B.E. (Computer Science and Engineering)

Revised 2018 Regulations, Curriculum & Syllabi

(Candidates admitted during Academic Year 2021-2022)

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

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

SATHYAMANGALAM - 638401 ERODE DISTRICT TAMILNADU INDIA

Ph : 04295-226000/221289 Fax : 04295-226666 E-mail : stayahead@bitsathy.ac.in Web : www.bitsathy.ac.in

CONTENTS

VISION OF THE DEPARTMENT

To excel in the field of Computer Science and Engineering, to meet the emerging needs of the industry, society, and beyond.

MISSION OF THE DEPARTMENT

1. To impart need based education to meet the requirements of the industry and society.
2. To equip students for emerging technologies with global standards and ethics that aid in societal sustainability.
3. To build technologically competent individuals for industry and entrepreneurial ventures by providing infrastructure and human resources.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Graduates will apply computer science and engineering principles and practices to solve real-world problems with their technical competence.

II. Graduates will have the domain knowledge to pursue higher education and apply cutting edge research to develop solutions for socially relevant problems.

III. Graduates will communicate effectively and practice their profession with ethics, integrity, leadership, teamwork, and social responsibility, and pursue lifelong learning throughout their careers

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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, andenvironmental 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 modelling to complex engineeringactivities 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.

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.

k) **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a memberand 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

PSO2: n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

MAPPING OF PEOs, POs and PSOs

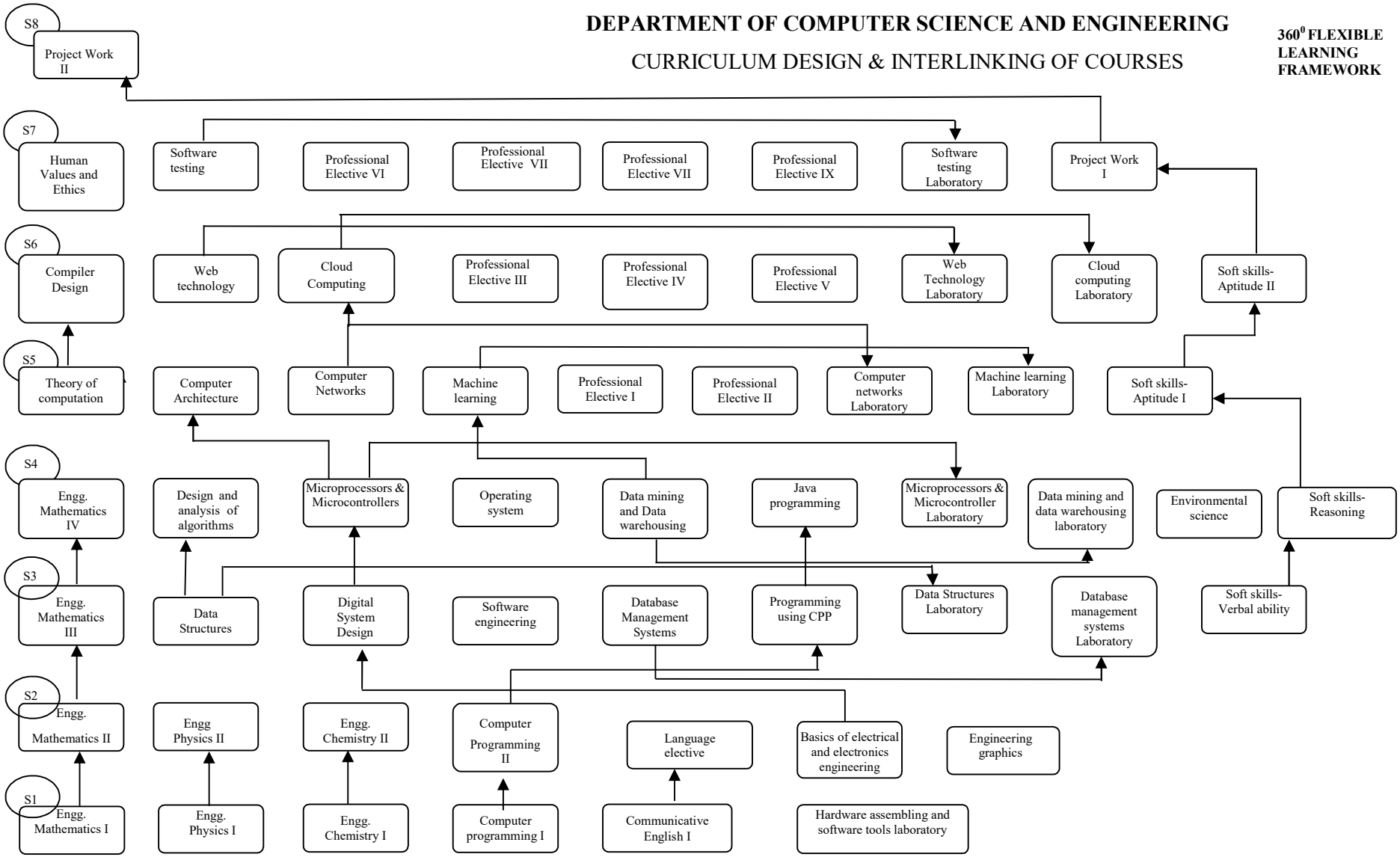
PEOs	Program Outcomes(s)													
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
I	X	X	X	X	X	X	X						X	X
II								X	X	X	X			
III												X	X	X

