENERATION

BIOS - Device Drivers - Resources - Scheduler - Applications Generation and Creation - Stages of Compilation - Linkers, Loaders and Libraries.

UNIT V **8 Hours**

SOFTWARE DEVELOPMENT

Phases of application life cycle management - Software Development Methodologies - Web Page development.

Total: 45 Hours

Reference(s)

1. Charles Petzold, "Code: The Hidden Language of Computer Hardware and Software", Microsoft Press books, 2009.
2. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, "Little Man Computer Programming: For The Perplexed From The Ground Up", The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne, Operating System Concepts", 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, "Software Engineering: A Practitioner"s Approach", McGraw Hill International edition, Seventh edition, 2010

22HS001 FOUNDATIONAL ENGLISH 1 0 2 2

Course Objectives

Heighten awareness of grammar in oral and written expression
Improve speaking potential in formal and informal contexts
Improve reading fluency and increased vocabulary
Prowess in interpreting complex texts
Fluency and comprehensibility in self-expression
Develop abilities as critical readers and writers
Improve ability to summarize information from longer text, and distinguish between primary and supporting ideas

Course Outcomes (COs)

1. Express themselves in a professional manner using error-free language
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

UNIT I **15 Hours**

UNIT 1 - SELF-EXPRESSION

Lesson Plan 1: Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)-Subject Verb Concord-Tenses-Common Errors in verbal communication Be-verbs-

Lesson Plan 2: Self-Introduction-Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions-Paralinguistic/Vocalics- Body Language- Appearance-Eye Contact-Artefacts Lesson Plan 3: Self-Introduction-Powerful openings and closings at the interview-Effective stock phrases - Modified for spontaneity and individuality-Question tags, framing questions including WH- questions-Prepositions-Listening to Ted talks-Listening for specific information

UNIT II **15 Hours**

UNIT 2 - CREATIVE EXPRESSION

Lesson Plan 4: Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One word substitution-Adjectives-Similes, Metaphors, Imagery & Idioms -Link words Inclusive language

Lesson Plan 5: Narrative Expression- Travelogue and Minutes of Meeting -Verbal analogy-Sequence & Time order words Jumbled paragraph, sentences, Sequencing-Text & Paragraph completion-Past tense - Using quotation marks

UNIT III **15 Hours**

UNIT 3 - FORMAL EXPRESSION

Lesson Plan 6: Formal Letters and Emails-Writing: E-mails and Letters of apology, Requisition and Explanation, and Letters to newspapers-Speaking: Tendering verbal apologies, and explanations, persuading a listener/ audience-Hierarchy in Business correspondence- Subject of a mail, Header, Body

(Salutation) and Footer of a mail. Conjunctional clause Punctuation-Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs

Lesson Plan 7: Precision in comprehension, Summary writing, Selective summary-Reading: Active reading- short paragraphs, excerpts, articles and editorials-Skimming and Scanning Reading comprehension & analysis- Tenses, QP/ PQ approach. Identifying the central themes/ crux-Interpreting tone - formal/informal/semi-formal-Note-taking-Listening: Listening for data, for specific information, for opinion-Active and passive Listening-Transcription-Paraphrasing and summarising information-Agreeing & disagreeing-Note-taking-Writing: Summary writing, selective summary, paraphrasing, note-making, opinion pieces-Finding synonyms in the context Paraphrasing-Sentence Transformation - simple, compound, complex. Sentence substitution-Sentence completion- Interpreting paragraphs

Total: 45 Hours

Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking Foundation Books, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010
4. Reynolds, John. Cambridge IGCSEÃ‚Â® First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22GE004 BASICS OF ELECTRONICS ENGINEERING 2 0 2 3

Course Objectives

To Understand the concept of energy transmission through mechanical, electrical and electromagnetic form.
To Analyze the use of PN Junction Diode and BJT for signal conditioning.
To apply the working principle of PN Junction Diode and BJT for the design of basic Digital Logic.
To analyze the working and characteristics of Special Purpose Semiconductor Electronic Devices.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.

Course Outcomes (COs)

1. Understand the need for electrical and electromagnetic signal transmission.
2. Analyze the working principle and characteristics of PN junction diode.
3. Analyze the working principle and characteristics of Bipolar Junction Transistor.
4. Apply the working principle of PN Junction diode and BJT for designing basic Digital Logic functions.
5. Analyze the energy conversion needs and working principle of Special purpose electronic devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2										
2	3	2	3											
3	2	3	3											
4	2	3	3	3										
5	1	2	3	2										

UNIT I **6 Hours**

ENERGY TRANSFER AND SIGNALS

Energy Transmission through Mechanical, Electrical and Electromagnetic means, Signal as Energy Transmission, Complexity in signal transmission (Volume of Information, Distance and Time taken), Limitations of Mechanical Energy Transmission, Electrical and Electromagnetic Signal Transmission, Need for Conversion between Electrical and Mechanical Signals.

UNIT II **8 Hours**

SIGNAL CONDITIONING USING DIODE

Need for Vacuum Tubes in the Evolution of Electronics, Overview of Vacuum Tubes, Diode and Triode, Limitations of Vacuum Tubes. Semiconductor Group in Periodic Table, Overview of Semiconductor Materials, Flow of electrical energy through PN Junction Diode, Signal Clipping, Signal Clamping and Signal Multiplication using PN Junction Diode, Limitations of PN Junction Diode.

UNIT III **6 Hours**

SIGNAL CONDITIONING USING TRANSISTOR

Need for controlling electrical signals, Principle of Bipolar Junction Transistor operation, Signal Switching and Amplification using BJT, Limitations of BJT, Principle of Field Effect Transistor operation.

UNIT IV **6 Hours**

LOGIC SYNTHESIS USING DIODE AND TRANSISTORS

Overview of Logic Gates, PN Junction and BJT as electronic switches, Digital Logic Synthesis using Diode and Transistor: Diode Logic, Resistor Transistor Logic, Diode Transistor Logic, Transistor Logic.

UNIT V **4 Hours**

DEVICES FOR SPECIAL REQUIREMENTS

Voltage Regulation using Zener Diode, Variable Capacitance using Varactor Diode, Electrical Energy to Light Energy conversion using Light Emitting Diode, Light to Energy to Electrical Energy conversion using Solar Cell.

1 **4 Hours**

EXPERIMENT 1

Design and Implement a simple device to communicate basic information between two different small distance points
using wired and wireless methods.

2 **6 Hours**

EXPERIMENT 2

Design and Implement different wave shaping Circuits using PN Junction Diodes.

3 **4 Hours**

EXPERIMENT 3

Design and Implement Voltage Multiplier Circuit using PN Junction Diodes and Capacitors.

4 **4 Hours**

EXPERIMENT 4

Design and Implement t a three Stage Circuit to convert 220V 50Hz AC mains supply to 12V DC supply.

5 **4 Hours**

EXPERIMENT 5

Design and Implement a BJT Amplifier Circuit to amplify audio input signal.

6 **4 Hours**

EXPERIMENT 6

Design and Implement Basic Logic Gates using PN Junction Diodes.

7 **4 Hours**

EXPERIMENT 7

Design and Implement Basic Logic Gates using BJTs.

Total: 60 Hours

Reference(s)

1. Thomas L. Floyd ,Electronic Devices: Electron Flow Version, Ninth Edition, Prentice Hall, 2012.
2. J Millman, C. Halkias & Satyabrata JIT, Electronic Devices and Circuits, Tata McGraw-Hill, 2007.
3. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education 2006.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2003.
5. Adel S. Sedra & Kenneth C. Smith, Micro Electronic Circuits Theory and Applications, Sixth Edition, Oxford University Press, 2013.
6. Behzad Razavi, Microelectronics, Wiley India Pvt. Ltd.; 2nd edition (2018)

22HS002 STARTUP MANAGEMENT 1 0 2 2

Course Objectives

Promote entrepreneurial spirit and motivate to build startups
Provide insights on markets and the dynamics of buyer behaviour
Train to develop prototypes and refine them to a viable market offering
Support in developing marketing strategies and financial outlay
Enable to scale up the porotypes to commercial market offering

Programme Outcomes (POs)

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. 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.

Course Outcomes (COs)

1. Generate valid and feasible business ideas
2. Create Business Model Canvas and formulate positioning statement
3. Invent prototypes that fulfills an unmet market need
4. Formulate business strategies and create pitch decks
5. Choose appropriate strategies for commercialization

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	2				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I **3 Hours**

BUSINESS MODELS AND IDEATION

Startups: Introduction, Types of Business Modes for Startups. Ideation: Sources of Ideas, Assessing Ideas, Validating Ideas, Tools for validating ideas, Role of Innovation and Design Thinking

UNIT II **3 Hours**

UNDERSTANDING CUSTOMERS

Buyer Decision Process, Buyer Behaviour, Building Buyer Personas, Segmenting, Targeting and Positioning, Value Proposition (Business Model Canvas), Information Sourcing on Markets, Customer Validation

UNIT III **3 Hours**

DEVELOPING PROTOTYPES

Prototyping: Methods-Paper and Digital, Customer Involvement in Prototyping, Product Design Sprints, Refining Prototypes

UNIT IV **3 Hours**

BUSINESS STRATEGIES AND PITCHING

Design of Marketing Strategies and Campaigns, Go-To-Market Strategy, Financial KPIs Financial Planning and Budgeting, Assessing Funding Alternatives, Pitching, Preparing Pitch Decks

UNIT V **3 Hours**

COMMERCIALIZATION

Implementation: Prototype to Commercialization, Test Markets, Institutional Support, Registration Process, IP Laws and Protection, Legal Requirements, Type of Ownership, Building and Managing Teams, Defining role of investors

1 **1 Hours**

EXPERIMENT 1

Analysis of various business sectors

2 **2 Hours**

EXPERIMENT 2

Developing a Design Thinking Output Chart

3 **1 Hours**

EXPERIMENT 3

Creating Buyer Personas

4 **3 Hours**

EXPERIMENT 4

Undertake Market Study to understand market needs and assess market potential

5 **2 Hours**

EXPERIMENT 5

Preparation of Business Model Canvas

6 **15 Hours**

EXPERIMENT 6

Developing Prototypes

7 **2 Hours**

EXPERIMENT 7

Organizing Product Design Sprints

8 **2 Hours**

EXPERIMENT 8

Preparation of Business Plans

9 **2 Hours**

EXPERIMENT 9

Preparation of Pitch Decks

Total: 45 Hours

Reference(s)

1. Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India, 2020
3. Ronnie Screwvala, Dream with Your Eyes Open: An Entrepreneurial Journey, Rupa Publications, 2015
4. Stephen Carter, The Seed Tree: Money Management and Wealth Building Lessons for Teens, Seed Tree Group, 2021
5. Kotler Philip, Marketing Management, Pearson Education India, 15th Edition
6. Elizabeth Verkey and Jithin Saji Isaac, Intellectual Property, Eastern Book Company, 2nd Edition, 2021

22MA201 ENGINEERING MATHEMATICS II 3 1 0 4

Course Objectives

To impart and analyze the concepts of differential equations to describe in real-world phenomena
To provide basic understanding on differential equation models and vector field models
Summarize and apply the methodologies involved in framing the real world problems related to fundamental principles of complex functions

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering

Course Outcomes (COs)

1. Interpret the concept of differential equations through mathematical modeling and analyze its applications in engineering
2. Formulate the real world problems as second order linear differential equations and give solutions for the same
3. Demonstrate the real-world phenomena with magnitude and direction in the form of vector functions
4. Apply the concept of vector fields and line integrals through mathematical modeling in engineering
5. Determine complex functions and apply them to formulate problems arising in engineering

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3												
2	2	3												
3	2	3												
4	3	3												
5	1	3												

UNIT I **9 Hours**

FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II **9 Hours**

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

Methods of solving second order linear ordinary differential equations -Models for linear oscillators: Simple harmonic motion - Mechanical vibrations with and without damping - Electric circuit system: RLC circuits

UNIT III **9 Hours**

VECTOR DIFFERENTIAL CALCULUS

Vector and scalar functions - Fields - Derivative of vector function and geometrical interpretation- Velocity and acceleration - Gradient and its properties- Tangent and normal vectors - Directional derivative- Divergence of a vector field - Curl of a vector field - Projectile motion

UNIT IV **9 Hours**

VECTOR INTEGRAL CALCULUS

Line integrals of vector point functions - Surface integral of vector point functions - Applications of line and surface integrals - Greens theorem in a plane - Stokes theorem - Gauss divergence theorem

UNIT V **9 Hours**

COMPLEX FUNCTIONS

Basic concepts of Complex numbers Geometrical representation of complex number - Analytic functions and its properties - Construction of Analytic functions: Fluid flow Electric flow - Mapping of complex functions

Total: 60 Hours

Reference(s)

1. Richard E. Williamson, Introduction to Differential Equations and Dynamical Systems, McGraw Hill Companies. Inc, 1997
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass Thomas Calculus, 13/e, Pearson Publishers, 2013
4. Erwin Kreyszig, Advanced Engineering Mathematics Wiley, 10th editi5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017on ,2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

22PH202 ELECTROMAGNETISM AND MODERN PHYSICS

2 0 2 3

Course Objectives

Understand the principles and mechanisms of electricity and magnetism
Infer the classification of electromagnetic waves
Analyze the theory of relativity and energy bands

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Understand the principles and mechanism of electrostatics and current
2. Illustrate the principles and mechanism of magneto statics
3. Classify electromagnetic waves and infer the characteristics of visible light
4. Outline the importance of theory of relativity and analyze the wave nature of particles
5. Exemplify the electrical properties of semiconductor based on the band theory

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1							2					
4	2	1												
5	2	1							2					

UNIT I **6 Hours**

ELECTRICITY

Electric monopoles - Electric field- Electric flux - Electric potential - electrical energy- capacitor- conductors and insulators-Electric dipole and polarization - electric current -voltage sources- resistance

UNIT II **6 Hours**

MAGNETISM

Sources of magnetism- monopoles-magnetic field and force-magnetic field and current distribution- magnetic dipole-magnetic potential energy-inductor- electric and magnetic field comparison

UNIT III **6 Hours**

ELECTROMAGNETIC WAVES AND LIGHT

Electromagnetism: basic laws-electromagnetic energy-radiation. Electromagnetic waves: origin, nature and spectrum-visible light
Principle of least time- geometrical optics-Human eye - Diffraction - Interference - polarization-LASER

UNIT IV **6 Hours**

MODERN PHYSICS

Special theory of relativity - simultaneity and time dilation - length contraction - relativistic mass variation. Matter waves - de-Broglie hypothesis - wave nature of particles

UNIT V **6 Hours**

ENERGY BANDS IN SOLIDS

Band theory of solids - classification of materials - semiconductors - direct and indirect semiconductor - fermi energy -Intrinsic and extrinsic semiconductor - carrier concentration - electrical conductivity

1 **5 Hours**

EXPERIMENT 1

Determination of V-I characteristics of a solar cell

2 **5 Hours**

EXPERIMENT 2

Determination of Hall voltage of a given specimen by Hall Effect method

3 **5 Hours**

EXPERIMENT 3

Determination of wavelength of a given laser source - Grating method

4 **4 Hours**

EXPERIMENT 4

Determination of particle size using diode laser

5 **3 Hours**

EXPERIMENT 5

Determination of refractive index of a given solid medium and liquid medium

6 **4 Hours**

EXPERIMENT 6

Determination of energy loss per cycle of a ferromagnetic material using hysteresis curve

7 **4 Hours**

EXPERIMENT 7

Determination of band gap energy of a given semiconducting material

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part II: Electricity and Magnetism, Cognella Academic Publishing, 2019
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH203 ENGINEERING CHEMISTRY II 2 0 2 3

Course Objectives

Understand the concept of electrochemistry for determination of electrode potential, pH and applications as energy storage devices
Outline the chemistry of metal corrosion and analyze the methods of corrosion control
Understand how catalyst increases the reaction rate
Summarize the variation in properties and reactivity of isotopes

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Apply the electrochemical principles to determine the electrode potential of a metal
2. Analyze the construction, cell reactions and working of energy storage devices
3. Analyze the specific operating conditions under which corrosion occurs and suggest a method to control corrosion
4. Illustrate reaction mechanisms and assess the role of catalyst in a chemical reaction
5. Analyze various types of nuclear transmutation including decay reactions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

UNIT I **5 Hours**

ELECTROCHEMISTRY

Origin of potential - electromotive force - electrical double layer - transport of charge within the cell - cell description - prediction of cell potentials

UNIT II **7 Hours**

ENERGY STORING DEVICES

Relation between electrical energy and energy content of a cell - reversible and irreversible cell - charging and discharging reactions in a reversible cell - current challenges in energy storage technologies

UNIT III **6 Hours**

METAL CORROSION AND ITS PREVENTION

Oxidation of metals: Electrochemical origin of corrosion - electromigration - electron transfer in the presence and absence of moisture - galvanic series. Strategies for corrosion control: Galvanic anode and impressed current.

UNIT IV **6 Hours**

CATALYSIS

Energy profile diagram for a chemical reaction - activation energy - role of catalyst - homogeneous and heterogeneous catalysis - types

UNIT V **6 Hours**

NUCLEAR REACTIONS

Radioactive and stable isotopes - variation in properties between isotopes - radioactive decay (alpha, beta and gamma) - half-life period - nuclear reactions - radiocarbondating

1 **3 Hours**

EXPERIMENT 1

Electroplate copper on the given target object and estimate the amount of copper deposited at cathode

2 **3 Hours**

EXPERIMENT 2

Construct an electrochemical cell exhibiting valid output and compare its potential with the given standard cell

3 **3 Hours**

EXPERIMENT 3

Construct a microbial fuel using organic manure and measure its output

4 **4 Hours**

EXPERIMENT 4

Application of calomel electrode to determine the redox potential of Fe(II) solution

5 **5 Hours**

EXPERIMENT 5

Determination of percentage of corrosion inhibition in iron/mild steel using a natural inhibitor

6 **4 Hours**

EXPERIMENT 6

Determination of corrosion percentage of iron/steel by weight loss method /Tafel polarization method

7 **4 Hours**

EXPERIMENT 7

Conductometric titration of mixture of acids (HCl and CH3COOH)

8 **4 Hours**

EXPERIMENT 8

Determination of strength of hydrochloric acid in a given solution using pH meter

Total: 60 Hours

Reference(s)

1. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2013.
2. P.H. Rieger, Electrochemistry, Second Edition (Reprint), Springer, Netherland, 2012
3. E.McCafferty, Introduction to Corrosion Science, Springer; 2010 Edition, January 2010
4. S. Vairam, Engineering Chemistry, John Wiley &Sons, 2014
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th edition, (revised) New Age International Publishers, 2011
6. U. Hanefeld, L. Lefferts, Catalysis: An Integrated Textbook for Students, Wiley- VCH, 2017

22GE002 COMPUTATIONAL PROBLEM SOLVING 3 0 0 3

Course Objectives

Analyze the algorithm design techniques and development principles in solving the real life problems.
Illustrate the different ways of organizing and storing the data in computing systems.
Understand the basic network configuration and setup connections among different device systems.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.

Course Outcomes (COs)

1. Analyze a problem and formulate algorithms, pseudocodes and flowcharts.
2. Develop algorithmic solutions to simple computational problems and explore algorithmic approaches to problem solving.
3. Design and apply appropriate data structures for solving computing problems.
4. Compare the various storage devices used in a computer system.
5. Analyze the requirements for a given organizational structure and establish the connection between two or more computers to form a network.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2										
2	3	3	3	3										
3	2	2	2	3										
4	2	2	2	2										
5	2	2	2	2										

UNIT I **6 Hours**

VISUAL PROCESS MODELING

Scenario decomposition - logical sequencing - drawing flowchart - preparing visual process model.

UNIT II **12 Hours**

ALGORITHMIC DESIGN THINKING

Analysis - Verification - Brute force - Divide and conquer - Greedy - Backtracking.

UNIT III **12 Hours**

DATA ORGANIZATION

Elementary Data Organization - Abstract Data Types - Fundamentals of Linear and Non Linear Data Structures.

UNIT IV **7 Hours**

DATA STORAGE

Flat File and Relational database- Data Read & Write in Local Storage, Server Storage and Cloud storage - Database Query Methods.

UNIT V **8 Hours**

NETWORKING ESSENTIALS

Networking Components and Services - IP Addressing - Configuring and Managing the Campus Network - Network Security - Firewalls.

Total: 45 Hours

Reference(s)

1. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,2016.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill, 2015.
5. Behrouz A.Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw- Hill, 2014.

22GE003 BASICS OF ELECTRICAL ENGINEERING 2 0 2 3

Course Objectives

To understand the basic concepts of electrical charge and its properties
To interpret the formation of electric field due to electric charges
To illustrate the concept of magnetic fields due to revolving electron
To illustrate the force on moving charges in electric and magnetic field
To understand the energy transfer in electro mechanical conversion

Programme Outcomes (POs)

e. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
f. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
g. 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.
h. 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.

Course Outcomes (COs)

1. Interpret the behavior of electric charges in different medium using coulombs law.
2. Analyse the electric field due to different charge distributions.
3. Analyse the magnetic field intensity due to long conductor, solenoid, toroid and magnetic dipoles.
4. Analyze the force on conductors due to the moving charges.
5. Interpret the energy conversion concepts in electromagnetic fields.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		1										
2	3	2		1										
3	1	1	3											
4	2	1		3										
5	3	2		1										

UNIT I **5 Hours**

ELECTRIC CHARGE

Properties of charge, additivity of charges, quantization of charge, conservation of charge , Forces between multiple charges, Electric charge in conductors, Drift of Electrons, Charges in Clouds.

UNIT II **7 Hours**

ELECTRIC FIELD

Electric field due to system of charges, Significance of Electric field line. Electric Dipole and its significance, Continuous charge distribution, Field in infinite long uniform straight conductors, field in uniform charged uniform infinite plane sheet, field due to uniform thin spherical sheet.

UNIT III **7 Hours**

MAGNETIC FIELDS

Concept of magnetic field, magnetic fields in infinitely long straight wire, straight and toroidal solenoids, Magnetic dipole moment of a revolving electron, Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to axis, Induced Electric field due to changing Magnetic Field.

UNIT IV **6 Hours**

FORCE ON CHARGES

Force on a moving charge in uniform magnetic and electric fields, Force on a current carrying conductor in a uniform magnetic field, Force between two parallel current carrying conductors.

UNIT V **5 Hours**

ELECTRO MECHANICAL ENERGY CONVERSION

Energy transfer in electromagnetic fields, Energy storage in magnetic field, Electromagnetic induction, induced emf, Eddy currents. Self and mutual inductance Linear Momentum and Angular Momentum carried by Electromagnetic Fields.

1 **15 Hours**

EXPERIMENT 1

Analyze and design of Electromechanical energy conversion system.

2 **15 Hours**

EXPERIMENT 2

Develop an electrical machine and analyze its performance with supplied input of AC from 0 V to 230 V.

Total: 60 Hours

Reference(s)

1. Mathew N. O. Sadiku, Principles of Electromagnetics, 6th Edition, Oxford University 2020
2. William H. Hayt and John A. Buck, Engineering Electromagnetics, McGraw Hill 2020
3. Kraus and Fleisch, Electromagnetics with Applications, McGraw Hill International Editions, 2017
4. S.P.Ghosh, Lipika Datta, Electromagnetic Field Theory, First Edition, McGraw Hill Education(India) Private Limited 2017

22IT206 DIGITAL COMPUTER ELECTRONICS 3 0 2 4

Course Objectives

- Understand the operation of Arithmetic Logic unit in Microprocessors
- Interpret Data retrieval from Memory by Microprocessors
- Analyze the role of Control Unit in Microprocessors
- Analyze Instruction execution in Microprocessors

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.

Course Outcomes

1. Analyze the Design of Arithmetic and Logic Unit in Microprocessors
2. Analyze the Data Storage and Retrieval from Random Access Memory
3. Analyze the working mechanism of Control Unit in Microprocessors
4. Analyze the execution of Arithmetic and Logical Instructions
5. Analyze the execution of Jump and Memory related Instructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2											
2	2	2	2											
3	2	2	2											
4	2	2												
5	2	2												

UNIT I 9 Hours

BINARY SYSTEM AND DESIGN OF ALU

Conversion of Decimal, Hexadecimal, Octal and Binary Numbers - Representation of Negative Numbers in Binary - Design of Binary Arithmetic Logic Modules - Magnitude Comparator - Encoder - Decoder - Multiplexer - Demultiplexer - Design of Arithmetic and Logic Unit (ALU)

UNIT 2 9 Hours

SYNCHRONOUS CIRCUIT AND DESIGN OF RAM

Latches and Flip Flops - Clock - Registers - Counters - Shift Registers - Storage and Retrieval of Binary Numbers from Registers - Design of Random Access Memory (RAM) - Encoding and Decoding of Memory address locations

UNIT 3 **9 Hours**

DESIGN OF CONTROL UNIT

Design of Control Unit - Mechanism of Instruction Read, Data Read, Instruction Decode, Instruction Execute and Data Write

UNIT 4 **9 Hours**

BASIC INSTRUCTION EXECUTION

Arithmetic Instructions - Increments, Decrements and Rotate Instructions - Logic Instructions - Arithmetic and Logic instructions

UNIT 5 **9 Hours**

ADVANCED INSTRUCTION EXECUTION

Memory Reference instructions - Register Instructions - Jump and Call Instructions - Concept of Flag - Extended Register Instructions - Indirect Instructions - Stack instructions

LIST OF EXPERIMENTS

All the below experiments can be simulated using the Open Source Tool Called LogiSim.

1. Design and Simulation of Fundamental Gates using Universal Gates (NAND and NOR) – 2 Hours
2. Design and Simulation of Half Adder, Full Adder, Half Subtractor, Full Subtractor – 3 Hours
3. Design and Simulation of 4-bit Ripple Carry Adder – 3 Hours
4. Design and Simulation of a 4-bit Arithmetic and Logic Unit - 4 Hours
5. Design and Simulation of D Flip Flop and J K Flip Flop - 4 Hours
6. Design and Simulation of 8-bit Register - 4 Hours
7. Design and Simulation of an 8 bit SISO, SIPO, PISO, PIPO Shift Registers - 4 Hours
8. Simulation of Data Read and Data Write from a RAM- 3 Hours
9. Simulation of Control Unit Functionality - 3 Hours

Total: 75 Hours

Reference(s)

1. Digital Logic & Computer Design , Morris Mano Pearson Education India, 2019
2. Digital Computer Electronics, Albert Paul Malvino and Jerald A Brown (3rd Edition), McGraw Hill Education India, 2001
3. Digital Design and Computer Architecture, David Money Harris and Sarah L Harris, Elsavier, 2007
4. But How do it Know? The Basic Principles of Computers for Everyone, John C Schott, John C Scott Publishers, 2009
5. Code: The Hidden Language of Computer Hardware and Software (2nd Edition), Petzold Charles, Microsoft Press , 2022
6. Digital Computer Fundamentals (6th Edition), Thomas C Bartee, Tata Mcgraw Hill Education, 2011

22HS003 HERITAGE OF TAMILS 0 0 2 1

UNIT I **3 Hours**

LANGUAGE AND LITERATURE

Language Families in India - Dravidian Languages - Tamil as aClassical Language- Classical Literature in Tamil- Secular Nature of Sangam Literature- Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II **3 Hours**

HERITAGE - ROCK ART PAINTINGS TO MODERN ART- SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III **3 Hours**

FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV **3 Hours**

THINAI CONCEPT OF TAMILS

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V **3 Hours**

CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India - Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine - Inscriptions & Manuscripts - Print History of Tamil Books.

Total: 15 Hours

Reference(s)

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

22IT301 PROBABILITY, STATISTICS AND QUEUING THEORY

3 1 0 4

Course Objectives

- The students will be able to understand the basic concepts of probability and the distributions with characteristics and also two dimensional random variables
- Summarize and apply the methodologies of the statistics and queuing theory.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in the core areas.
2. Apply the concepts of probability distributions in an appropriate place of computers and Engineering.
3. Implement basic statistical inference techniques engineering problems.
4. Design an experiment using ANOVA technique and summarize the measurements for statistical quality control.
5. Identify and apply the queuing methodologies to optimize the result of the waiting line.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	1	2												
3	1	2												
4	1	2												
5	1	2												

UNIT I **9 Hours**

PROBABILITY AND RANDOM VARIABLE

Axioms of probability-Conditional probability-Total probability-Bayes theorem-Random variable-Probability mass function-Probability density functions-Properties-Moments - Moment generating functions and their properties.

UNIT II **9 Hours**

STANDARD DISTRIBUTIONS

Discrete distributions: Binomial - Poisson - Negative Binomial - Continuous distributions: Uniform - Exponential - Gamma - Normal distributions and their properties.

UNIT III **9 Hours**

TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on normal distribution for single mean and difference of means -Small sample tests: t-test for mean -F- test - Chi-square test for Goodness of fit

and Independence of attributes.

UNIT IV **9 Hours**

DESIGN OF EXPERIMENTS AND CONTROL CHART

One way and two way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts).

UNIT V **9 Hours**

QUEUING THEORY

Pure Birth and Death Process -Characteristics of Queuing models- Kendalls notation- Single and multi server Markovian queuing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

Total: 60 Hours

Reference(s)

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, PHL Publisher, 1996.
2. Kishore S Trivedi, Probability and Statistics with Reliability Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queuing Theory with Computer Applications, New Age International, 2003.
4. Jay L Devore, Probability and Statistics for Engineering and The Sciences, Thomson Learning, Seventh Edition, 2002.
5. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists,

22IT302 DATA STRUCTURES I **3 0 2 4**

Course Objectives

- Implement array and hash data structure for real world applications.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the performance of various data structures using asymptotic notations.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
k. Project Management and Finance: Demonstrate the 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.
l. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

Course Outcomes (COs)

1. Implement the array data structure and its types for searching and sorting operations.
2. Outline the algorithm efficiency with different asymptotic notations for optimizing the code.
3. Implement the linear node-based data structure for real world applications.
4. Evaluate the performance of Hash over arrays and list in memory access.
5. Analyze the tree traversal algorithms for various non-linear data structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	1
2	2	2	2	2	2						2	2	1	
3	2	3	3	2	2						2	2	2	1
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	2	2

UNIT I **10 Hours**

FOUNDATIONAL DATA STRUCTURES

Algorithms and Data Structures - Data Structures hierarchy -Types of Data- Singular Data and Plural Data - Position

indexing : Array - Sets - Ordered Arrays - Searching over Arrays and Ordered Arrays.

UNIT II **7 Hours**

ALGORITHM EFFICIENCY

Algorithm efficiency using Asymptotic Notations - Optimizing code with and without Big O Notation - Optimizing for optimistic scenarios - Trade- offs between Time and Space.

UNIT III **10 Hours**

ADT AND NODE BASED DATA STRUCTURES

ADT : Stacks - Queues - Recursion - Recursive Algorithms for Speed - Node Based Data Structures : Linked list - Need of Linked List - Arrays vs Linked List - Types of Linked List and its operations - Skip Lists.

UNIT IV **8 Hours**

FAST LOOKUP WITH HASH

Hash Table - Hash functions - Internal implementation of Hash - Iteration over Hash - Hash operations - Hash of Hash - Array of Hash - Hash of Array.

UNIT V **10 Hours**

TREES

Tree - Binary Tree - Binary Search Tree - Tree traversal - AVL Tree - Red Black Tree - B Tree - B+ Tree - Heap.

1 **2 Hours**

EXPERIMENT 1

Implementing Array operations

2 **6 Hours**

EXPERIMENT 2

Implementing stack and queue data structures:
i. Stack applications (expression evaluation, stack-based algorithms)
ii. Queue applications (implementing a circular queue, queue-based algorithms)

3 **4 Hours**

EXPERIMENT 3

Implementing Singly linked list and its operations like insertion, deletion, searching, and traversal

4 **4 Hours**

EXPERIMENT 4

Implementing hashing techniques (linear probing, quadratic probing, chaining)

5 **2 Hours**

EXPERIMENT 5

Implementing Binary tree traversal algorithms (pre-order, in-order, post-order)

6 **2 Hours**

EXPERIMENT 6

Implementing various searching algorithms:
i. Linear search
ii. Binary search

7 **10 Hours**

EXPERIMENT 7

Implementing and analyzing various sorting algorithms:

i. Bubble sort
ii. Selection sort
iii. Insertion sort
iv. Merge sort
v. Quick sort
vi. Heap sort

Total: 75 Hours

Reference(s)

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2013.
2. Larry Wall, Tom Christiansen & Randal L. Schwartz, Progrmaming Perl, O"Reilly, 3rd edition, 2000.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
4. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.
6. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009.

22IT303 COMPUTER ORGANIZATION AND ARCHITECTURE

3 0 0 3

Course Objectives

- Understand the computer architecture concepts related to design of processors, memory management and I/O system.
- Explore the GPU computing architecture and develop an environment for creating high performance GPU-accelerated applications using CUDA programming.
- Gain knowledge on modern processor architecture to design the best processor/computing system.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
l. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

Course Outcomes (COs)

1. Analyze the processor architecture and instruction sets of x86/x64 and ARM architecture.
2. Design a data path for a simple processor and compare the various techniques related to simultaneous execution of multiple instructions from a program.
3. Organize the computer memory to speed up the performance and facilitate the transfer of data between the computer""s central processing unit and the external devices.
4. Analyze the GPU computing architecture and develop applications to run on NVIDIA GPUs using the CUDA programming environment.
5. Analyze the modern processor architectures and instruction sets and implement a RISC-V processor in a low-cost FPGA board.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2								2		1
2	3	3	2	2								2		2
3	2	2	2									2	2	2
4	2	2	2	2	3							2	1	1
5	2	2	2	2								2		2

UNIT I **9 Hours**

UNDERSTANDING PROCESSOR ARCHITECTURE AND INSTRUCTION SETS

Basic Computer Organization and Design - Instruction Set principles - x86 and x64 architecture & instruction sets - 32 bit and 64 bit ARM architecture & instruction sets.

UNIT II **9 Hours**

PROCESSOR DESIGN

Designing a Data path for a Simple Processor - DLX Pipeline - Super Pipelining - Super scalar processor - Instruction level parallelism (ILP) - Speculative Execution - Side channel attack (Spectre and Meltdown)

UNIT III **9 Hours**

MEMORY UNIT AND I/O ORGANIZATION

Memory Hierarchy - Cache Architectures - Levels in Cache - Improving Cache Performance - Memory Prefetch - Tera MTA - Connecting I/O Devices to the Processor.

UNIT IV **8 Hours**

EXPLORING GPU ARCHITECTURE

GPU Vs CPU architecture - GPU Architecture Basics - NVIDIA"s CUDA Toolkit - CUDA Programming

UNIT V **10 Hours**

MODERN COMPUTER ARCHITECTURE

Domain-Specific Computer Architectures - Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebas - Wafer Scale Computing, Accelerators (FPGA, ASIC) - RISC-V Architecture and Instruction Set - Implementing RISC-V in a field-programmable gate array (FPGA).

Total: 45 Hours

Reference(s)

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill,Third Reprint, 2015.
2. David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/ software interface, MorganKaufmann,4th edition, 2014.
3. Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition,2022.

22IT304 PRINCIPLES OF PROGRAMMING LANGUAGES 3 0 2 4

Course Objectives

- Understand the history and evolution of programming language.
- Gain knowledge about the different data types and control flow statements.
- Impart knowledge about the subprograms, functions, debugging and error handling mechanisms.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
k. Project Management and Finance: Demonstrate the 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.
l. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

Course Outcomes (COs)

1. Outline the programming paradigms and the basic structure of programming language.
2. Assess the implementation of different types of data, variable and types system.
3. Analyze suitable conditional statements and control structures for real world applications.
4. Develop programs using subprograms and explore their types for problem solving.
5. Determine the tools for error handling and event handling in Programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1	3						1	2	1	
2	2	3	3	1	3						2	2	1	
3	1	2	3	1	3						2	2	2	
4	1	2	3	1	3						2	2		2
5	1	2	3	1	3						2	2		2

UNIT I **8 Hours**

UNDERSTANDING PROGRAMMING PARADIGMS

Natural Vs Artificial language - Common Programming Paradigms - Syntax and semantics - Language Evaluation Criteria

- Programming Language Grammar.

UNIT II **10 Hours**

VARIABLES AND DATA TYPES

Variable Declarations - Guidelines for Initializing Variables - Power of Variable names - Fundamental Data types - Type Systems - Type Inference and Polymorphism.

UNIT III **10 Hours**

STATEMENTS

Expressions and Assignment statements - Organizing straight-line code - Using conditionals - Controlling loops - Unusual control structures - General control issues.

UNIT IV **9 Hours**

SUBPROGRAMS

Fundamentals of Subprograms - Design issues - Parameter passing methods - Overloaded subprograms -Generic subprograms - Implementing subprograms.

UNIT V **8 Hours**

DEBUGGING AND ERROR HANDLING

Debugging - Debugging Strategies - Debugging Tools - Error Messages - Documentation - Test cases - Debugging with print statements - Debugging with comments and questions - Exception handling and Event handling

1 **3 Hours**

EXPERIMENT 1

Write a Python program to Experiment with different variable scopes (global, local)

2 **3 Hours**

EXPERIMENT 2

Create a program for using the built-in data structures (lists, sets, tuples, dictionary etc.)

3 **3 Hours**

EXPERIMENT 3

Generate a n x n table and implement the following,
a. Fill the odd rows with '1'
b. Fill the even rows and odd columns with '1'
c. Fill the odd rows with 1 and odd columns with '0'
d. Fill the diagonal cells with '9'
e. Fill all the cells with number from 1 to n^2 from the middle cell in a spiral order
f. Fill all the cells with number from 1 to n^2 from the last cell to the middle cell in a spiral order

4 **3 Hours**

EXPERIMENT 4

Implement a program that uses conditional statements to simulate a decision-making process.

5 **3 Hours**

EXPERIMENT 5

Create a program to implement looping statements.

6 **3 Hours**

EXPERIMENT 6

Create a program that demonstrates the concept of short-circuit evaluation in logical expressions.

7 **6 Hours**

EXPERIMENT 7

Develop a program for implementation of subprograms and nested subprograms and investigate the differences between pass-by-value and pass-by-reference parameter passing mechanisms

8 **3 Hours**

EXPERIMENT 8

Develop a program to implement the concept of Recursion.

9 **3 Hours**

EXPERIMENT 9

Create a program to demonstrate the Exception Handling mechanisms

Total: 75 Hours

Reference(s)

1. Code Complete, Steve McConnell, Microsoft Press, 2004.
2. Concepts of Programming Languages Robert. W. Sebesta 10/E, Pearson Education.
3. Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.
4. Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH.
5. Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003

22IT305 SOFTWARE ENGINEERING **3 0 0 3**

Course Objectives

- Understand the systematic approach related to the design, development and maintenance of a software system
- Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
- Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
g. 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.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance: Demonstrate the 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.
l. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

Course Outcomes (COs)

1. Apply the software development methodologies to various real life scenarios.
2. Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
3. Analyze the coding strategies and techniques to write well-structured, efficient, and error-free code.
4. Apply specific modern testing tools to ensure the quality and reliability of software products.
5. Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	1	
2	3	3	2	2	3		2		2			2		2
3	2	2	2				2		2			2	1	

4	2	2	2		3		2		2			2		2
5	2	2	2						2				1	

UNIT I **9 Hours**

SOFTWARE DEVELOPMENT PROCESS

Phases in Software Development - Traditional Software Development Models - Agile Methodologies - Agile Scaling Frameworks - Lean Software Development - Software Requirements Specification(SRS) - Project Scheduling and Estimation.

UNIT II **10 Hours**

TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT

DevOps - Version control with Git - Containerization Using Docker and Kubernetes- Application Performance Monitoring (APM) - Continuous Integration Continuous deployment (CICD) - Clean Room build.

UNIT III **9 Hours**

CODE QUALITY

Software Metaphors - Upstream Prerequisites - Key Construction Decisions - Defensive Programming - Code Tuning Strategies and Techniques.

UNIT IV **9 Hours**

TESTING

Writing good test cases - Test driven development - Test Automation - Testing using Selenium tool - Continuous Testing - Exploratory Testing - Testing in Agile and DevOps Environments.

UNIT V **8 Hours**

ENTERPRISE ARCHITECTURE AND MODELING

Enterprise Architecture (EA) in Digital Transformation - Agility in Digital Business - Measuring EA: Metrics, KPIs and Risks.

Total: 45 Hours

Reference(s)

1. Charles Petzold, Code: The Hidden Language of Computer Hardware and Software, Microsoft Press books, 2009.
2. David D. Riley, Kennya. Hunt, Computational thinking for the modern problem Solver, CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, Little Man Computer Programming: For The Perplexed From The Ground Up, The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, Software Engineering: A Practitioner""s Approach, McGraw Hill International edition, Seventh edition, 2010.

22HS004 HUMAN VALUES AND ETHICS 2 0 0 2

Course Objectives

- Understand the concept of good values and comprehend the importance of value-based living.
- Recognize the culture of peace through education.
- Identify and apply the practices for value development and clarification.

Programme Outcomes (POs)

Course Outcomes (COs)

1. Understand the importance of human values and ethics in life.
2. Execute the importance of harmonious living in a diverse society.
3. Analyze the sensitivity to the crying needs of society such as ungodliness, corruption, poverty, and suffering, and play a vital role in eradicating them.
4. Plan intellectually mature, morally upright, ethically correct, and spiritually inspired decisions.
5. Execute a correct balance between professional excellence and social commitment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

UNIT I **6 Hours**

COURSE INTRODUCTION - NEED, BASIC GUIDELINES AND ANALYSIS

Importance of Human Values & Ethics in 21st Century - Understanding the theory of basic human values and ethics - Openness to change - Self enhancement - Conservation - Self transcendence - Schwartz Value Survey: Self-Assessment

UNIT II **6 Hours**

EMBRACING THE COMMON ETIQUETTE

Altruism- Integrity - Freedom - Justice - Honesty - Truthfulness - Responsibility - Compassion

UNIT III **6 Hours**

CONTINUOUS HAPPINESS AND PROSPERITY

An overview on basic Human Aspirations - Understanding and living in harmony at various levels of life - Embracing self-love and wellness - Understanding harmony in the family and society

UNIT IV **6 Hours**

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Reflection on growing global multifold problems: poverty, pollution, hunger, disease, unemployment, caste system, child labour, gender equality, politics and violence. Understanding the challenges in cultural, personal, social, political, and economic environment

UNIT V **6 Hours**

UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE

Understanding the harmony in Nature - Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions

Total: 30 Hours

Reference(s)

1. Martin, G. The Little Book of Ethics: A Human Values Approach. Australia: G.P. Martin. 2011.
2. Gupta, N. L. Human Values for The 21St Century. India: Anmol Publications Pvt. Limited. 2002.
3. Mishra, A. Happiness Is All We Want. India: Bloomsbury Publishing.2017.
4. Universal Human Values. (n.p.): Booksclinic Publishing. 2023.
5. A Textbook on Professional Ethics and Human Values. India: New Age International (P) Limited.2007.

22HS005 SOFT SKILLS AND EFFECTIVE COMMUNICATION **0 0 2 1**

Course Objectives

- Communicate proficiently in formal discussions at the workplace.
- Describe experiences and events, and briefly give reasons and explanations for opinions and plans.
- Interact with a degree of fluency and spontaneity that results in efficacious communication
- Convey agreement and disagreement in a polite but firm manner
- Communicate with coherence and imagination in both written and spoken formats

Programme Outcomes (POs)
Course Outcomes (COs)

1. Enhance confidence in expressing thoughts in grammatically proper language and etiquette in waiting for the opportunity to provide input
2. Effectively communicate in English on formal occasions and proficiency in the use of link words and other discourse markers
3. Provide constructive feedback and file logical complaints
4. Analyse the understanding of oral and written communication in real-world situations.
5. Apply the improved spelling and punctuation in writing and heightened understanding of tone, pitch and stress in oral formats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

1 **6 Hours**

SELF-EXPRESSION

Group discussion/ Peer discussion - Communicating decisions and opinions - Tone, Pitch, Stress - Agreeing, Disagreeing, Suggesting, Speculating - Comparing and Contrasting - Comparatives and Superlatives
Discourse markers - Interjections
Decision making - Synthesis - Higher order thinking

2 **6 Hours**

LESSON PLAN 2

Group discussion/Peer discussion - Effective Communication
Types of communication - Written vs Spoken
Contractions
Intonation
Stress
Active voice
Question tags
Confidence and body language

Guided writing- Outlining Main Points

3 **6 Hours**

LESSON PLAN 3

Group discussion/Peer discussion - Avoiding common errors
Reduction of MTI
Common errors
Barriers to communication
Accent

4 **6 Hours**

CREATIVE EXPRESSION

JAM, Debate, Review writing, Social media posts
Synonyms
Antonyms
Cloze test
Phrasal verbs
Spotting errors
Collocation
Commonly mispronounced

5 **6 Hours**

FORMAL EXPRESSION

Lesson Plan 5: Critical composition
Writing: Giving written feedback, Review writing, and Letter of complaint.

Speaking: Giving constructive feedback and offering suggestions, asking for inputs, commenting politely on appropriate phrases
Giving written feedback, Review writing, and Letter of complaint.
Critical reasoning
Modal verbs
Polite ways to express negatives

Total: 30 Hours

Reference(s)

1. Word Power Made Easy by Norman Lewis, W. R. Goyal Pub. & Distributors, 2009.
2. Sasikumar, V, et al., A Course in Listening & Speaking Foundation Books, 2005.
3. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
4. Prasad, Hari Mohan. A Handbook of Spotting Errors, Mcgraw Hill Education, 2010.
5. Personality Development & Soft Skills, Barun K. Mitra, Oxford University Press, 2012
6. Business English by Ken Taylor, Orient Blackswan, 2011

22HS006 TAMILS AND TECHNOLOGY **1 0 0 1**

Course Objectives

- Analyse graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
- Investigate the building materials and the historical context of Hero stones during the Sangam Age by Analysing the details of stage constructions in Silappathikaram and their cultural significance.
- Examine ancient knowledge of oceans and its impact on Tamil society.

Programme Outcomes (POs)
Course Outcomes (COs)

1. Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
2. Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
3. Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
4. Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
5. Trace the development of scientific terminology and vocabulary in Tamil language.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

UNIT I **3 Hours**

WEAVING AND CERAMIC TECHNOLOGY

Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

UNIT II **3 Hours**

DESIGN AND CONSTRUCTION TECHNOLOGY

Designing and Structural construction House and designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

UNIT III **3 Hours**

MANUFACTURING TECHNOLOGY

Art of Ship Building-Metallurgical studies-Iron industry-Iron smelting,steel-Copper and gold-Coins as source of history-Minting of Coins-Beads making-industries Stone beads -Glass beads-Terracotta beads-Shell beads-bone beats-Archeological evidences-Gem stone types described in Silappathikaram.

UNIT IV **3 Hours**

AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry-Wells designed for cattle use- Agriculture and Agro Processing-Knowledge of Sea-Fisheries-Pearl-Conche diving-Ancient Knowledge of Ocean-Knowledge Specific Society.

UNIT V **3 Hours**

SCIENTIFIC TAMIL

Development of Scientific Tamil-Tamil computing-Digitalization of Tamil Books-Development of Tamil Software-Tamil Virtual Academy-Tamil Digital Library-Online Tamil Dictionaries-Sorkuvai Project.

1 **3 Hours**

UNIT I

TAMILS AND tECHNOLOGY

Total: 18 Hours

Reference(s)

1. Dr. K. K. Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL
2. Dr. S. Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr. S. V. Subatamanian , Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr. M. Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies
5. Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr. K. K. Pillay, Studies in the History of India with Special Reference to Tamil Nadu.

22IT401 DISCRETE MATHEMATICS 3 1 0 4

Course Objectives

- Implement the definitions of relevant vocabulary from graph theory and combinatorics and be able to perform related calculations.
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Understand and apply the concepts of Boolean algebra and characteristics in computers.
2. Apply formalized arguments to classify and assess real-world arguments.
3. Represent the characteristics of predicate logic in computer engineering.
4. Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
5. Interpret the concepts of Permutations, Combinations and Mathematical induction in the phenomena of real world.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1												
3	1	2												
4	2	2												
5	1	2												

UNIT I **9 Hours**

BOOLEAN ALGEBRA

Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality- Canonical form - Karnaugh map.

UNIT II **9 Hours**

PROPOSITIONAL CALCULUS

Propositions- Logical connectives-Compound propositions-Conditional and biconditional propositions- Truth tables - Tautologies and Contradictions - Logical and equivalences and implications-DeMorgans Laws-Normal forms-Principal conjunctive and disjunctive normal forms - Rules of inference-Arguments-Validity of arguments.

UNIT III **9 Hours**

PREDICATE CALCULUS

Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.

UNIT IV **9 Hours**

SET THEORY AND FUNCTIONS

Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering- Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions- inverse functions.

UNIT V **9 Hours**

COMBINATORICS

Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations- Recursion and recurrence relations-Generating Functions- Mathematical Induction- Inclusion - Exclusion

Total: 60 Hours

Reference(s)

1. Trembly J P and Manohar R, Discrete Mathematical Structures with Applications to computer Science, Tata McGraw Hill Publications Co. Ltd., New Delhi 30th Re-print 2007.
2. Alan Doerr and Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications Pvt. Ltd. Delhi. 2010.
3. Ralph P Girmaldi and Ramana B.V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2007.
4. Kolman Busby Ross, Discrete Mathematical Structures , Prentice-Hall India, New Delhi, Fifth Edition, 2007.
5. Rosen K.H Discrete Mathematics and its Applications, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

22IT402 DATA STRUCTURES II **3 0 2 4**

Course Objectives

- Understand and use the various major modern data structures like Trie, Rope, Segment tree and Octree.
- Apply the graph data structure and tree traversal algorithms for solving real time problems.
- Analyze the performance of algorithm design techniques with different data structures.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
k. Project Management and Finance: Demonstrate the 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.
l. 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.

Course Outcomes (COs)

1. Implement the Trie data structure and its basic search operations.
2. Outline the traversal algorithm and its types with graph data structure.
3. Implement Minimum Spanning tree algorithms and analyze their performance.
4. Design and implement different problems using the backtracking and branch and bound techniques and analyze the time complexities of them.
5. Implement modern data structures like Segment tree, Quadtree and Octree for real world applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	1	2	2	2	2						2	2		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	3	3	3						3	3		

UNIT I **9 Hours**

TRIE DATA STRUCTURES

Trie Structure-Types-Prefix-Based Search-Space Efficiency-Time Complexity-Compact Tries-Applications-Suffix Array and Suffix Tree-Rope.

UNIT II **9 Hours**

GRAPH

Graph representation-Breadth-first traversal-Depth-first traversal-Shortest Path Algorithms: Unweighted Shortest Paths-Dijkstras Algorithm-Travelling Salesman Problem-Analysis of shortest path algorithms.

UNIT III **9 Hours**

GRAPH MST

Minimum Spanning Tree: Prims Algorithm-Kruskals Algorithm-Disjoint-Set Union (Union-Find)-A* algorithm-Flood filling algorithm-Analysis of MST algorithms.

UNIT IV **9 Hours**

ALGORITHM DESIGN TECHNIQUES

NP Complete problems- Backtracking: N-Queens Problem and Subset-Sum problem - Branch and bound: Knapsack problem-Approximation algorithms for NP hard problems: Traveling salesman-P, NP, NP-Complete and NP-Hard Problems.

UNIT V **9 Hours**

MODERN DATA STRUCTURES

Segment Tree-Interval Tree-Fenwick Tree-K-D Tree-Quadtree and Octree-Circular Buffer (Ring Buffer)-Marshaling/Unmarshalling-JSON-benefits-Schema-limitations-Protobuf.

1 **4 Hours**

EXPERIMENT 1

Implement a Trie data structure and perform prefix based search.

2 **4 Hours**

EXPERIMENT 2

For a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra s algorithm.

3 **4 Hours**

EXPERIMENT 3

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskals algorithm.

4 **6 Hours**

EXPERIMENT 4

Implement the Flood fill algorithm for replacing the color from the source row to source column in 2D array.

5 **4 Hours**

EXPERIMENT 5

Implement N Queens problem using Backtracking.

6 **4 Hours**

EXPERIMENT 6

Construct a segment tree for computing sum of the elements in a given range.

7 **4 Hours**

EXPERIMENT 7

Implement a Quad tree for locating a node in the given quad.

Total: 75 Hours

Reference(s)

1. 1.Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley publications,2013.
2. 2.Mark Allen Weiss, Data Structures and Algorithm Analysis in C,2nd Edition,Pearson Education,2016.
3. 3.Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson 2011.
4. 4.Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5. 5.Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

22IT403 OPERATING SYSTEMS **3 1 0 4**

Course Objectives

- Establish a solid foundation in the introductory concepts of operating systems and gain insights into the structures, services, and roles of operating systems in computing environments.
- To apply process scheduling algorithms in a multi-programming environment and implement the various deadlock strategies effectively to prevent each other from accessing the computer resources
- To gain knowledge on the operations of memory management and File management.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
g. 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.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance: Demonstrate the 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.
l. 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.

Course Outcomes (COs)

1. 1.Analyze the basic structure and architectural components of the operating system and interpret how application programs interact with the operating system through APIs.
2. 2.Apply the various scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. 3.Analyze memory allocation and deallocation mechanisms involved in memory management for a specific system.
4. 4.Apply the various file handling strategies to manage files on a secondary storage structure and in a distributed environment.
5. 5.Analyze the virtualization technologies and their types to simulate hardware functionality and create a virtual computer system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2		
2	3	3	2	2	3		2		2			2		
3	2	2	2				2		2			2		
4	2	2	2		3		2		2			2		

5	2	2	2						2						

UNIT I **8 Hours**

INTRODUCTION TO OPERATING SYSTEMS

Basic Operating System Concepts-Operating System Structure and Components-Operating System Services and Interfaces-Role of the Kernel and User Space-System calls and System Programs-Open Source and Closed source operating systems.

UNIT II **12 Hours**

PROCESS MANAGEMENT

Processes and Threads-Process Scheduling and CPU Scheduling Algorithms-Process Synchronization and Concurrency Control-Deadlocks and Handling Strategies-Inter-Process Communication (IPC)-Multi-Core and Multi-Processor Management

UNIT III **9 Hours**

MEMORY MANAGEMENT

Memory Hierarchy-Address Spaces and Memory Allocation-Paging and Segmentation-Page Replacement Algorithms-NUMA (Non-Uniform Memory Access)-Memory Compression-Memory Tiering.

UNIT IV **8 Hours**

FILE SYSTEM DESIGN AND AND IMPROVEMENTS

File System Structures-Storage Technologies-SSD and Flash Storage Optimization-Copy-on-Write (CoW) File Systems-File System Journaling-Distributed File Systems and Cloud Storage-File System Monitoring and Analytics

UNIT V **8 Hours**

VIRTUALIZATION AND RECENT DEVELOPMENTS

Virtualization Principles and Types (Hardware, Software, Network, Storage)-Hypervisors and Virtual Machine Monitors-Microkernels and Exokernels-Security and Integrity in Virtualized Environments-Security in Operating Systems-Operating Systems for Quantum Computers-Cross-Platform Compatibility.

Total: 60 Hours

Reference(s)

1. 1.Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. 2.Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. Ltd, 2014
3. 3.William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. 4.Harvey M. DeitelM, Operating Systems, Pearson Education Pvt. Ltd, 2007.
5. 5.Distributed file system for cloud: A Clear and Concise Reference Kindle Edition by Gerardus Blokdyk
6. 6.https://www.redhat.com/en/topics/virtualization

22IT404 WEB TECHNOLOGY AND FRAMEWORKS 2 0 2 3

Course Objectives

- Understand the Web Application Architectures and trace the evolution of the web and introduce concepts like Web 3.0 and Decentralized Web.
- Familiar with the different Web development Frameworks and Full stack development.
- Explore the emerging web technologies and implement best practices for making web applications accessible to all users

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
k. Project Management and Finance: Demonstrate the 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.
l. 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.

Course Outcomes (COs)

1. Analyze the architecture of various web applications and develop simple use cases for the real time web applications
2. Implement web applications using client-side scripting language and server-side scripting languages.
3. Integrate the web applications with databases using Web frameworks.
4. Develop a complete, functional web application that incorporates both front-end and back-end components.
5. Implement the emerging web technologies in web application development projects.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	2	2	2	2	2						2	2		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	3	3	3						3	3		

UNIT I **5 Hours**

INTRODUCTION TO WEB APPLICATION

Evolution of the web-Understanding Web Application Architectures:Server Side Rendered Applications-Single Page

Application SPA-Mobile Application Development-Comparison of Monolithic and Microservice architectures-Serverless computing-HTTP Protocol and Methods-Web Browsers and Rendering Engines-Use cases of various web applications, including Flipkart, BIT Discourse, BIP, Wiki and Moodle.

UNIT II **7 Hours**

SCRIPTING LANGUAGES

SCRIPTING LANGUAGES

Client-side Scripting vs Server-Side Scripting-Client-side Scripting: Execution Location-Languages: JavaScript Fundamentals-Document Object Model DOM.

Server-Side Scripting: Execution Location-Languages-PHP Programming fundamentals

UNIT III **6 Hours**

WEB DEVELOPMENT FRAMEWORKS

Introduction to Web Development Frameworks -MVC Architecture - Building APIs with a Framework - RESTful APIs and API Design - Building a RESTful API - Database Integration with ORM/ODM -Building a Basic Front-End Application.

UNIT IV **6 Hours**

FULL STACK DEVELOPMENT

Full-Stack Development - Combining Front-End and Back-End Technologies - Building a Full-Stack Web Application- 12 factor application model - Deployment and Hosting Options - Continuous Integration and Continuous Deployment CI/CD - Performance Optimization and Scalability.

UNIT V **6 Hours**

EMERGING WEB TECHNOLOGIES

Emerging Web Technologies-Progressive Web Apps PWAs-WebAssembly and WebRTC-Web Security Best Practices-Open Web Application Security Project OWASP-Web Accessibility and Inclusive Design-Web Performance Optimization.

1 **3 Hours**

EXPERIMENT 1

Create a simple HTML page and use the browsers developer tools to inspect and manipulate elements.

2 **3 Hours**

EXPERIMENT 2

Write JavaScript to validate the following fields of the Registration page.

a)First Name (Name should contains alphabets and the length should not be less than 6 characters).

b)Password (Password should not be less than 6 characters length).

c)E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)

d)Mobile Number (Phone number should contain 10 digits only).

e)Last Name and Address (should not be Empty).

3 **3 Hours**

EXPERIMENT 3

Develop a multi-page website using HTML and CSS and apply responsive design techniques to make the site mobile-friendly.

4 **3 Hours**

EXPERIMENT 4

Develop a QR code generator using PHP and connect to a database to store and retrieve data

5 **3 Hours**

EXPERIMENT 5

Developing a Simple Web Application using a server-side framework (e.g., Flask, Django, or Ruby on Rails) and apply security measures to protect against common web vulnerabilities

6 **4 Hours**

EXPERIMENT 6

Create a single-page application (SPA) using the front-end framework (e.g., React, Angular, or Vue.js) and implement routing and state management.

7 **3 Hours**

EXPERIMENT 7

Develop a RESTful API using a back-end framework (e.g., Node.js or Express), perform the CRUD operations and Test the API using tools like Postman

8 **4 Hours**

EXPERIMENT 8

Create a full-stack web application to implement user authentication and authorization connected to a database to store and retrieve data for the application

9 **4 Hours**

EXPERIMENT 9

Deploy a web application in a hosting platform (e.g., Heroku, AWS, or Azure) and set up a continuous integration and continuous deployment (CI/CD) pipeline to monitor the deployed application for performance and errors.

Total: 60 Hours

Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2. James Gillies and Robert Cailliau, How the Web Was Born: The Story of the World Wide Web, 2000
3. D Crockford , The Good Parts, O Reilly , 2009
4. Mark Masse , REST API Design Book,O Reilly,2011
5. Matti Luukkainen and Jarkko Moilanen , Fullstack Open: Deep Dive Into Modern Web Development
6. Michal Zalewski , The Tangled Web: A Guide to Securing Modern Web Applications 2011

22IT405 DATABASE MANAGEMENT SYSTEM 3 0 2 4

Course Objectives

- Analyze the data models, conceptualize and Design a database system using E-R diagrams.
- Gain knowledge on the design principles of relational and modern database systems like SQL, NoSQL and NewSQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
k. Project Management and Finance: Demonstrate the 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.
l. 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.

Course Outcomes (COs)

1. Analyze the data models and the types of data used in databases.
2. Implement SQL queries for creating databases and performing the relational operations.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.
5. Analyze the performance of NoSQL and NewSQL databases related to design.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2		
2	2	2	2	2	2						2	2		
3	2	3	3	2	2						2	2		
4	3	3	3	3	2						3	3		
5	3	2	2	3	3						3	3		

UNIT I **8 Hours**

INTRODUCTION TO DATABASES AND DBMS

Understanding Data and Information - Database vs DBMS - Modern Databases - DBMS Architecture and Components - Data Models - Relational Model - Codd"s 12 Rules - Object-Relational Mapping (ORM).

UNIT II **10 Hours**

STRUCTURED QUERY LANGUAGE (SQL)

SQL Basic Commands - Constraints - Database Objects - SQL Functions - Subqueries- Correlated Subqueries- Nested subqueries - Recursive queries - Common Table Expressions (CTEs) - Triggers and Stored procedures.

UNIT III **9 Hours**

DATABASE DESIGN AND NORMALIZATION

Database Design fundamentals - Entity-Relationship Diagrams (ERD) - ERD to tables - Functional Dependencies and Normal Forms: 1NF, 2 NF, 3 NF, BCNF, 4 NF, 5NF and 6 NF - Domain-Key Normal Form (DKNF) - Nested Normal Form (NNF) - Denormalization and Trade-offs - Emerging trends in Database Design - Dealing with real-world complexities in Database Design- CASE Tools for Database Design.

UNIT IV **9 Hours**

QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT

Query Optimization and Execution Plans -Optimization Visualization Tool - DB Sharding - Vitess - Vitess vs MySQL- Table partitioning - Transaction Management and ACID Properties - Concurrency Control: Lock based protocols - Deadlock handling - Multi version concurrency control (MVCC) - Transaction isolation.

UNIT V **9 Hours**

NOSQL AND NEWSQL DATABASES

NoSQL Vs NewSQL- NoSQLDatabases: MongoDB and Cassandra - NewSQL databases: Redis and NuoDB -Selection of NoSQL or NewSQL over RDBMS - CAP Theorem and BASE Properties - HeidiSQL - In-Memory Databases and Caching - Database Security and Encryption - Database Performance Tuning

1 **4 Hours**

EXPERIMENT 1

Create a simple relational database with tables and write SQL queries for basic CRUD operations (Create, Read, Update, Delete).

2 **3 Hours**

EXPERIMENT 2

Create multiple tables and perform Database Querying - Simple queries, Nested queries, Sub queries, Joins and views.

3 **3 Hours**

EXPERIMENT 3

Create a database with multiple tables. Add constraints (e.g., primary key, foreign key, check constraints) to database tables. Create indexes for performance optimization. Implement triggers to automate actions based on data changes.

4 **3 Hours**

EXPERIMENT 4

Design an ERD for a simple database schema. Normalize the schema to eliminate redundancy and improve data integrity.

5 **3 Hours**

EXPERIMENT 5

Implement the normalized schema in the RDBMS and populate it with sample data.

6 **3 Hours**

EXPERIMENT 6

Install and set up a NoSQL database (e.g., MongoDB). Write queries to insert, update, and query data in MongoDB.

7 **4 Hours**

EXPERIMENT 7

Set up a distributed database cluster using open-source tools (e.g: Apache Cassandra). Store and retrieve data in a distributed environment.

8 **4 Hours**

EXPERIMENT 8

Implement in-memory caching using technologies (Redis) and measure the performance improvements achieved through caching.

9 **3 Hours**

EXPERIMENT 9

Implement access control and user authentication in an RDBMS. Encrypt sensitive data at rest and in transit

Total: 75 Hours

Reference(s)

1. 1.Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw -Hill, Sixth Edition, 2018
2. 2.Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems,Pearson Education, Seventh Edition, 2016
3. 3.Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology, Ninth edition, 2011
4. 4.Guy Harrison , Next Generation Databases: NoSQLand Big Data, Apress.

22HS007 ENVIRONMENTAL SCIENCE **2 0 0 0**

Course Objectives

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

Programme Outcomes (POs)

Course Outcomes (COs)

1. Show the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Demonstrate the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Assess the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Compare the impacts of population and human activities on environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer - pesticide problems (eutrophication, blue baby syndrome, biomagnification). Energy resources - renewable (solar, wind, and hydro).

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: desert ecosystem. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - Water pollution - Sewage water treatment by activated sludge and trickling filter process - Noise pollution - Thermal pollution. Disaster management - causes - effects - control measures of floods - Earthquake

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development - Definition - Unsustainable to sustainable development - solid waste management - causes - effects - 5R Principles - landfills, incineration, composting. Water conservation - rain water harvesting - watershed management. Climate change - Global warming - acid rain - Ozone layer depletion. E-waste

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

Total: 30 Hours

Reference(s)

1. Anubha Kaushik, C.P. Kaushik, Environmental Science and Engineering, 4th Multi Colour Edtion, New Age International Publishers, New Delhi, 2014
2. Raven, P. H. Hassenzahl, D.M. & Berg, L.R. 2012. Environment, 8th edition. John Wiley & Sons
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014
4. Pepper, I. L, Gerba, C. P. & Brusseau, M. L. 2011, Environmental and Pollution Science, Academic Press
5. A. K. De, Environmental Chemistry, 7th Edition, New age international publishers, New Delhi, 2014

22HS008 ADVANCED ENGLISH AND TECHNICAL EXPRESSION

0 0 2 1

Course Objectives

- To enable students to achieve proficiency in academic writing
- effectively use the language to persuade others
- appreciate the nuances of the language and engage an audience
- use advanced tools of language to improve communicative competence
- prepare for professional demands at the workplace
- give concrete expression to the plans and goals

Programme Outcomes (POs)

Course Outcomes (COs)

1. Understand the clarity in articulating the objectives and aims and improved proficiency in using the English language
2. Communicate effectively and with good interpersonal skills; speak in public, engage the audience, and lead a group discussion
3. Critically evaluate the ethics of persuasive appeals and confidence to influence opinion
4. Analyse a specific piece of information; take in what is read, and use good writing techniques with proper grammar and syntax in all formal situations
5. Create awareness and empathy to emotional signals in communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														
4														
5														

1 **5 Hours**

UNIT 1

Creative Expression
Lesson Plan 1 Persuasive Discourse
Proposals

2 **5 Hours**

LESSON PLAN 2

Humor and satirical expression
Creating Business Memes
Comic Strips
Stand-up comedy
Caption writing
Limericks

3 **5 Hours**

UNIT 2

Formal Expression
Lesson Plan 3 Organizing Subject matter
Writing Action plans, Mind-Mapping, Paragraph writing
Logical reasoning
Conditional Clause
Opening and closing sentences

4 **5 Hours**

LESSON PLAN 4

Talking about plans
Action plans, Anecdotal references, order of communication/ narration, complete communication- WH - questions
Effective beginning and closing
Rhetorical questions
Appraising target audience

5 **5 Hours**

LESSON PLAN 5

Research Writing
Writing - SOPs, Research Objectives, Thesis Statement, Indexing, Academic Writing, Executive Summary, Survey Questionnaires, List of References

6 **5 Hours**

READING

Quantitative
Analysis and paraphrasing of reference materials

Total: 30 Hours

Reference(s)

1. Sangeeta Sharma et.al. Communication Skills for Engineers and Scientists, PHI Learning Pvt. Ltd, 2011
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001
4. Personality Development, Harold R. Wallace & L.Ann Masters, Cengage Learning, New Delhi
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji-Macmillan India Ltd. 1990, Delhi
6. English Grammar, Composition and Usage by N. K. Agrawal & F. T. Wood, Macmillan India Ltd., New Delhi

22IT501 PRINCIPLES OF COMMUNICATION 3 0 0 3

Course Objectives

- Understand the basic concepts of communication and its types
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques
- Gain knowledge on various mobile communication technologies and their performances

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. 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.

Course Outcomes (COs)

1. Analyze the performance of AM,FM and PM systems
2. Analyze and design various pulse modulation schemes for the transmission of analog message signal
3. Analyze the performance of various digital modulation techniques
4. Compare and analyze different multiple access techniques used for wireless communication systems
5. Design the spread spectrum modulation schemes for secured communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	2												
3	1	2												
4		2	1											
5		2	2											

UNIT I **9 Hours**

ANALOG COMMUNICATION

Elements of Communication systems - Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Radio Transmitter and Receiver-Basic principles of Frequency Modulation and Phase Modulation - Frequency Translation – Super-heterodyne Receiver - Envelope Detector - FM Receiver.

UNIT II **9 Hours**

PULSE MODULATION

Sampling process - Pulse Amplitude modulation - Pulse width modulation - Pulse position modulation - Bandwidth Noise trade off - Quantization process - Pulse Code Modulation - Noise considerations in PCM systems - Time Division Multiplexing.

UNIT III **9 Hours**

DIGITAL MODULATION

Introduction to pass band data transmission - Pass band transmission model - Coherent binary modulation techniques: BPSK, QPSK - Coherent Quadrature modulation techniques: QAM - Non-coherent binary modulation: BFSK, DPSK -

performance of digital modulation systems based on probability of error, band width.

UNIT IV **9 Hours**

MOBILE COMMUNICATION TECHNOLOGIES

Wireless transmission - Signal propagation - Medium access control: Motivation for a specialized MAC - TDMA - FDMA - CDMA - GSM: System architecture - Radio interface - Protocols - Localization and calling - Handover – Security- HSCSD-UMTS-LTE-3GPP (5G).

UNIT V **9 Hours**

SPREAD SPECTRUM MODULATION

Pseudo noise Sequences - A Notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Frequency hopping spread spectrum: Slow Frequency hopping, Fast Frequency hopping - RAKE receiver for wireless communication using CDMA

FOR FURTHER READING

A survey on 5G Communication and its applications

Total: 45 Hours

Reference(s)

1. Simon Haykin, Communication systems, 5th Edition, John Wiley and Sons, 2018.
2. Introduction to mobile network engineering : GSM, 3G-WCDMA, LTE and teh road to 5G,4th Edition,2018.
3. John Proakis, Massoud Salehi, Digital Communication, 5th Edition, McGraw-Hill, 2014.
4. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson, 2014.
5. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley, 2018.
6. A B Carlson and Paul Crilly, Communication Systems, 5th Edition, McGraw-Hill, 2017.

22IT502 COMPUTER NETWORKS 3 0 2 4

Course Objectives

- To understand the division of network functionality into layers and to familiarize the functions and protocols of each layer of TCP/IP protocol suite.
- To understand the components required to build different types of network and to learn concepts related to network addressing.
- To understand the flow of information from one node to another node in the network and to learn the application layer utilities.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.
d. 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.
e. 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.
f. 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.

Course Outcomes (COs)

1. Compare OSI model with TCP/IP protocol suite and design a network based on four different topologies.
2. Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.
3. Identify and apply the suitable routing algorithms for the given network.
4. Develop a client/server application using TCP/UDP and design algorithms for end-end communication.
5. Analyze the capabilities of application layer utilities and replicate the same for new applications.

Articulation matrix:

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	1	3										2	
2	1	2	3	1	1								2	

3	3	2	2										2	
4	1	3	2										2	
5	3	2											2	

UNIT I **9 Hours**

DATA COMMUNICATIONS

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer - Transmission Media: Guided Media, Unguided Media.

UNIT II **9 Hours**

DATA LINK LAYER

Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled

UNIT III **9 Hours**

NETWORK LAYER

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4 - Routing Algorithms- Unicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

UNIT IV **9 Hours**

TRANSPORT LAYER

Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.

UNIT V **9 Hours**

APPLICATION LAYER

Client Server Programming - WWW - HTTP - FTP - DNS – SNMP - DHCP.

1 **5 Hours**

EXPERIMENT 1

Experiment on configuring network topology using packet tracer.

2 **5 Hours**

EXPERIMENT 2

Experiment on error correction code like CRC and Checksum.

3 **5 Hours**

EXPERIMENT 3

Experiment on configuring router and switch.

4 **5 Hours**

EXPERIMENT 4

Experiment on ARP and RARP in live network.

5 **5 Hours**

EXPERIMENT 5

Experiment on routing algorithms like Distance Vector and Link State Routing.

6 **5 Hours**

EXPERIMENT 6

Experiment on chat programming using TCP and UDP sockets.

Total: 75 Hours

REFERENCE(S)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2017.
2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, Fifth Edition, Pearson Education, 2011.
3. William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2013.
4. Larry L Peterson and Bruce S Davie, Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
5. James F Kurose and Keith W Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Sixth Edition, Addison-Wesley, 2013.

22IT503 INFORMATION CODING TECHNIQUES 3 1 0 4

Course Objectives

- Apply the concept of probability to model information and compress text
- Use the principles of differential coding to compress speech
- Exploit the three types of redundancies to design image compression algorithms
- To have a detailed knowledge of compression and decompression techniques.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. 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.

Course Outcomes (COs)

1. Apply the concept of probability to model information and compress text
2. Apply the principles of differential coding to compress speech
3. Analyze the techniques involved in the design of audio and video compression algorithms
4. Apply compression techniques to compress text and images
5. Design algorithms to ensure error-free communication/information retrieval

Articulation Matrix

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	1	2	1											
2	1		2											
3		2	1											
4	1	1	2											
5		2												

UNIT I **9 Hours**

INFORMATION ENTROPY FUNDAMENTALS

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II **9 Hours**

DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III **9 Hours**

AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

UNIT IV **9 Hours**

COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG

standards.

UNIT V **9 Hours**

ERROR CONTROL CODING

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

FOR FURTHER READING

Case study on Wavelet compression.

Total: 60 Hours

Reference(s)

1. Simon Haykin, Communication Systems, John Wiley and Sons, 4th Edition, 2014
2. Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, 2012
3. Mark Nelson, Data Compression Book, BPB Publication, 2010
4. Rafael C.Gonzalez and Richard E.Woods, Digital image processing, PHI, 2013

22IT504 OBJECT ORIENTED PROGRAMMING WITH CPP and JAVA 2 0 2 3

Course Objectives

- Design, write, debug, run C++ and Java Programs.
- Develop console based applications using C++.
- Develop Console and windows applications using Java.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering

specialization to the solution of complex engineering problems
b. 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.
c. 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
e. 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.

Course Outcomes (COs)

1. Design class and objects for real world scenario.
2. Apply Inheritance concept to obtain code reusability.
3. Create applications to manipulate data from files using functions and streams
4. Develop console applications using Java OOPS.
5. Develop GUI application using Java library classes.

Articulation Matrix

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	1	3			3								1	
2	1	3	2		3								1	
3	1	3	3		3								2	
4	1	3	3		3								2	
5	1	3	3		3								2	

UNIT I **6 Hours**

CLASSES AND OBJECTS

Overview of OOPs Principles - Introduction to classes & objects - Instantiating and Using Classes with objects - Data Members - Member Functions - this Pointer - Constructor & Destructor - Control Structures - Arrays and Strings in C++ - Static class member

UNIT II **6 Hours**

INHERITANCE

Derived Class and Base Class - Derived Class Constructors - Overriding Member Functions - Public and Private Inheritance - Types of Inheritance: Single, Multi Level, Multiple, Hierarchical and Hybrid - Virtual Base Classes - Abstract Classes.

UNIT III **6 Hours**

FUNCTIONS AND STREAMS

Pointers - this Pointer - Pointers to Objects and Derived Classes - Function Overloading - Operator Overloading - Virtual Function - Friend Function - Static Function - Streams: Stream Classes - Unformatted I/O Operations - Formatted Console I/O Operations

UNIT IV **6 Hours**

JAVA BASICS

Java Basics - Classes and Objects - Inheritance- Interfaces - Abstract Class - packages - Exception handling- Strings - Type wrappers

UNIT V **6 Hours**

JAVA COLLECTIONS AND IO

Generics - Collections -Java Utility Classes - I/O Classes and Interfaces-Java Database Connectivity- Multithreading- Java swing basics

1 **3 Hours**

EXPERIMENT 1

Introduction to OOP lab (Simple C program) - Classes and Objects

2 **3 Hours**

EXPERIMENT 2

Programs using inheritance and polymorphism

3 **3 Hours**

EXPERIMENT 3

Programs on operator overloading

4 **3 Hours**

EXPERIMENT 4

Programs on dynamic memory management using new, delete operators

5 **3 Hours**

EXPERIMENT 5

Programs on exception handling

6 **3 Hours**

EXPERIMENT 6

Programs on generic programming using template function

7 **3 Hours**

EXPERIMENT 7

Programs on java classes and objects and strings

8 **3 Hours**

EXPERIMENT 8

Programs on inheritance in java

9 **3 Hours**

EXPERIMENT 9

Programs on multi-threading in java

10

EXPERIMENT 10 **3 Hours**

Programs on java swing

Total: 60 Hours

Reference(s)

1. E Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing, NewDelhi, 2011
2. Robert Lafore, Object Oriented Programming in C++, Galgotia Publication, 2010.
3. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw-Hill Education,2018
4. D.T. Editorial Services ,Java 8 Programming Black Book , second edition, Dreamtech Press,2015

22IT601 DATA MINING AND WAREHOUSING 3 0 2 4

Course Objectives

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in preprocessing the data
- Learn data mining algorithms, methods and tools

Course Outcomes (COs)

1. Design data warehouse by applying principles of dimensional modelling and ETL concepts
2. Analyze various data pre-processing techniques for efficient data mining.
3. Apply association rule mining for finding hidden and interesting patterns in data.
4. Apply statistical procedure, machine learning and neural network based classification algorithms for data prediction
5. Apply clustering algorithms for the application and generalizations for real time problems

UNIT I **9 Hours**

INTRODUCTION TO DATA WAREHOUSING

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modeling:Star schema,Snowflake schema and Galaxy schema .

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern-Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

UNIT IV **9 Hours**

CLASSIFICATION

Classification and Prediction ,Basic Concepts, Decision Tree Induction,Bayesian Classification ,Rule Based Classification, Classification by Back propagation , Support Vector Machines, Lazy learners.

UNIT V **9 Hours**

CLUSTERING

Types of Data in Cluster Analysis, Data similarity and dissimilarity measures, Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids, Hierarchical Methods-Agglomerative vs Divisive - Outlier Analysis and Detection.

FURTHER READING

Text mining, Web mining ,Multimedia mining,Spatial data mining

1 **4 Hours**

EXPERIMENT 1

Creation of a Data Warehouse

2 **4 Hours**

EXPERIMENT 2

Apriori Algorithm for market Basket Analysis

3 **4 Hours**

EXPERIMENT 3

Frequent Pattern-Growth Algorithm

4 **4 Hours**

EXPERIMENT 4

Bayesian Classification

5 **4 Hours**

EXPERIMENT 5

Decision Tree Induction Algorithm

6 **5 Hours**

EXPERIMENT 6

K-means clustering algorithm

7 **5 Hours**

EXPERIMENT 7

Hierarchical clustering algorithm

Total: 75 Hours

Reference(s)

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques,Third Edition, Elsevier, 2012.
2. Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010.
3. Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007.
5. G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

22IT602 COMPILER DESIGN 3 1 0 4

Course Objectives

- Understand the principles, algorithms, and data structures involved in the design and construction of compilers
- Acquire knowledge in construction of scanners, parsers and in intermediate code generation
- Familiar with the code generation schemes and optimization methods.

Course Outcomes (COs)

1. Examine the role of each phase of a compiler and the compiler construction tools
2. Construct Finite automata to recognize regular language
3. Construct Parser to recognize Context Free Grammar
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

UNIT I **8 Hours**
INTRODUCTION TO FORMAL LANGUAGES AND COMPILERS

Formal Language – Elements of Language - Formal Grammar – Chomsky Classification. Compilers: Language Processors – Structure of a Compiler - Grouping of Phases into Passes - Compiler Construction Tools.

UNIT II **9 Hours**
LEXICAL ANALYSIS

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Specification of tokens - Recognition of Tokens. Finite automata - Regular expression to finite automata- Optimization of DFA based Pattern Matches-Lexical Analyzer Generator Lex.

UNIT II **11 Hours**
SYNTAX ANALYSIS

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-Top Down parsing - LL(1) Grammars- Non-recursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing-LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser – Parser Generator YACC.

UNIT IV **8 Hours**
INTERMEDIATE CODE GENERATION

Variants of Syntax Trees- Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow - Switch-Statements - Backpatching

UNIT V **9 Hours**
CODE GENERATION

Issues in the Design of a Code Generator - The Target Language - Basic Blocks and Flow Graphs- Optimization of Basic Blocks - A Simple Code Generator- Principal Sources of Optimization.

Total: 45 Hours

REFERENCES

1. Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools, 2nd Edition, Pearson, 2012.
2. Torbengidius Mogensen, “Basics of Compiler Design”, Springer, 2011.
3. Charles N, Ron K Cytron, Richard J LeBlanc Jr., “Crafting a Complier”, Pearson Education, 2010
4. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008
5. Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2006.
6. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2007.

22IT603 CLOUD COMPUTING 3 0 2 4

Course Objectives

- To provide the ideal solution to manage enterprise resources effectively and efficiently by cloud computing.
- Identify the security and privacy issues in cloud computing.
- To develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

Course Outcomes (COs)

1. Outline the concept of virtualization in Cloud Computing.
2. Deploy applications over different Cloud computing infrastructures.
3. Implement Cloud Dockers to automate the deployment of applications.
4. Identify the security and privacy issues in cloud computing.
5. Implement the cloud applications to solve real time problems.

UNIT 1 **9 Hours**

INTRODUCTION

Introduction to Cloud Computing –Characteristics and Benefits of Cloud Computing- Hardware and software - Evolution of cloud computing - Server virtualization: parallel and vector processing.

UNIT II **9 Hours**

CLOUD SERVICE MODELS

Software as a Service (SaaS) - Infrastructure as a Service (IaaS)- Platform as a Service (PaaS) - Cloud Data Center - Service Oriented Architecture (SoA) – Basic approach to a Data center Based SoA.

UNIT III **9 Hours**

CLOUD DOCKER

Introduction – Docker Architecture –Docker Engine - Docker Containers - Docker Objects – Docker Run - Pipeline – Automation Scripts.

UNIT IV **9 Hours**

CLOUD SECURITY

Securing cloud boundary – Service boundary – Security mapping – Brokered cloud storage access - Storage location and tenancy – Encryption – Establishing the Identity and Presence.

UNIT V **9 Hours**

CLOUD APPLICATIONS & STORAGE

Applications in the cloud – Functionality mapping – Applications attributes – Cloud APIs-Cloud storage definition – Managed and Unmanaged cloud storage – Exploring cloud backup solutions – Cloud storage interoperability.

45 Hours

EXPERIMENT 1
Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows

2 **4 Hours**
EXPERIMENT 2
Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3 **4 Hours**
EXPERIMENT 3
Implement the procedure to transfer the files from one virtual machine to another virtual machine for reliable data access with the help of any open stack virtual machine

4 **4 Hours**
EXPERIMENT 4
Install the single node private cloud environment to resource allocation

5 **4 Hours**
EXPERIMENT 5
Implement the procedure to create and deploy a simple web application in public cloud environment

6 **4 Hours**
EXPERIMENT 6
Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim

7 **3 Hours**
EXPERIMENT 7
Create and Deploy applications on Microsoft Windows Azure

8 **3 Hours**
EXPERIMENT 8
Install Hadoop single node cluster and run simple applications like word count.

Total: 75 Hours

Reference(s):

- Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
- Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.
- Adrian Mouat — Using Docker: Developing and Deploying software with containers,O'Reilly Media ,2016.

- George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009., CRC Press, 2017
- Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
- IBM Cloud Computing http://www.ibm.com/cloud-computing/us/en/

22IT701 INFORMATION SECURITY 3 0 0 3

Course Objectives

- Understand information security's importance in our data-driven digital world.
- Acquire the knowledge of key concepts of information security and how they work.
- Develop a Security mindset learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, technologies, policies, laws, standards, and practices.

Course Outcomes (COs)

1. Examines the business drivers behind the information security analysis design process.
2. Illustrate the major components, scope, and target audience for each of the levels of security policy
3. Apply the suitable security technologies to segregate the organizations systems from the insecure Internet.
4. Identify the underlying foundations of modern cryptosystems and analyze the traditional symmetric encryption systems with more modern asymmetric encryption systems.
5. Interpret the several key laws, policies, standards and practices that shape the field of information security.

UNIT I **9 Hours**

INTRODUCTION TO INFORMATION SECURITY

The History of Information Security-Key Information Security Concepts-The Security Systems Development Life Cycle- Security Professionals and the Organization- Need for Security.

UNIT II **9 Hours**

INFORMATION SECURITY POLICY, STANDARDS AND PRACTICES

Information Security Planning and Governance - Information Security Policy, Standards, and Practices – The Information Security Blueprint -Security Education, Training, and Awareness Program – Continuity Strategies.

UNIT III **9 Hours**

SECURITY TECHNOLOGIES

Introduction-Access Control, Identification, Authentication, Authorization and Accountability-Firewalls Virtual Private Networks (VPNs)- Intrusion Detection and Prevention Systems - Scanning and Analysis Tools- Biometric Access Controls.

UNIT IV **9 Hours**

CRYPTOGRAPHY

Foundations of Cryptology-Cipher Methods-Cryptographic Algorithms-Cryptographic Tools-Protocols for Secure Communications-Attacks on Cryptosystems.

UNIT V **9 Hours**

LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY

Law and Ethics in Information Security - General Computer Crime Laws - International Laws and Legal Bodies - Agreement on Trade-Related Aspects of Intellectual Property Rights - Digital Millennium Copyright Act (DMCA) - Ethics and Information Security-Codes of Ethics and Professional Organizations.

Total: 45 Hours

Reference(s)

1. Michael E Whitman, Herbert J Mattord , Principles of Information Security ,Sixth Edition, Cengage Learning,2017.
2. Mark Stamp, Information Security : Principles and Practices, Wiley ,Second edition,2011
3. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India/Pearson Education, New Delhi, 2007.
4. Charles B.fleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Education, 2014.
5. Dieter Gollmann, Computer Security, John Wiley & Sons Ltd., 2011.
6. SunitBelapure and Nina Godbole , Cyber Security, Wiley, 2011

22IT702 ARTIFICIAL INTELLIGENCE 3 0 2 4

Course Objectives

- Understand the fundamental concepts of artificial intelligence
- Impart the different paradigms in knowledge representation and reasoning
- Determine the problems to solve using artificial intelligence and machine learning

Course Outcomes (COs)

1. Understand the awareness of intelligent agents and problem solving using uninformed, informed and local search methods
2. Identify the knowledge representation and reasoning techniques in logic programming
3. Implement the use of planning and simple decision making
4. Apply and integrate various artificial intelligence techniques in intelligent system development
5. Summarize the basic features of JADE and develop simple programs using it

UNIT I **9 Hours**

INTRODUCTION

Intelligent Agents - Agents and environments - Good behavior - The nature of environments - Structure of agents - Problem Solving - Problem solving agents- Uniformed search strategies - Avoiding repeated states- Searching with partial information.

UNIT II **9 Hours**

SEARCHING TECHNIQUES

Informed search and exploration - Informed search strategies - heuristic function - Local search algorithms and optimization problems- Local search in continuous spaces - Online search agents and unknown environments -Constraint satisfaction problems (CSP)-Backtracking search and Local search for CSP

UNIT III **9 Hours**

KNOWLEDGE REPRESENTATION

First order logic - Representation revisited - Syntax and semantics for first order logic - Using first order logic -Knowledge engineering in first order logic - Inference in First order logic - Prepositional versus first order logic - Unification and lifting - Forward chaining - Backward chaining-Ontological Engineering

UNIT IV **9 Hours**

PLANNING

Planning problem- Planning with state space search - Partial order planning - Planning graphs - Planning with proportional logic - Time, Schedules, and Resources - Hierarchical task Planning - Conditional Planning - Execution monitoring and re planning-Continuous planning

UNIT V **9 Hours**

LEARNING

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning - Logical formulation of learning - Explanation based learning -Learning using relevant information-Statistical Learning Methods

1 **4 Hours**

EXPERIMENT 1

Implement the Logic Programming for solving N-Queen problem

2 **4 Hours**

EXPERIMENT 2

Implement the Logic Programming for solving Zebra puzzle

3 **4 Hours**

EXPERIMENT 3

A magic square is an arrangement of distinct numbers, generally integers, in a square grid, where the numbers in each row, and in each column, and the numbers in the diagonal, all add up to the same number called the "magic constant".

Implement Heuristic Search to generate Magic squares

4 **6 Hours**

EXPERIMENT 4

Build a Bot to Play Tic Tac Toe gaming problem

5 **6 Hours**

EXPERIMENT 5

Implement Bayes Inference Rule to a problem of drug screening (mandatory testing for federal or many other jobs which promise a drug-free work environment). Suppose that a test for using a particular drug is 97% sensitive and 95% specific. That is, the test will produce 97% true positive results for drug users and 95% true negative results for non-drug users. These are the pieces of data that any screening test will have from their history of tests. Bayes' rule allows us to use this kind of data-driven knowledge to calculate the final probability.

6 **6 Hours**

EXPERIMENT 6

Harry installed a new burglar alarm at his home to detect burglary. The alarm reliably responds at detecting a burglary but also responds for minor earthquakes. Harry has two neighbors David and Sophia, who have taken a responsibility to inform Harry at work when they hear the alarm. David always calls Harry when he hears the alarm, but sometimes he got confused with the phone ringing and calls at that time too. On the other hand, Sophia likes to listen to high music, so sometimes she misses to hear the alarm. Here we would like to compute the probability of Burglary Alarm.

Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called the Harry using Bayes Belief Networks

Total: 75 Hours

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence - A Modern Approach, Prentice Hall India, 2012
2. Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Tata Mcgraw-Hill, 1997.
3. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2010.
4. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publisher, 2010.
5. Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi agent Systems with JADE, John Wiley and Sons Ltd, 2007.

22IT001 EXPLORATORY DATA ANALYSIS 3 0 0 3

Course Objectives

- To outline an overview of exploratory data analysis
- To implement data cleaning and preparation techniques
- To perform descriptive statistics and data visualization techniques to present insights from the data
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high-dimensional data

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis
2. Implement the data cleaning and preparation techniques
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3									
2	2	2	2	3	3									
3	2	3	2	2	3									
4	2	2	2	2	3									
5	2	2	3	2	1									

UNIT I **6 Hours**

EXPLORATORY DATA ANALYSIS

Overview of Exploratory Data Analysis- importance of EDA - data analysis process: data collection, data cleaning, and data exploration- Introduction to common data types and formats - Introduction to Python - data analysis libraries

UNIT II **6 Hours**

DATA CLEANING AND PREPARATION

Introduction to data quality issues and common data cleaning techniques - Handling missing data and outliers - Data transformation techniques - Feature engineering and variable creation

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape - Data visualization principles and best practices - Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables - Bivariate analysis: exploring relationships between variables - Multivariate analysis: analyzing relationships among multiple variables - Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction - Principal Component Analysis (PCA) and its applications - Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

Total: 30 Hours

Reference(s)

1. Provost Foster and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking O Reilly Media Inc. 2013. (Unit 1)
2. McKinney Wes Python for Data Analysis O Reilly Media Inc 2022 Unit 1 3 5
3. Knaflic Cole Nussbaumer Storytelling with data A data visualization guide for business professionals John Wiley & Sons 2015 (Unit 2)
4. Kazil Jacqueline and Katharine Jarmul Data wrangling with python tips and tools to make your life easier O Rilly Media Inc 2016 (Unit 3)
5. Wickham Hadley and Garrett Grolemund R for data science import tidy transform visualize and model data O Reilly Media Inc 2016 (Unit 4, 5)
6. Matthew O Ward Georges Grinstein, Daniel Keim Interactive Data Visualization Foundations Techniques and Applications 2nd Edition CRC press 2015

22IT002 RECOMMENDER SYSTEMS 3 0 0 3

Course Objectives

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1									
2	1	2	1	1	1									
3	2	3	1	1	1									
4	3	2	2	2	1									
5	2	2	1	2	1									

UNIT I **9 Hours**

INTRODUCTION

Introduction and basic taxonomy of recommender systems Traditional and non-personalized Recommender Systems Overview of data mining methods for recommender systems similarity measures Dimensionality

reduction Singular Value Decomposition SVD

UNIT II **9 Hours**

CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems Item profiles Representing item profiles Methods for learning user profiles Similarity-based retrieval and Classification algorithms.

UNIT III **9 Hours**

COLLABORATIVE FILTERING

A systematic approach Nearest-neighbor collaborative filtering (CF) user-based and item-based CF components of neighborhood methods (rating normalization similarity weight computation and neighborhood selection

UNIT IV **9 Hours**

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction Types of Attacks Detecting attacks on recommender systems Individual attack Group attack Strategies for robust recommender design Robust recommendation algorithms.

UNIT V **9 Hours**

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms User Studies Online and Offline evaluation Goals of evaluation design Design Issues Accuracy metrics Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C Aggarwal Recommender Systems The Textbook Springer 2016
2. Dietmar Jannach Markus Zanker Alexander Felfernig and Gerhard Friedrich Recommender Systems An Introduction Cambridge University Press (2011) 1st ed.
3. Francesco Ricci Lior Rokach Bracha Shapira Recommender Systems Handbook 1st ed Springer (2011)
4. Jure Leskovec Anand Rajaraman Jeffrey David Ullman Mining of massive datasets 3rd edition Cambridge University Press 2020

22IT003 BIG DATA ANALYTICS 3 0 0 3

Course Objectives

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in MapReduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools
4. Understand the basics of Hadoop
5. Apply the usage of Hadoop related tools for Big Data Analytics

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								2	2
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								1	3

UNIT I **9 Hours**

UNDERSTANDING BIG DATA

Introduction to big data Convergence of key trends Unstructured data Industry examples of big data Web analytics Big data applications Big data technologies Introduction to Hadoop Open source technologies Cloud and big data Mobile business intelligence Crowd sourcing analytics Inter and trans firewall analytics.

UNIT II **9 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL Aggregate data models Key value and document data models Relationships Graph databases Schema less databases Materialized views Distribution models Master-slave replication Consistency Cassandra Cassandra data model Cassandra examples Cassandra clients

UNIT III **9 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows Unit tests with MRUnit Test data and local tests Anatomy of MapReduce job run Classic Map reduce YARN Failures in classic Map-reduce and YARN Job scheduling Shuffle and sort Task execution MapReduce types Input formats Output formats

UNIT IV **9 Hours**

BASICS OF HADOOP

Data format Analyzing data with Hadoop Scaling out Hadoop streaming Hadoop pipes Design of Hadoop distributed file system (HDFS) HDFS concepts Java interface Data flow Hadoop I/O Data integrity Compression Serialization Avro File based data structures Cassandra Hadoop integration.

UNIT V **9 Hours**

HADOOP RELATED TOOLS

Hbase Data model and implementations Hbase clients Hbase examples Praxis. Pig Grunt Pig data model Pig Latin Developing and testing Pig Latin scripts. Hive Data types and file formats HiveQL data definition HiveQL data manipulation HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today"s Businesses", Wiley,2013
2. Eric Sammer, "Hadoop Operations", O"Reilley, 2012.
3. Sadalage Pramod J. NoSQL distilled 2013
4. E. Capriolo D. Wampler and J. Rutherglen Programming Hive O Reilley 2012.
5. Lars George HBase The Definitive Guide O Reilley 2011
6. Eben Hewitt Cassandra The Definitive Guide O Reilley 2010.

22IT004 NEURAL NETWORKS AND DEEP LEARNING

3 0 0 3

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications
2. Analyze the various categories of associative memory and unsupervised learning networks
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II **6 Hours**

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks Deep Learning Neural Networks-Extreme Learning Machine Model Convolutional Neural Networks The Convolution Operation Mo ivation Pooling Variants of the basic Convolution Function Structured Outputs Data Types Efficient Convolution Algorithms Neuroscientific Basis Applications Computer Vision Image Generation Image Compression

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning A Probabilistic Theory of Deep Learning Gradient Learning Chain Rule and Backpropagation Regularization Dataset Augmentation Noise Robustness Early Stopping Bagging and Dropout batch normalization VC Dimension and Neural Nets

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks Introduction Recursive Neural Networks Bidirectional RNNs Deep Recurrent Networks Applications Image Generation Image Compression Natural Language Processing Complete Auto encoder Regularized Autoencoder Stochastic Encoders and Decoders Contractive Encoders

Total: 30 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning A Textbook, Springer International Publishing, 1st Edition, 2018
3. James A Freeman, David M S Kapura, Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22IT005 NATURAL LANGUAGE PROCESSING 3 0 0 3

Course Objectives

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Natural Language Processing - Components - Basics of Linguistics and Probability and Statistics - Words-Tokenization-Morphology-Finite State Automata.

UNIT II **9 Hours**

STATISTICAL NLP AND SEQUENCE LABELING

N-grams and Language models -Smoothing -Text classification-NaÃƒÂ¯ve Bayes classifier -Evaluation - Vector Semantics - TF-IDF - Word2Vec- Evaluating Vector Models -Sequence Labeling - Part of Speech - Part of Speech Tagging -Named Entities -Named Entity Tagging.

UNIT III **9 Hours**

CONTEXTUAL EMBEDDING

Constituency -Context Free Grammar -Lexicalized Grammars- CKY Parsing - Earleys algorithm Evaluating Parsers -Partial Parsing - Dependency Relations- Dependency Parsing -Transition Based -Graph Based

UNIT IV **9 Hours**

COMPUTATIONAL SEMANTICS

Word Senses and WordNet - Word Sense Disambiguation - Semantic Role Labeling - Proposition Bank-FrameNet- Selectional Restrictions - Information Extraction - Template Filling.

UNIT V **9 Hours**

DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence - Discourse Structure Parsing - Centering and Entity Based Coherence - Question Answering - Factoid Question Answering - Classical QA Models - Chatbots and Dialogue systems - Frame-based Dialogue Systems - Dialogue-State Architecture
FOR FURTHER READING
Frame-based Dialogue Systems - Dialogue - State Architecture

Total: 45 Hours

Reference(s)

1. 1.Daniel Jurafsky and James H.Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020.
2. 2.Jacob Eisenstein. Natural Language Processing , MIT Press, 2019.
3. 3.Samuel Burns - Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. 4.Christopher Manning, Foundations of Statistical Natural Language Processing, MIT Press,2009.
5. 5.Nitin Indurkhya,Fred J. Damerau, Handbook of Natural Language Processing, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

22IT006 COMPUTER VISION 3 0 0 3

Course Objectives

- To understand the fundamental concepts related to Image formation and processing
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image-based rendering and recognition

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
f. 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.
g. 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
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic and some advanced image processing techniques in OpenCV.

3. To apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques
5. To design and develop innovative image processing and computer vision applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		2		2	1	2	2	3	
3	3	3	2	2	3				1	1	2	2	3	-
4	2	3	3	2	3				2	1	2	3	2	
5	2	3	3	2	2	2			2	1	2	3	3	

UNIT I **9 Hours**

INTRODUCTION TO IMAGE FORMATION AND PROCESSING

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization

UNIT II **8 Hours**

FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods

UNIT III **10 Hours**

FEATURE-BASED ALIGNMENT

2D and 3D feature-based alignment- Pose estimation - Geometric intrinsic calibration -Triangulation -Two-frame structure from motion -Factorization -Bundle adjustment -Constrained structure and motion - Translational alignment -Parametric motion -Spline-based motion-Optical flow - Layered motion

UNIT IV **9 Hours**

3D RECONSTRUCTION

Shape from X - Active range finding - Surface representations -Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V **9 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based Rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

Total: 45 Hours

Reference(s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

22IT007 AGILE SOFTWARE DEVELOPMENT 3 0 0 3

Course Objectives

- To provide students with a theoretical as well as practical understanding of agile software development practices.
- To understand the Agile Scrum framework and development practices.
- To apply software design principles and refactoring techniques to achieve agility.
- To understand Agile requirements and perform testing activities within an agile project.
- To understand the benefits and pitfalls of working in an Agile team in terms of quality assurance.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	2		-							2	2	
2	1	2	2									-	2	
3	1		2		2							2	2	
4	1		2		2							2	2	
5	1		1		2							2	2	

UNIT I **9 Hours**

AGILE METHODOLOGY

Theories for Agile management - agile software development - traditional model vs. agile model - classification of agile methods - agile manifesto and principles - agile project management - agile team

interactions - ethics in agile teams - agility in design - testing - agile documentations - agile drivers - capabilities and values

UNIT II **9 Hours**

AGILE PROCESSES

Extreme Programming: Method overview - lifecycle - work products, roles and practices - Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model

UNIT III **9 Hours**

AGILITY AND KNOWLEDGE MANAGEMENT

Agile information systems - agile decision making - Earls schools of KM - institutional knowledge evolution cycle - development, acquisition, refinement, distribution, deployment, leveraging - KM in software engineering - managing software knowledge - challenges of migrating to agile methodologies - agile knowledge sharing - role of story-cards - Story - card Maturity Model (SMM)

UNIT IV **9 Hours**

AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE - current agile practices - variance - overview of RE using agile - managing unstable requirements - requirements elicitation - agile requirements abstraction model - requirements management in agile environment, agile requirements prioritization - agile requirements modeling and generation - concurrency in agile requirements generation

UNIT V **9 Hours**

AGILITY AND QUALITY ASSURANCE

Agile Interaction Design - Agile product development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile approach to Quality Assurance - Test Driven Development - Pair programming: Issues and Challenges - Agile approach to Global Software Development

Total: 45 Hours

Reference(s)

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds), Agile Software Development, Current Research and Future Directions, Springer - Verlag Berlin Heidelberg, 2010
2. David J. Anderson; Eli Schragenheim, - Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003
3. Hazza& Dubinsky, - Agile Software Engineering, Series - Undergraduate Topics in Computer Science, Springer, VIII edition, 2009
4. Craig Larman, - Agile and Iterative Development -A manager""s Guide, Addison - Wesley, 2004
5. Kevin C. Desouza, - Agile information systems: conceptualization, construction, and managemen, Butterworth - Heinemann, 2007

22IT008 UI AND UX DESIGN **3 0 0 3**

Course Objectives

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved Able o to understand UX design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

UNIT I **9 Hours**

USER-CENTERED DESIGN PROCESS

Scripting Languages - HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface

(UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation - Primary and Secondary persona - Requirement definition - Creative ideation - brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

UNIT II **9 Hours**

FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Master the Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III **9 Hours**

ELEMENTARY SKETCHING

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools - Figma - Low-High Fidelity Design : Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions

UNIT IV **9 Hours**

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System - Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements

UNIT V **9 Hours**

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation - Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud - Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World

Product Design : Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

Total: 45 Hours

Reference(s)

1. 1.Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. 2.Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. 3.Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. 4.Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
5. 5.Ben Sheiderman, Design The User Interface, Pearson Education, 1998.
6. 6.Alan Cooper, The Essential Of User Interface Design, Wiley- Dream Tech Ltd.,2002.

22IT009 WEB FRAMEWORKS 3 0 0 3

Course Objectives

- Understand the architecture behind an Angular application and how to use it
- To understand the significance of using MongoDB as a database system
- To understand the role of React in designing front-end components
- Build a Web Server in Node and understand how it really works
- Develop a web application and API using web frameworks

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. 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.
e. 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.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages
2. Create web applications by performing CRUD operations in database using web frameworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS
5. Use Node Package Manager and Node packages for Server Side programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2				2	2			2	
2	1		1		3				2	2			3	
3	1		2		2				2	2			3	
4	1		1		3				2	2			2	
5	1		1		3				1	1			2	

UNIT I **9 Hours**

ANGULAR FRONT-END FRAMEWORK

Introduction - Setup - Architecture: Modules, Components, Services and DI fundamentals - Components and Templates - Configuration - Forms - Observables & RxJS - Boot Strapping - Ng Modules - Dependency Injection - Http Client - Routing and Navigation - Animations

UNIT II **9 Hours**

FRAMEWORKS WITH DATABASES

MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD operations - projections - Indexing - Aggregation - Replication - Sharding - Creating backup - Deployment

UNIT III **9 Hours**

ANGULAR TECHNIQUES

Service workers & PWA - Server side rendering - Angular Libraries - Schematics - CLI Builders - Angular Ivy - Web Workers

UNIT IV **9 Hours**

REACT

React Introduction - React ES6 - React Render HTML - React JSX - Components - React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components - React Forms - React CSS - React SaaS

UNIT V **9 Hours**

NODE JS BACK-END FRAMEWORK

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js EventEmitter - Frameworks for Node.js - Express.js Web App - Serving static Resource - Node.js Data Access

Total: 45 Hours

Reference(s)

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman,Learning Angular, Packt Publishing Limited, 2nd Revised edition edition, 2017.
3. Caleb Dayley Brad Dayley,Brendan Dayley ,Node.js, MongoDB and Angular Web Development, 2nd Edition,Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step , O''Reilly; First edition, 2018

22IT010 APP DEVELOPMENT 2 0 2 3

Course Objectives

- To facilitate students to understand android SDK
- To help students to gain a basic understanding of Android application development
- To inculcate working knowledge of Android Studio development tool

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify fundamental concepts of mobile programming that make it unique from programming for other platforms
2. Analyze the essential of Android Application with their anatomy and terminologies
3. Apply rapid prototyping techniques to design, develop and deploy the Android Applications
4. Analyze the essentials of User Interface Design in IOS with SQLite Database
5. Design the flutter applications on the Android marketplace for distribution

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3								1	
2	1	2	2		3								2	
3	1		2		3								2	
4	1	1	2		3								3	
5	1	2	2		3								3	

UNIT I **6 Hours**

INTRODUCTION TO ANDROID

The Android Platform - Android SDK - Eclipse Installation - Android Installation - building your First Android application - Understanding the Android Manifest file

UNIT II **6 Hours**

ANDROID APPLICATION DESIGN ESSENTIALS

Anatomy of Android applications - Android terminologies - Application Context - Activities - Services -

Intents - Receiving and Broadcasting Intents - Using Intent Filter - Permissions

UNIT III **9 Hours**

COMMON ANDROID APIS

Testing Android applications - Publishing Android applications - Using Android Data and Storage APIs - managing data using SQLite - Using Android Web APIs - Using Android Telephony APIs - Deploying Android Applications to the World

UNIT IV **9 Hours**

IOS USER INTERFACE DESIGN ESSENTIALS

IOS features - UI implementation - Touch frameworks - Data persistence using Core Data and SQLite - Integrating calendar and address book with social media application - Using WIFI - iPhone marketplace

UNIT V **10 Hours**

APP DEVELOPMENT WITH FLUTTER

Flutter Introduction - Create First Flutter Application - Exploring commonly used flutter widgets: Container - Margin - Padding and Box Constraints - Custom Fonts - Column and Expanded Widgets - Image Asset - Raised Button - and Alert Dialog

1 **2 Hours**

EXPERIMENT 1

Develop a simple application with one EditText so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice

2 **2 Hours**

EXPERIMENT 2

Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number

3 **3 Hours**

EXPERIMENT 3

Create a SIGNUp activity with Username and Password. Validation of password should happen based on the following rules:
Password should contain uppercase and lowercase letters.
Password should contain letters and numbers.
Password should contain special characters.
Minimum length of the password (the default value is 8).
On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another

4 **4 Hours**

EXPERIMENT 4

Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in

the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name

5 **4 Hours**

EXPERIMENT 5

Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds

6 **3 Hours**

EXPERIMENT 6

Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts

7 **2 Hours**

EXPERIMENT 7

Implement UI elements like TextFields, Label, Toolbar, Statusbar, Tabbar

Total: 60 Hours

Text Book(s)

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Second Edition, Pearson Education, 2011

Reference(s)

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd 3. R3. Android Application Development All in one for Dummies by Barry Burd
3. Alberto Miola, "Flutter Complete Reference: Create beautiful, fast and native apps for any device" ISBN-13 9780141044804
4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.55

22IT011 SOFTWARE TESTING AND AUTOMATION 3 0 0 3

Course Objectives

- Understand the importance of software testing in the software development process
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts
- Apply automation testing tools and frameworks to design and implement automated test suites

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of testing in the software development process
2. Compare the different test case design strategies
3. Analyze the different levels of testing and their importance
4. Apply test management techniques and the role of a test specialist
5. Analyze the software test automation and its requirements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		1								1	
2	2	3	2		2								1	
3	2	2	2		2								1	
4	2	3	2		3								1	
5	3	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Basic definitions - Software Testing Principles - The Tester''s Role in a Software Development Organization - Origins of Defects - Cost of Defects - Defect Classes - The Defect Repository and Test Design - Defect Examples - Developer/Tester Support of Developing a Defect Repository

UNIT II **9 Hours**

TEST CASE DESIGN STRATEGIES

Test Scenarios - Test Cases - Test case Design Strategies - Black Box Approach to Test Case Design - Using White Box Approach to Test design - Test Adequacy Criteria - Static testing vs. Structural testing - Code functional testing - Coverage and Control Flow Graphs - Covering Code Logic - Paths - Code complexity testing - Additional White box testing approaches - Test Coverage

UNIT III **9 Hours**

LEVELS OF TESTING

Types of testing - manual and automation - Introduction to testing methods - White-box, Black-box and Grey-box - Functional testing - Non-functional testing - Introduction to levels of testing - Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing - Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing

UNIT IV **9 Hours**

TEST MANAGEMENT

People and organizational issues in testing - Organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group - The Structure of Testing Group - The Technical Training Program

UNIT V **9 Hours**

TEST AUTOMATION

Software test automation - Design and Architecture for Automation - Automation testing - Automation Tools - Selenium Web Driver - Create Selenese Commands - TestNG - TestNG Annotations - Jmeter - Assertions in JMeter - Junit

Total: 45 Hours

Reference(s)

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson Education, 2006
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007
3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003
4. Edward Kit, "Software Testing in the Real World - Improving the Process", Pearson Education, 1995
5. Boris Beizer, "Software Testing Techniques", Second Edition, Van Nostrand Reinhold, New York, 1990
6. Aditya P. Mathur, "Foundations of Software Testing - Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

22IT012 DEVOPS **3 0 0 3**

Course Objectives

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand different actions performed through Version control tools like Git
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
3. Ability to Perform Automated Continuous Deployment
4. Ability to do configuration management using Ansible
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2								3	
2	3	3	3	3	2								2	
3	2	2	2	3	2								2	
4	2	2	2	2	2								2	
5	2	2	2	2	2								3	

UNIT I **7 Hours**

INTRODUCTION TO DEVOPS

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and GitHub

UNIT II **10 Hours**

COMPILE AND BUILD USING MAVEN

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles - Maven repositories (local, central, global) - Maven plugins - Maven create and build Artifacts - Dependency Management - Installation of Gradle - understanding build using Gradle

UNIT III **12 Hours**

CONTINUOUS INTEGRATION USING JENKINS

Install & Configure Jenkins - Jenkins Architecture Overview - creating a Jenkins Job - Configuring a Jenkins job - Introduction to Plugins - Adding Plugins to Jenkins - commonly used plugins (Git Plugin, Parameter Plugin- HTML Publisher - Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java - Git - and Maven - Creating a Jenkins Build and Jenkins workspace

UNIT IV **9 Hours**

CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction - Installation - Ansible master/slave configuration - YAML basics - Ansible Modules - Ansible Inventory files - Ansible playbooks - Ansible Roles - and ad-hoc commands in Ansible

UNIT V **7 Hours**

BUILDING DEVOPS PIPELINES USING AZURE

Create GitHub Account, Create Repository - Create Azure Organization - Create a new pipeline - Build a sample code - Modify azure - pipelines - yaml file

Total: 45 Hours

Reference(s)

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014
3. Mitesh Soni, "Hands-On Azure DevOps: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure, English Edition, Paperback - 1 January 2020
4. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015
5. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
6. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

22IT013 VIRTUALIZATION IN CLOUD COMPUTING 3 0 0 3

Course Objectives

- 1. Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud based applications
- 2. Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- 3. Identify major security and privacy problems in cloud computing environment
- 4. Apply the ability to use the architecture of cloud, service and delivery models
- 5. Implement the key enabling technologies that help in the development of cloud.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Analyze the concept of virtualization and its properties.
2. 2. Apply different forms of virtualization.
3. 3. Implement various architectures for implementing virtualization methods.
4. 4. Create virtual machines and installing various operating systems.
5. 5. Evaluate the performance of the virtual machines and deployed applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3									1	
2			1	2	3								-	1
3			2	1	3									2
4	1		2	1	3									2
5	1		3		2									2

UNIT I **9 Hours**

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moores Law-Understanding the Importance of Virtualization -Examining Todays Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications.

UNIT II **9 Hours**

HYPERVISORS

Describing a Hypervisor -Exploring the History of Hypervisors -Understanding Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor -Holodecks and Traffic Cops -Resource Allocation -Comparing Todays Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

UNIT III **9 Hours**

UNIT III

Introduction to Virtual Machine - CPUs in a Virtual Machine -Memory in a Virtual Machine -Network Resources in a Virtual Machine - Storage in a Virtual Machine -Understanding How a Virtual Machine Works -Working with Virtual Machines -Virtual Machine Clones -Templates -Snapshots -OVF -Containers

UNIT IV **9 Hours**

CREATION OF VIRTUAL MACHINES

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

UNIT V **9 Hours**

AVAILABILITY

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers - Examining Virtual Infrastructure Performance Capabilities -Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps -Open Stack and Containers.

Total: 45 Hours

Reference(s)

1. 1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. 2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. 3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. 4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. 5. http//www.microsoft.com/learning/default.mspx
6. 6. https://www.oreilly.com/library/view/cloud- security-and/9780596806453/ch04.html

22IT014 CLOUD SERVICES AND DATA MANAGEMENT

3 0 0 3

Course Objectives

- 1. Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- 3. Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack
- 4. Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- 5. Select appropriate structures for designing, deploying and running cloud-based services in a business environment

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Apply Cloud Computing reference architecture for developing clouds
2. 2. Analyze the different forms of cloud service models
3. 3. Apply the characteristics and architecture of IaaS using various real world applications.
4. 4. Evaluate PaaS concepts and architectures with real-world examples
5. 5. Analyze, and synthesize concepts related to the SaaS delivery model.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1									
2	3	1	2	3	2									
3	1	1	3	1	3									2
4	1	1	1	2	3									2
5	1	3	3	2	2									1

UNIT I **9 Hours**

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds.

UNIT II **9 Hours**

INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

UNIT III **9 Hours**

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

UNIT IV **9 Hours**

PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

UNIT V **9 Hours**

SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

Total: 45 Hours

Reference(s)

1. 1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011
2. 2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
3. 3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011
4. 4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010
5. 5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O reilly, SPD, 2011

22IT015 CLOUD STORAGE TECHNOLOGIES 3 0 0 3

Course Objectives

- 1. Characterize the functionalities of logical and physical components of storage
- 2. Describe various storage networking technologies
- 3. Identify different storage virtualization technologies
- 4. Discuss the different backup and recovery strategies
- 5. Understand common storage management activities and solutions

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
2. 2. Apply the usage of advanced intelligent storage systems and RAID.
3. 3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. 4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. 5. Implement the security needs and security measures to be employed in information storage management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								2	
2	3	1	2	3	3									1
3	1	1	2	3	3									2
4	3	2	1	2	2									1

5	1	3	2	1	2									2

UNIT I **8 Hours**

STORAGE SYSTEMS

Cloud Storage Fundamentals and Architecture - Cloud Storage Providers and Services - Access methods (RESTful APIs, SDKs) for cloud object storage - Block storage technologies in cloud environments - File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols -Hybrid Cloud Storage - Data Migration - Data Lifecycle Management in the Cloud

UNIT II **9 Hours**

INTELLIGENT STORAGE SYSTEMS AND RAID

Storage Tiering and Caching - Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation - RAID Technologies in Cloud Storage: RAID Levels - Data Striping, Mirroring, and Parity for Fault Tolerance - RAID Configuration and Performance Optimization

UNIT III **10 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Storage Networking in Cloud Environments - Understanding storage protocols - Network-attached storage (NAS) vs. storage area network (SAN) - Storage virtualization techniques and technologies - Network-Attached Storage (NAS) - Storage Area Network (SAN) - iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage - Network Virtualization and Overlay Networks - Storage Virtualization and Abstraction - Network Performance Optimization - Network Security in Cloud Storage

UNIT IV **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security - Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods - Disaster Recovery in the Cloud - Hybrid Backup and Archiving in Cloud Environments - Backup and Archive Management in Cloud Environments

UNIT V **9 Hours**

SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems - Storage-level Encryption and Application-level Encryption - Storage infrastructure Management Functions and Processes.

Total: 45 Hours

Reference(s)

1. 1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O Reilly, 2009.
2. 2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. 3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. 4. Rittinghouse, John W., and James F. Ransome, Cloud Computing Implementation, Management and Security, CRC Press, 2017.

5. 5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

22IT016 CLOUD AUTOMATION TOOLS AND APPLICATIONS

3 0 0 3

Course Objectives

- 1. To learn the options for running automation tools, and load balancers in the cloud-native applications.
- 2. To learn the configuration management in the cloud.
- 3. To know why cloud automation is important.
- 4. To learn what types of cloud automation tools can be used.
- 5. To learn load balancing and auto scaling in the cloud.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement cloud native applications on AWS, Terraform etc.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3									2
2		2			3									1
3			3	2	3									2
4			2		3								2	
5			2		3									2

UNIT I **7 Hours**

UNDERSTANDING THE CLOUD AUTOMATION

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying & Destroying AWS environment with Terraform. Introduction to Packer.

UNIT II **9 Hours**

ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

UNIT III **9 Hours**

AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD

Cloud automation at scale, Cloud Configuration Management unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments Balancers.

UNIT IV **9 Hours**

LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer

UNIT V **11 Hours**

AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

Total: 45 Hours

Reference(s)

1. 1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures,O"Reilly Media, First Edition, 2021.
2. 2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. 3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. 4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. 5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

22IT017 SOFTWARE DEFINED NETWORKS 2 0 2 3

Course Objectives

- understand the need for SDN and its data plane operations
- understand the functions of control plane
- comprehend the migration of networking functions to SDN environment
- explore various techniques of network function virtualization
- comprehend the concepts behind network virtualization

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply the motivation behind SDN
2. Analyze the functions of the data plane and control plane
3. Evaluate and develop network applications using SDN
4. Execute network services using NFV
5. Implement various use cases of SDN and NFV

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3	1	3									
2	2	1	2	2	3								1	
3	2	2	2	3	3									
4	2	2	2	3	1									
5	3	3	1	1	3								2	

UNIT I **6 Hours**

SDN:INTRODUCTION

History of Software Defined Networking (SDN)-Modern Data Center - Traditional Switch Architecture - Why SDN - Evolution of SDN - How SDN Works - Centralized and Distributed Control and Date Planes

UNIT II **6 Hours**

SDN DATA PLANE AND CONTROL PLANE

Data Plane functions and protocols - OpenFLow Protocol - Packet Processing and Performance Optimization - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface - SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III **6 Hours**

SDN APPLICATIONS

SDN Application Plane Architecture - Network Services Abstraction Layer - Traffic Engineering - Measurement and Monitoring - Security - Data Center Networking - Wide Area Networks (WAN) - Service Provider Networks - Internet Service Providers (ISPs)

UNIT IV **6 Hours**

NETWORK FUNCTION VIRTUALIZATION

Network Virtualization - NFV Architecture - Virtual LANs - OpenFlow VLAN Support - NFV Standards and Frameworks - NFV Concepts - Benefits and Requirements - Reference Architecture

UNIT V **6 Hours**

NFV FUNCTIONALITY

NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Cor, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV

1 **5 Hours**

EXPERIMENT 1

Setup your own virtual SDN lab
i) Virtualbox/Mininet Environment for SDN - http://mininet.org
ii) https://www.kathara.org
iii) GNS3

2 **5 Hours**

EXPERIMENT 2

Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

3 **6 Hours**

EXPERIMENT 3

Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

4 **6 Hours**

EXPERIMENT 4

Create a simple end-to-end network service with two VNFs using vim-emu
https://github.com/containernet/vim-emu

5 **6 Hours**

EXPERIMENT 5

Install OSM and onboard and orchestrate network service.

Total: 58 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1st Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.
3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2nd Edition, O"Reilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, O"Reilly Media, 2013.

22IT018 SECURITY AND PRIVACY IN CLOUD 3 0 0 3

Course Objectives

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.
- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the cloud security concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Delivers various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2									
2	1	3	2	3	1									
3	3	2	2	3	2								1	
4	2	1	2	3	3									
5	1	3	3	1	1									3

UNIT I 50 **8 Hours**

FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of Cloud Security - Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of Cryptography - Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures

UNIT II **11 Hours**

SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security Design Principles for Cloud Computing - Comprehensive Data Protection - End-to-end access control - Common Attack Vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III **9 Hours**

ACCESS CONTROL AND IDENTITY MANAGEMENT

Access Control Requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection

UNIT IV **9 Hours**

CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V **9 Hours**

MONITORING, AUDITING AND MANAGEMENT

Proactive Activity Monitoring - Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges - Events and Alerts - Auditing - Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management

Total: 46 Hours

Reference(s)

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.

22IT019 CYBER SECURITY 3 0 0 3

Course Objectives

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								2	
2	1	3	1	3	3								2	
3	2	1	1	1	2								2	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

UNIT I **9 Hours**

INTRODUCTION

Cyber Security - History of Internet - Impact of Internet - CIA Triad; Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime; Cybercriminals - A Global Perspective on Cyber Crimes - Classification of Cybercrimes

UNIT II **9 Hours**

ATTACKS AND COUNTER MEASURES

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks - Security Breach - Types of Malicious Attacks - Malicious Software - Common Attack Vectors - Social engineering Attack - Wireless Network Attack - Web Application Attack - Attack Tools - Countermeasures

UNIT III **9 Hours**

RECONNAISSANCE

Harvester - Who is - Netcraft - Host - Extracting Information from DNS- Extracting Information from E-mail Servers - Social Engineering Reconnaissance; Scanning - Port Scanning - Network Scanning and Vulnerability Scanning - Scanning Methodology - Ping Sweer Techniques - Nmap Command Switches - SYN - Stealth - XMAS - NULL - IDLE - FIN Scans - Banner Grabbing and OS Fingerprinting Techniques

UNIT IV **9 Hours**

INTRUSION DETECTION

Host -Based Intrusion Detection-Network -Based Intrusion Detection-Distributed or Hybrid Intrusion Detection-Intrusion Detection Exchange Format -Honeypots - Example System Snort -Cyber Laws-The Indian IT Act - Cyber Crime and Punishment

UNIT V **9 Hours**

INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls -Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations - Intrusion Prevention Systems - Example Unified Threat Management Products

Total: 45 Hours

Reference(s)

1. Anand Shinde,Introduction to Cyber Security Guide to the World of Cyber Security, Notion Press, 2021
2. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publishers, 2011
3. David Kim, Michael G. Solomon, Fundamentals of Information Systems Security, Jones & Bartlett Learning Publishers, 2013.
4. Patrick Engebretson,The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy, Elsevier, 2011.
5. Kimberly Graves,CEH Official Certified Ethical hacker Review Guide, Wiley Publishers, 2007.
6. William Stallings, Lawrie Brown,Computer Security Principles and Practice, Third Edition, Pearson Education, 2015.

22IT020 MODERN CRYPTOGRAPHY 3 0 0 3

Course Objectives

- To learn about the basics of modern cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct the basics of cryptanalytic techniques for ensuring data integrity.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Codes to authenticate information transmitted between the users.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-

4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **9 Hours**

INTRODUCTION

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT II **9 Hours**

FORMAL NOTIONS OF ATTACKS

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III **9 Hours**

RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV **9 Hours**

BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT V **9 Hours**

MESSAGE AUTHENTICATION CODES

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir"s Secret Sharing Scheme- Formally Analyzing Cryptographic Protocols- Zero Knowledge Proofs and Protocols

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

22IT021 CYBER FORENSICS 3 0 0 3

Course Objectives

- To understand the principles and concepts of computer forensics.
- To learn to utilize forensic tools for network-based attacks.
- To identify and apply appropriate methodologies for forensics data.
- To identify and analyze the vulnerabilities in the network.
- To analyze the various hacking techniques and their impacts.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. To understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system"s safety from hackers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

UNIT I **9 Hours**

INTRODUCTION TO COMPUTER FORENSICS

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques Incident and incident response methodology Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. Forensics Technology and Systems, Understanding Computer Investigation, Data Acquisition.

UNIT II **9 Hours**

EVIDENCE COLLECTION AND FORENSICS TOOLS

Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data, Data Hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics.

UNIT IV **9 Hours**

E-MAIL SECURITY

PGP - S/MIME, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology, Types of Firewalls, Firewall designs, SET for E-Commerce Transactions

UNIT V **9 Hours**

ETHICAL HACKING IN WEB

Social Engineering, Denial of Service, Session Hijacking, Hacking Web servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

22IT022 ETHICAL HACKING 3 0 0 3

Course Objectives

- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
j. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking
3. Understand the various vulnerabilities of Windows and Linux OS
4. Apply the techniques to hack web servers and tools for it.
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1					-			2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II **9 Hours**

SCANNING AND ENUMERATION

Introduction to Scanning - Objectives - Scanning Methodology - Tools - Introduction to Enumeration - Enumeration Techniques - Enumeration Procedure - Tools

UNIT III **9 Hours**

SYSTEM HACKING

Introduction - Cracking Passwords - Password Cracking Websites - Password Guessing - Password Cracking Tools - Password Cracking Countermeasures - Escalating Privileges - Executing Applications - Keyloggers and Spyware

UNIT IV **9 Hours**

PROGRAMMING FOR SECURITY PROFESSIONALS

Programming Fundamentals - C language - HTML - Perl - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures - Linux OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures

UNIT V **9 Hours**

NETWORK PROTECTION SYSTEMS

Access Control Lists - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams - Honeypots.

Total: 45 Hours

Reference(s)

1. EC-Council,"Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. Jon Erickson,"Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013.
4. Patrick Engebretson,"The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. RafayBoloch,"Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

22IT023 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- To understand the basics of Blockchain Technology.
- To learn Different protocols and consensus algorithms in Blockchain.
- To learn the Blockchain implementation frameworks.
- To experiment the Hyperledger Fabric, Ethereum networks.
- To understand the Blockchain Applications.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Analyze the real life applications of Blockchain Technologies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1	-								-	
4	-	2	2	-	3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain, Public Ledgers, Blockchain as Public Ledgers, Block in a Blockchain, Transactions, The Chain and the Longest Chain, Permissioned Model of Blockchain, Cryptographic, Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH, the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW), Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem, Proof of Stake, Proof of Burn, Proof of Elapsed Time, Bitcoin Miner, Mining Difficulty, Mining Pool, Permissioned model and use cases.

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue, DApps, NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc, Case Study.

1 **5 Hours**

EXPERIMENT 1

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2 **5 Hours**

EXPERIMENT 2

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3 **5 Hours**

EXPERIMENT 3

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

4 **5 Hours**

EXPERIMENT 4

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

5 **5 Hours**

EXPERIMENT 5

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6 **5 Hours**

EXPERIMENT 6

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.

Total: 60 Hours

Text Book(s)

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, OReilly, 2014.

Reference(s)

1. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, Blockchain: Blueprint for a New Economy, OReilly, 2015
4. Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT024 MALWARE ANALYSIS 3 0 0 3

Course Objectives

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

UNIT I **9 Hours**

INTRODUCTION AND BASIC ANALYSIS

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning - Hashing - Finding Strings - Packing and Obfuscation - PE file format - Static - Linked Libraries and Functions - Static Analysis tools

- Virtual Machines and their usage in Malware analysis - Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring - Viewing processes - Registry snapshots

UNIT II **9 Hours**

ADVANCED STATIC ANALYSIS

The Stack - Conditionals - Branching - Rep Instructions- Disassembly - Global and local variables - Arithmetic operations - Loops - Function Call Conventions - C Main Method and Offsets. Portable Executable File Format - The PE File Headers and Sections - IDA Pro - Function analysis - Graphing - The Structure of a Virtual Machine - Analyzing Windows programs - Anti-static analysis techniques - obfuscation - packing - metamorphism - polymorphism

UNIT III **9 Hours**

ADVANCED DYNAMIC ANALYSIS

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls - registries - network activities. Anti-dynamic analysis techniques - VM detection techniques - Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark - Kernel vs. User-Mode Debugging - OllyDbg - Breakpoints - Tracing - Exception Handling - Patching

UNIT IV **9 Hours**

MALWARE FUNCTIONALITY

Downloaders and Launchers - Backdoors - Credential Stealers - Persistence Mechanisms - Handles - Mutexes - Privilege Escalation - Covert malware launching - Launchers - Process Injection - Process Replacement - Hook Injection - Detours - APC injection..

UNIT V **9 Hours**

ANDROID MALWARE ANALYSIS

Android Malware Analysis: Android architecture - App development cycle - APKTool - APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security

Total: 45 Hours

Reference(s)

1. Michael Sikorski and Andrew Honig,"Practical Malware Analysis" by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden,"The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.
3. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
4. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SÃƒÂ©bastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
5. Victor Marak,"Windows Malware Analysis Essentials" Packt Publishing, O"Reilly, 2015.
6. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere,"Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.

22IT025 MULTIMEDIA AND ANIMATION 2 0 2 3

Course Objectives

- Understand the basic knowledge of multimedia Systems and related technologies
- To learn about multimedia elements in a comprehensive way
- Understand the basics of digital 2D animation to create story and multimedia production
- Design the technical and artistic skills to produce 3D animations.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the multimedia elements, image processing and animation
2. Analyze the encode and decode the multimedia elements
3. Apply the author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Create the 2D animation and develop the storyboards.
5. Create and animate the 3D models using software tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		2									
2	2	1	1	1	2								3	
3	3												2	2
4	2	2	2											2
5	2	3	2											2

UNIT I **6 Hours**

INTRODUCTION TO MULTIMEDIA ELEMENTS

Multimedia-Medium Properties of a Multimedia System-Traditional Data Stream Characteristics-Text-Basic Sound Concept-Speech-Computer Image Processing

UNIT II **6 Hours**

MULTIMEDIA COMPRESSION

Storage Space-Coding Requirements-Hybrid Coding-JPEG Image Preparation-Lossy Mode-Lossless Mode-Hierarchical Mode-H.261- MPEG Video Encoding-Data Stream-MPEG3-MPEG7-MPEG21

UNIT III **6 Hours**

MULTIMEDIA AUTHORING

Authoring metaphors-Tools Features and Types-Card and Page Based Tools-Icon and Object Based Tools-Time Based Tools-3D Modeling and Animation Tools-Image Editing Tools-audio Editing Tools-Digital Movie Tools-Creating interactive presentations-virtual learning-simulations.

UNIT IV **6 Hours**

2D ANIMATION

Introduction to 2D Animation-Colour theory and basics-Layout and Designing Basic of sketching-Composition of basic elements-Graphics and advertising-Creating Digital Layout-Professional image editing-Story Boarding-stop motion animation-Production-Post-Production-Background composition, 2D animation and techniques

UNIT V **6 Hours**

3D ANIMATION

3D Modeling-Modeling Techniques-Types of Modeling-3D Shading-Use of Material-Shader and Texture editing-Introduction to 3D Animation-3D Animation and Rigging-Setting up controllers for joints-Simple Skeleton structure with proper joint orientation-3D Lighting and Rendering

1 **3 Hours**

EXPERIMENT 1

Image Editing and Manipulation - Basic Operations on images using any image editing software

2 **3 Hours**

EXPERIMENT 2

Implementation of audio and Video Editing techniques

3 **3 Hours**

EXPERIMENT 3

Sketching of cartoon characters

4 **3 Hours**

EXPERIMENT 4

Design 2D Logo using the image editing tool

5 **3 Hours**

EXPERIMENT 5

Creating gif animated images in 2D Animation

6 **3 Hours**

EXPERIMENT 6
Exploring the Interface of 3D application

7 **3 Hours**

EXPERIMENT 7
Create different types of Materials and Shading

8 **3 Hours**

EXPERIMENT 8
Create a simple walk cycle using the character Rigs

9 **3 Hours**

EXPERIMENT 9
Create a 3-point Light Setup

10 **3 Hours**

EXPERIMENT 10
Create particle Simulation and Rendering

Total: 60 Hours

Reference(s)

1. Ze-Nian Li,Mark S Drew,Jiangchuan Liu,Fundamentals of Multimedia,Third Edition,Springer Texts in Computer Science-2021
2. Andleigh,P K and Kiran Thakrar,Multimedia Systems and Design,PHI,2003 Multimedia: Making It Work, Tay Vaughan, 9th Edition
3. The Illusion of Life:Disney Animation-Frank Thomas and Ollie Johnston Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls New Riders,2008
4. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016
5. Mark Gaimbruno, 3D Graphics and Animation, Second Edition, New Riders, 2002.
6. Rogers David,Animation master-A Complete Guide,Charles River Media,2006

22IT026 AUGMENTED REALITY/VIRTUAL REALITY

2 0 2 3

Course Objectives

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the tools and technologies related to AR/VR.
2. Design various models using modelling techniques.
3. Apply programming concepts and techniques specific to VR development, including 3D graphics.
4. Develop AR/VR applications in different domains.
5. Apply the technologies related to AR to build AR-enabled devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2			2	2	2		2	2	2
2	2	3	3	3	3			2	2	2		2	3	3
3	2	2	2	2	2			2	2	2		2	3	3
4	3	3	3	3	3			2	2	2		2	3	3
5	3	3	3	3	3			2	2	2		2	3	3

UNIT I **6 Hours**

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality - Definition - Introduction to Trajectories and Hybrid Space -Three Is of Virtual Reality - Virtual Reality Vs 3D Computer Graphics - Benefits of Virtual Reality - Components of VR System - Introduction to AR-AR Technologies - Input Devices -Types of Trackers - Human Visual System - Personal Graphics Displays - Human Auditory System.

UNIT II **6 Hours**

VR MODELING

Modelling - Geometric Modelling - Virtual Object Shape - Object Visual Appearance - Kinematics Modelling - Transformation Matrices - Object Position - Transformation Invariants - Object Hierarchies - Physical Modelling - Behavior Modelling - Model Management.

UNIT III **6 Hours**

VR PROGRAMMING

VR Programming - Toolkits and Scene Graphs - World ToolKit - Java 3D - Comparison of World ToolKit and Java 3D

UNIT IV **6 Hours**

APPLICATIONS

Human Factors in VR - Methodology and Terminology - VR Health and Safety Issues - VR and Society- Medical Applications of VR - Education, Arts and Entertainment - Military VR Applications - Emerging Applications of VR.

UNIT V **6 Hours**

AUGMENTED REALITY

Introduction to Augmented Reality - Computer vision for AR - Interaction - Modelling and Annotation Navigation - Wearable devices.

1 **3 Hours**

EXPERIMENT 1

Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.

2 **3 Hours**

EXPERIMENT 2

Use the primitive objects and apply various projection types by handling camera.

3 **3 Hours**

EXPERIMENT 3
Download objects from asset store and apply various lighting and shading effects

4 **3 Hours**

EXPERIMENT 4
Model three dimensional objects using various modelling techniques and apply textures over them.

5 **3 Hours**

EXPERIMENT 5
Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.

6 **3 Hours**

EXPERIMENT 6
Add audio and text special effects to the developed application.

7 **3 Hours**

EXPERIMENT 7
Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity

8 **3 Hours**

EXPERIMENT 8
Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

9 **3 Hours**

EXPERIMENT 9
Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization and surgery simulation

10 **3 Hours**

EXPERIMENT 10
Develop simple MR enabled gaming applications

Total: 60 Hours

Reference(s)

1. Charles Palmer, John Williamson, Virtual Reality Blueprints :Create compelling VR experiences for mobile , Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, Augmented Reality: Principles & Practice, Addison Wesley, 2016
3. John Vince, Introduction to Virtual Reality, Springer - Verlag, 2004
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality - Interface, Application, Design, Morgan Kaufmann, 2003

22IT027 GAME DEVELOPMENT 2 0 2 3

Course Objectives

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the foundations of 2D and 3d Graphics
2. Design game design documents
3. Implementation of gaming engines.
4. Survey gaming environments and frameworks.
5. Develop and construct a simple game in Pygame.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								1	1
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **6 Hours**

3D GRAPHICS FOR GAME DESIGN

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components - 2D and 3D Transformations - Projections -Color Models - Illumination and Shader Models - Animation -Controller

Based Animation.

UNIT II **6 Hours**

GAME DESIGN PRINCIPLES

Character Development, Storyboard Development for Gaming -Script Design - Script Narration, Game Balancing, Core Mechanics, Principles of Level Design - Proposals - Writing for Preproduction, Production and Post - Production.

UNIT III **6 Hours**

GAME ENGINE DESIGN

Rendering Concept - Software Rendering - Hardware Rendering -Spatial Sorting Algorithms - Algorithms for Game Engine - Collision Detection - Game Logic - Game AI - Pathfinding.

UNIT IV **6 Hours**

OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development - Unity - Unity Scripts - Mobile Gaming, Game Studio, Unity Single player and Multi - Player games.

UNIT V **6 Hours**

GAME DEVELOPMENT USING PYGAME

Developing 2D and 3D interactive games using Pygame - Avatar Creation - 2D and 3D Graphics Programming - Incorporating music and sound - Asset Creations - Game Physics Algorithms Development - Device Handling in Pygame - Overview of Isometric and Tile Based Arcade Games - Puzzle Games.

1 **3 Hours**

EXPERIMENT 1

Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

2 **3 Hours**

EXPERIMENT 2

Character design, sprites, movement and character control

3 **3 Hours**

EXPERIMENT 3

Level design: design of the world in the form of tiles along with interactive and collectible objects

4 **4 Hours**

EXPERIMENT 4

Design of interaction between the player and the world, optionally using the physics engine.

5 **4 Hours**

EXPERIMENT 5

Developing a 2D interactive using Pygame

6 **4 Hours**

EXPERIMENT 6

Developing a Puzzle game

7 **3 Hours**

EXPERIMENT 7

Design of menus and user interaction in mobile platforms.

8 **3 Hours**

EXPERIMENT 8

Developing a 3D Game using Unreal

9 **3 Hours**

EXPERIMENT 9

Developing a Multiplayer game using unity

Total: 60 Hours

Reference(s)

1. Sanjay Madhav, Game Programming Algorithms and Techniques: A Platform Agnostic Approach, Addison Wesley,2013.
2. Will McGugan, Beginning Game Development with Python and Pygame: From Novice to Professional, Apress,2007.
3. Paul Craven, Python Arcade games, Apress Publishers,2016.
4. David H. Eberly, 3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, Second Edition, CRC Press,2006.
5. Jung Hyun Han, 3D Graphics for Game Programming, Chapman and Hall/CRC, 2011.

22IT028 VIDEO CREATION AND EDITING 2 0 2 3

Course Objectives

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the strengths and limitations of Nonlinear editing
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Address the core issues of advanced editing and training techniques.
5. Design and develop projects using AVID XPRESS DV 4.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

1	3	1	2	1	1				1	2	3	2	3	1
2	2	3	3	3	1				1	2	2	1	1	1
3	2	2	3	3	1				3	1	1	1	2	1
4	2	2	2	2	1				3	1	1	1	2	2
5	2	1	3	3	1				3	2	1	2	2	2

UNIT I **6 Hours**

FUNDAMENTALS

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II **6 Hours**

STORYTELLING

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - Understanding video color - Color Correcting Basics - Color Enhancement Effects mechanics of digital editing - pointer files - media management.

UNIT III **6 Hours**

USING AUDIO AND VIDEO

Audio: Timeline Audio Tracks - Editing Audio- Gaining, Fading and Balancing Audio- Video: Capturing digital and analog video - importing audio on putting video - exporting digital video to tape - recording to CDs and VCDs.

UNIT IV **6 Hours**

WORKING WITH FINAL CUT PRO

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V **6 Hours**

WORKING WITH AVID XPRESS DV 4

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

1 **3 Hours**

EXPERIMENT 1

Write a Movie Synopsis (Individual/Team Writing)

2 **3 Hours**

EXPERIMENT 2

Present team stories in class

3 **4 Hours**

EXPERIMENT 3

Script/Storyboard Writing(Individual Assignment) 75

4 **4 Hours**

EXPERIMENT 4
Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts

5 **4 Hours**

EXPERIMENT 5
Production: Single camera production personnel

6 **3 Hours**

EXPERIMENT 6
Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

7 **4 Hours**

EXPERIMENT 7
Write Documentary and Animation Treatment

8 **5 Hours**

EXPERIMENT 8
Post-production: Editing, Sound design, Finishing

Total: 60 Hours

Reference(s)

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw - Hill 2003.

22IT029 DIGITAL MARKETING 3 0 0 3

Course Objectives

- Understand the overview of Digital Marketing.
- Examine the role and importance of digital marketing in the business environment.
- Determine the focuses on digital marketing and its measure

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for todays' Marketer.
2. Compare the strengths and limitations of search engine optimisation.
3. Apply the suitable techniques for E-Mail Marketing.
4. Discover the hottest techniques to help to successfully plan, predict, and manage your digital Marketing campaigns.
5. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								1	1
2	2	2	3		3								2	3
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **9 Hours**

INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II **9 Hours**

SEARCH ENGINE OPTIMISATION

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT IV **9 Hours**

SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V **9 Hours**

DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

FOR FURTHER READING

Conversion Tracking - Personality Development - Google AdSense - Getting Started as Freelancer - Affiliate Marketing.

Total: 36 Hours

Reference(s)

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN- 10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition(April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,first edition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

22IT030 PROGRAMMING ON EDGE DEVICES 3 0 0 3

Course Objectives

- Compare Fog and Edge Computing with different sets of use cases.
- Illustrate the architecture for the edge device.
- Implement the Microcomputer RaspberryPi and device Interfacing.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze, with different use cases, the difference between Fog and Edge Computing.
2. Develop the architecture for IoT edge computing devices based on the requirements.
3. Design and configure the edge devices using RaspberryPi.
4. Implement the Microcomputer RaspberryPi and device Interfacing.
5. Analyze the requirements of Industrial and Commercial edge devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1		2										
2	3	2	2	3	2								2	
3	3	2	3	3	3								3	
4	3	2	3	2	3								3	
5	3	2	-	-	-								2	

UNIT I **6 Hours**

IOT AND EDGE COMPUTING DEFINITION AND USE CASES

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II **6 Hours**

IOT ARCHITECTURE AND CORE IOT MODULES

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples.

UNIT III **6 Hours**

RASPBERRYPI

Introduction to Aurdino and RaspberryPi, RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools.

UNIT IV **6 Hours**

IMPLEMENTATION OF DEVICE INTERFACING

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT communication formats.

UNIT V **6 Hours**

INDUSTRIAL AND COMMERCIAL IOT

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Total: 30 Hours

Reference(s)

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O"Reilly Media, Inc., 2019, ISBN: 978149204322.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition, 2020 by Perry Lea.

22IT031 ROBOTIC PROCESS AUTOMATION 3 0 0 3

Course Objectives

- Understand the basic concepts, methodologies and tools in RPA.
- Implement the exception handling and automation techniques using RPA.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the basic concepts and methodologies in RPA.
2. Infer the UiPath building blocks in the RPA.
3. Apply the RPA techniques to automate the application.
4. Implement the exception handling and BOT in RPA.
5. Implement the RPA to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								2	
2	2	2	3		3								2	
3	2	2	3		3								3	
4	2	3	3		3								3	
5	2	3	3		3								3	

UNIT I **9 Hours**

RPA AND PROCESS METHODOLOGIES

BPM, and BPA-Understanding RPA Skills: On-Premise Vs. the Cloud - Lean and Six Sigma Methodologies for Process Improvement - Overview of Agile Methodologies and its importance in RPA

UNIT II **9 Hours**

UIPATH ESSENTIALS

Introduction to UiPath: Installation and activation-UiPath Activities: Flowcharts, Sequences, and Data Manipulation-UiPath Variables and Data Types-Debugging techniques in UiPath-Overview of UiPath

Orchestrator: BOT Development and Management-UiPath Automation Best Practices

UNIT III **9 Hours**

ADVANCED RPA TECHNIQUES

Data Manipulation: Collections and Data Table Usage-File Operations: CSV/Excel to data table and vice versa-Working with UiExplorer and Desktop Automation-Web Automation: Basic and Desktop Recording-Advanced Screen Scraping Techniques-Data Scraping and Extraction from Websites

UNIT IV **9 Hours**

HANDLING EXCEPTIONS AND USER EVENTS

Exception Handling Techniques: Try-Catch, Re-throwing Exceptions, and Custom Exception Handling- Logging, Debugging, and Error Reporting Techniques- Handling User Events: Assistant bots, System Event Triggers, and Image and Element Triggers- Monitoring Techniques in RPA- Launching an Assistant bot on a Keyboard Event

UNIT V **9 Hours**

DEPLOYMENT AND MAINTENANCE OF BOT

Overview of Orchestration Server and its functionalities- Orchestrator to Control Bots and Deploy Bots- Uploading Packages, Managing Packages, and Deleting Packages- Publishing and Managing Updates- Continuous Integration and Continuous Deployment (CI/CD) in RPA

Total: 45 Hours

Reference(s)

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant.
2. Srikanth Miranda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

22IT032 AI ON EDGE COMPUTING 3 0 0 3

Course Objectives

- Understanding of the fundamental concepts, principles, and techniques of Artificial Intelligence, including its history, subfields, and applications.
- Reduce network latency and improve response times by processing data and running computations closer to the source or at the network edge.
- Address data privacy and security concerns by keeping sensitive data and computations localized at the edge devices or edge nodes.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
l. 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.

Course Outcomes (COs)

1. Enable the application of machine learning and deep learning approaches to real-world problems.
2. Explore the software services, standard bodies and open source communities available for edge computing.
3. Design and optimize edge device architectures, enabling efficient and resource-constrained processing for AI applications at the edge
4. Build an intelligent data driven applications by applying the edge data processing and analytics techniques to enable the easier decision making process.
5. Deploying AI models on edge devices, ensuring efficient inference, optimization, and integration to enable AI capabilities directly at the edge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2								2		
2	2	2	3	3								2		
3	2	2	3	3								2		
4	2	3	3	3								2		
5	2	3	3	3								2		

UNIT I **9 Hours**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Introduction to Artificial Intelligence and its subfields - Machine Learning algorithms and techniques - Supervised Learning - Unsupervised Learning - Reinforcement Learning - Deep Learning models and architectures

UNIT II **9 Hours**

INTRODUCTION TO EDGE COMPUTING

Overview of Edge Computing and its significance in AI applications - Edge devices and infrastructure - Challenges and opportunities in AI on Edge Computing

UNIT III **9 Hours**

EDGE DEVICE ARCHITECTURES

Edge devices and hardware platforms for AI - Accelerators and GPUs for Edge Computing - Edge computing frameworks and software tools

UNIT IV **9 Hours**

EDGE DATA PROCESSING AND ANALYTICS

Data preprocessing and feature extraction at the Edge - Real-time analytics and decision-making at the Edge - Edge-based data storage and retrieval

UNIT V **9 Hours**

AI MODEL DEPLOYMENT ON EDGE DEVICES

Model compression and optimization for resource-constrained Edge devices - On-device training and transfer learning - Model deployment and inference techniques on Edge devices

Total: 45 Hours

Text Book(s)

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.
3. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
2. Edge Computing for Internet of Things: From Device to Cloud-Based Services" by Hassan Fouad and Ammar Rayes.

22IT033 NATURAL LANGUAGE PROCESSING 3 0 0 3

Course Objectives

- * To learn the fundamentals of natural language processing
- * To understand the use of CFG and PCFG in NLP
- * To understand the role of semantics of sentences and pragmatics
- * To apply the NLP techniques to IR applications

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1. To understand the basic Language features
2. 2. To design an innovative application using NLP components
3. 3. To apply a rule based system to tackle morphology/syntax of a language
4. 4. To design a tag set to be used for statistical processing for real-time applications
5. 5. To compare and contrast the use of different statistical approaches for different types of NLP applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1										1	
2	2	2	2										1	
3	2	2	3										1	
4	2	2	3										1	
5	2	1	2										1	

UNIT I **9 Hours**

INTRODUCTION

Origins and challenges of NLP-Language Modeling: Grammar-based LM-Statistical LM - Regular Expressions, Finite-State Automata-English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II **9 Hours**

WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff-Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging-Hidden

Markov and Maximum Entropy models, Vector Based models

UNIT III **9 Hours**

SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar-Dependency Grammar-Syntactic Parsing, Ambiguity, Dynamic Programming parsing-Shallow parsing-Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs-Feature structures, Unification of feature structures

UNIT IV **10 Hours**

SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics-Syntax-Driven Semantic analysis, Semantic attachments-Word Senses, Relations between Senses, Thematic Roles, selectional restrictions-Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods-Word Similarity using Thesaurus and Distributional methods

UNIT V **8 Hours**

DISCOURSE ANALYSIS AND LEXICAL RESOURCES

Discourse segmentation, Coherence-Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm-Coreference Resolution-Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus.

Total: 45 Hours

Reference(s)

1. 1.Daniel Jurafsky, James H. Martin-Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 3rd edition 2023.
2. 2.Breck Baldwin,Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
3. 3.Richard M Reese,Natural Language Processing with Java, OReilly Media, 2015
4. 4.Nitin Indurkhya and Fred J. Damerau,Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010

22IT034 IOT ANALYTICS 3 0 0 3

Course Objectives

- * Understand the challenges of IoT analytics systems development and deployment
- * To learn about data analytics and use cloud offerings related to IoT.
- * Ability to understand the Searching and security requirements of IoT.
- * Acquire the knowledge of Tools, Platform and Services for IoT Analytics
- * To Develop IoT infrastructure for real time scenarios.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1. Identify the networking protocols for connecting devices and challenges of IoT Analytics
2. 2. Understand the cloud based IoT and IoT in Data Analytics
3. 3. Explain the concepts of Security requirements and Searching the IoT
4. 4. Apply the different tools and services for the IoT Analytics platform
5. 5. Analyze applications of IoT Analytics in a real time scenario

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	3				2	2			2	
2	2	1	3	2	3				2	2			2	
3	2	2	2	3	3				2	2			2	
4	3	2	3	3	3				2	2			3	
5	3	3	3	3	3				2	3			3	

UNIT I **8 Hours**

INTRODUCTION TO IOT ANALYTICS

Introduction-IoT Data and Big Data - Challenges of IoT Analytics - Applications - IoT Devices and Networking Protocols

UNIT II **9 Hours**

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS

IoT Hardware devices and its limitation - Cloud based IoT Platform - Iaas, Paas and Saas paradigms - Requirements of IoT in Big Data Analytics Platform - Functional Architecture - Data Collection Using Low-power, Long-range Radios - Web server: Web server for IoT applications

UNIT III **10 Hours**

SEARCHING THE INTERNET THINGS AND IOT SECURITY

Introduction - A search architecture for social and physical sensors - Local Event Retrieval - Sensor Metadata - Venue Recommendation - Security Requirements in IoT - Security Concerns in IoT Applications - Security Architecture in the Internet of Things - Insufficient Authentication Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT

UNIT IV **9 Hours**

TOOLS AND SERVICE FOR IOT ANALYTICS

Architecture for IoT Analytics Applications - Nodes - Development Examples - Open source framework for IoT Analytics as a service - Sensing as a service Infrastructure Tools and Platforms

UNIT V **9 Hours**

IOT ANALYTICS APPLICATIONS AND CASE STUDIES

Data Analytics and smart Building - Smart City - Data collection to deployment and operationalization using the vital platform - Transportation - Energy - Agriculture - Healthcare

Total: 45 Hours

Text Book(s)

1. Andrew Minteer, Analytics for the Internet of Things: Intelligent analytics for your intelligent devices, Packt Publishing, first edition, July 2017

Reference(s)

1. 1. John Soldatos, Building Blocks for IoT Analytics, River Publishers Series In Signal, Image and Speech Processing, 2017
2. 2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
3. 3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014
4. 4. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things Key applications and Protocols, Wiley, 2012
5. 5. Practical Internet of Things Security by Brian Russell, Drew Van,2018

22IT035 AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- * To understand the basics of Blockchain Technology
- * To learn Different protocols and consensus algorithms in Blockchain
- * To learn the Blockchain implementation frameworks
- * To experiment the Hyperledger Fabric, Ethereum networks
- * To understand the Blockchain Applications

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1.Understand emerging abstract models for Blockchain Technology
2. 2.Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain
3. 3.Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable
4. 4.Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application
5. 5.Analyze the real life applications of Blockchain Technologies

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1										
4		2	2		3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions - The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic-Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH-the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue- DApps-NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc - Case Study.

1 **5 Hours**

EXPERIMENT 1

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2 **5 Hours**

EXPERIMENT 2

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3 **5 Hours**

EXPERIMENT 3

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules

4 **5 Hours**

EXPERIMENT 4

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network

5 **5 Hours**

EXPERIMENT 5

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6 **5 Hours**

EXPERIMENT 6

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Total: 60 Hours

Text Book(s)

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O Reilly, 2014

Reference(s)

1. 1. Daniel Drescher,Blockchain Basics, First Edition, Apress, 2017
2. 2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. 3. Melanie Swan,Blockchain: Blueprint for a New Economy, O Reilly, 2015
4. 4.Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT036 XML AND WEB SERVICES 3 0 0 3

Course Objectives

- * Understand the proficiency in creating, manipulating, and validating XML documents, including understanding XML syntax, structure, and key concepts and use XML technologies such as XML Schema, XPath, and XSLT
- * Understanding of web services and their role in distributed systems. Explore SOAP and REST architectures, understand their differences
- * Acquire practical skills in implementing XML-based web services using industry-standard technologies like SOAP and WSDL

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
l. 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.

Course Outcomes (COs)

1. 1. Infer XML technologies including XML Schema, XPath, and XSLT, enabling effective data transformation and manipulation in XML-based systems
2. 2. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems
3. 3. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems.
4. 4. Design and implement XML-based solutions for electronic data interchange (EDI), data validation, and interoperability, ensuring compliance with industry standards and optimizing e-business processes
5. 5. Design and implement XML-based content management solutions, including content modeling, metadata management, and content transformation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3					2	2	1		1		

2	2	2	3					2	2	1		2		
3	2	3	3					2	2	2		2		
4	2	3	3					2	2	2		3		
5	2	3	3					2	2	2		3		

UNIT I **9 Hours**

XML TECHNOLOGY FAMILY

XML - benefits - Advantages of XML over HTML - EDL -Databases - XML based standards - DTD -XML Schemas - X- Files - XML processing - DOM -SAXpresentation technologies - XSL - XFORMS - XHTML - voice XML - Transformation - XSLT - XLINK - XPATH -XQ

UNIT II **9 Hours**

ARCHITECTING WEB SERVICES

Business motivations for web services - B2B - B2C- Technical motivations - limitations of CORBA and DCOM - Service - oriented Architecture (SOA) - Architecting web services - Implementation view - web services technology stack - logical view - composition of web services - deployment view - from application server to peer to peer - process view - life in the runtime

UNIT III **9 Hours**

WEB SERVICES BUILDING BLOCK

Transport protocols for web services - messaging with web services - protocols - SOAP - describing web services - WSDL - Anatomy of WSDL - manipulating WSDL - web service policy - Discovering web services - UDDI - Anatomy of UDDI- Web service inspection - Ad-Hoc Discovery - Securing web services.

UNIT IV **9 Hours**

IMPLEMENTING XML IN E-BUSINESS

B2B - B2C Applications - Different types of B2B interaction - Components of ebusiness XML systems - ebXML - Rosetta Net Applied XML in vertical industry - Web services for mobile devices

UNIT V **9 Hours**

XML AND CONTENT MANAGEMENT

Semantic Web - Role of Meta data in web content - Resource Description Framework - RDF schema - Architecture of semantic web - content management workflow - XLANG -WSFL

Total: 45 Hours

Text Book(s)

1. Ron schmelzer et al, XML and Web Services, Pearson Education, 2002
2. Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architects Guide, Prentice Hall, 2004.

Reference(s)

1. 1. Frank P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2002
2. 2. Keith Ballinger,NET Web Services Architecture and Implementation, Pearson Education, 2003.
3. 3. Henry Bequet and MeerajKunnumpurath, Beginning Java Web Services, Apress, 2004.
4. 4. Russ Basiura and Mike Batongbacal, Professional ASP.NET Web Services, Apress,2. ASP .NET Web Services, Apress, 2003.

22IT037 MINING AND SOCIAL MEDIA WEB ANALYTICS

3 0 0 3

Course Objectives

- To understand the foundations of Social Media and Web Analytics.
- To visualize and understand the data mining aspects in social networks.
- To solve mining problems by different algorithms.
- To understand network measures for social data.
- To understand behavioral part of web applications for Analysis.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand social media, web and social media analytics and their potential impact.
2. Understand the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Apply Behavior Analytics techniques to applications that leverage social media data, such as Facebook and Twitter.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		2			2				1	3	2
2	2	2	3		2			2				1	1	2
3	2	2	3		2			1				1	2	3
4	2	2	3		2			1				1	1	2

5	2	2	3		2			2				1	2	2

UNIT I **10 Hours**

ANALYTICS IN SOCIAL MEDIA AND WEB ANALYTICS TOOLS

Social Media Analytics: The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics.
Web Analytics: Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT II **9 Hours**

VISUALIZING SOCIAL NETWORKS

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III **9 Hours**

TEXT MINING IN SOCIAL NETWORKS

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV **8 Hours**

NETWORK MEASURES

Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality, Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence.

UNIT V **9 Hours**

BEHAVIOR ANALYTICS

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction.

Case Study: Mining Twitter: Overview, Exploring Twitters API, Analyzing 140 Characters; Mining Facebook: Overview, Exploring Facebooks Social Graph APIs, Analyzing Social Graph Connections.

Total: 45 Hours

Reference(s)

1. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 9th Edition, 2019.
2. Matthew A. Russell, Mining the Social Web, O"Reilly, 3rd Edition, ISBN:10:1449367615, 2019.
3. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
4. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
5. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
6. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

22IT038 OPERATION AND SUPPLY CHAIN ANALYTICS

3 0 0 3

Course Objectives

- Evaluate the effectiveness of different supply chain analytics techniques in optimizing supply chain operations.
- Synthesize data from multiple sources to develop comprehensive supply chain optimization strategies.
- Create and implement solutions to complex supply chain problems using advanced analytics techniques.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the fundamental concepts of operation in supply chain analytics.
2. Analyze supply chain data and identify opportunities for improvement.
3. Use various tools and techniques for supply chain analytics.
4. Develop strategies for optimizing supply chain operations.
5. Analyze Understand the impact of analytics on supply chain management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2			1	1			1	1	1

2	3	3	3	3	3			1	1				1	1
3	2	2	2	3	3			1	1			1		1
4	2	2	2	2	2			1	1			1		1
5	2	2	2	2	2			1	1					1

UNIT I **9 Hours**

INTRODUCTION TO OPERATION AND SUPPLY CHAIN ANALYTICS

Introduction to Supply chain management - Overview of operation and supply chain analytics - Importance of data-driven decision-making in supply chain management - Key performance indicators (KPIs) in supply chain management.

UNIT II **9 Hours**

DATA ANALYSIS FOR SUPPLY CHAIN MANAGEMENT

Data collection and analysis techniques - Data visualization and reporting - Statistical analysis for supply chain management.

UNIT III **9 Hours**

FORECASTING AND DEMAND PLANNING

Forecasting techniques for supply chain management - Demand planning and management - Sales and operations planning (S&OP).

UNIT IV **10 Hours**

INVENTORY MANAGEMENT AND OPTIMIZATION

Inventory management techniques - Safety stock and lead time optimization - Economic order quantity (EOQ) and reorder point (ROP) analysis.

UNIT V **8 Hours**

LOGISTICS AND TRANSPORTATION ANALYTICS

Transportation network optimization - Route optimization and scheduling - Warehouse and distribution center optimization

Total: 45 Hours

Reference(s)

1. "Supply Chain Analytics: Quantitative Methods for Decision Making" by Nada R. Sanders.
2. "Operations and Supply Chain Management" by F. Robert Jacobs and Richard B. Chase.
3. "Data Analytics for Supply Chain Management: Research and Applications" by Xi Chen, Hui Yang, and Lei Yu.
4. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl.
5. "Business Analytics: Data Analysis and Decision Making" by Christian Albright and Wayne Winston.

22IT039 SOCIAL NETWORK SECURITY 3 0 0 3

Course Objectives

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
e. 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.

Course Outcomes (COs)

1. Work on the internals components of the social network.
2. Model and visualize the social network.
3. Mine the behaviour of the users in the social network.
4. Predict the possible next outcome of the social network.
5. Apply social network in real time applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3									
5	1	2	2		3									

UNIT I **9 Hours**

FUNDAMENTALS OF SOCIAL NETWORKING

Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Historical overview of privacy and security - Major paradigms for understanding privacy and security.

UNIT II **9 Hours**

MODELING AND VISUALIZATION

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - Random Walks and their Applications - Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III **9 Hours**

EXTRACTION AND MINING IN SOCIAL NETWORKING DATA

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Big data and Privacy.

UNIT IV **9 Hours**

EVOLUTION

Evolution in Social Networks - Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation - Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V **9 Hours**

ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT

Understand the access control requirements for Social Network - Enforcing Access Control Strategies - Authentication and Authorization - Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network - Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

Total: 45 Hours

Text Book(s)

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.

Reference(s)

1. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
2. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, - Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012.
3. Borko Furht, - Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011
4. Charu C. Aggarwal, - Social Network Data Analytics, Springer; 2014
5. Giles, Mark Smith, John Yen, - Advances in Social Network Mining and Analysis, Springer, 2010.

22IT040 HUMAN COMPUTER INTERACATION 3 0 0 3

Course Objectives

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn the model and theories of human computer interaction.
- To be aware of mobile computer systems and its applications.
- To learn the guidelines for designing web user interfaces.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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.
c. 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.
d. 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.
e. 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.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Collect fundamental design and evaluation methodologies of computer.
2. Design effective HCI for individuals and persons with disabilities.
3. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.
4. Design mobile application framework using HCI tools
5. Develop a web interface using various tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2				2	2			2	
2	1	2	2	2	2				2	2			2	
3	1	2	2	3					3	3			2	
4	2	2	3	2	3				2	2			2	
5	2	2	1	2	3				2	2			2	

UNIT I **9 Hours**

FOUNDATIONS OF HCI

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. - Case Studies.

UNIT II **9 Hours**

DESIGN

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. Evaluation Techniques - Universal Design.

UNIT III **9 Hours**

MODELS AND THEORIES

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV **9 Hours**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V **9 Hours**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45 Hours

Reference(s)

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, -Mobile Design and Development, First Edition, OReilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, -Designing Web Interfaces, First Edition, OReilly, 2009.

22IT041 E-COMMERCE **3 0 0 3**

Course Objectives

- Learn the Various e-commerce business models.
- Understand how companies use e-commerce to gain competitive advantages.
- Familiarize with the planning and execution of e-commerce projects.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. 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.
f. 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.
k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Develop an understanding of the foundations, importance and applications of E-commerce
2. Understand various electronic payment types and the ways to protect against them.
3. Develop innovative new mobile commerce technologies and systems to improve the consumer experience
4. Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
5. Discuss legal issues and privacy in M-Commerce.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2			2					2	2	1	
2	2		2			2					2	2	2	
3	1		3			2					3	3	3	
4	2		2			2					2	2	2	
5	2		2			2					2	2	2	

UNIT I **9 Hours**

ELECTRONIC COMMERCE

Frame work, anatomy of ECommerce applications, ECommerce Consumer applications, ECommerce organization applications.

UNIT II **9 Hours**

CONSUMER ORIENTED ELECTRONIC COMMERCE

Mercantile Process models, Electronic payment systems: Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT III **9 Hours**

E-COMMERCE APPLICATIONS DEVELOPMENT

The Changing Face of Application Development, Enterprise Development Needs, Enhanced Web Server, Based ECommerce Site Business Objectives, Categories of Business Value, Assessing a Site"s Current Business Value, Improving Business Value, Managed Solutions.

UNIT IV **9 Hours**

MOBILE ELECTRONIC COMMERCE

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **9 Hours**

MOBILE COMMERCE: TECHNOLOGY

A Framework For The Study Of Mobile Commerce, NTT Docomos IMode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

FOR FURTHER READING

Security Issues in ECommerce, Social media and Online Retailing, Interaction Design for ECommerce Websites.

Total: 45 Hours

Reference(s)

1. Kenneth C.Laudon, Carol Guercio Traver ECommerce 2021:Business, Technology, and society, Pearson, 16th Edition, 2021.
2. Mobile Commerce: Framework, Development, and Strategies edited by Paul S. Minhas and Zahir Irani,2019
3. Mobile Commerce: Technology, Theory and Applications by Hannu Verkasalo,3rd Edition, 2019
4. Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson, 2017
5. Gary P Schneider ,E-commerce: Strategy, Technology and Implementation, eleventh edition, Cengage Learning, 2011.