CONNECTIVITY CHART

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM DESIGN & INTERLINKING OF COURSES

360^0 FLEXIBLE LEARNING FRAMEWORK



B.E CSE
Minimum Credits to be Earned : 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
18CS101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
18CS102	ENGINEERING PHYSICS I	2	0	2	3	4	50	50	100	BS
18CS103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
18CS104	COMPUTER PROGRAMMING I	2	0	2	3	4	50	50	100	ES
18HS101	COMMUNICATIVE ENGLISH I	1	0	2	2	3	100	0	100	HS
18CS106	HARDWARE ASSEMBLING AND SOFTWARE TOOLS LABORATORY	0	0	4	2	4	100	0	100	ES
Total		**10**	**1**	**12**	**17**	**23**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
18CS201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
18CS202	ENGINEERING PHYSICS II	2	0	2	3	4	50	50	100	BS
18CS203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
18CS204	COMPUTER PROGRAMMING II	2	0	2	3	4	50	50	100	ES
	LANGUAGE ELECTIVE	-	-	-	2	-	100	0	100	HS
18CS206	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
18CS207	ENGINEERING GRAPHICS	1	0	4	3	5	100	0	100	ES
Total		**12**	**1**	**12**	**21**	**25**	-	-	-	-

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CS301	ENGINEERING MATHEMATICS III	3	1	0	4	4	40	60	100	BS
18CS302	DATA STRUCTURES	3	0	0	3	3	40	60	100	PC
18CS303	DIGITAL SYSTEM DESIGN	3	0	2	4	5	50	50	100	ES
18CS304	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
18CS305	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	3	40	60	100	PC
18CS306	PROGRAMMING USING CPP	2	0	2	3	4	50	50	100	PC
18CS307	DATA STRUCTURES LABORATORY	0	0	4	2	4	100	0	100	PC
18CS308	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	4	2	4	100	0	100	PC
18GE301	SOFT SKILLS - VERBAL ABILITY	2	0	0	0	2	100	0	100	EEC
Total		**19**	**1**	**12**	**24**	**32**	**-**	**-**	**-**	**-**

IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CS401	ENGINEERING MATHEMATICS IV	3	1	0	4	4	40	60	100	BS
18CS402	DESIGN AND ANALYSIS OF ALGORITHMS	3	1	0	4	4	40	60	100	PC
18CS403	MICROPROCESSORS AND MICROCONTROLLER	3	0	0	3	3	40	60	100	ES
18CS404	OPERATING SYSTEM	3	0	0	3	3	40	60	100	PC
18CS405	DATA MINING AND DATA WAREHOUSING	3	0	0	3	3	40	60	100	PC
18CS406	JAVA PROGRAMMING	2	0	2	3	4	50	50	100	PC
18CS407	MICROPROCESSORS AND MICROCONTROLLER LABORATORY	0	0	4	2	4	100	0	100	ES
18CS408	DATA MINING AND DATA WAREHOUSING LABORATORY	0	0	4	2	4	100	0	100	PC
18HS001	ENVIRONMENTAL SCIENCE	2	0	0	0	2	100	0	100	HSS
18GE401	SOFT SKILLS – BUSINESS ENGLISH	2	0	0	0	2	100	0	100	EEC
Total		**21**	**2**	**10**	**24**	**33**	**-**	**-**	**-**	**-**

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CS501	THEORY OF COMPUTATION	3	1	0	4	4	40	60	100	ES
21CS502	COMPUTER ARCHITECTURE	3	0	0	3	3	40	60	100	PC
21CS503	COMPUTER NETWORKS	3	0	0	3	3	40	60	100	PC
21CS504	MACHINE LEARNING	3	0	0	3	3	40	60	100	PC
	PROFESSIONAL ELECTIVE I	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE II	3	0	0	3	3	40	60	100	PE
21CS507	COMPUTER NETWORKS LABORATORY	0	0	4	2	4	100	0	100	PC
21CS508	MACHINE LEARNING LABORATORY	0	0	4	2	4	100	0	100	PC
18GE501	SOFT SKILLS - APTITUDE I	0	0	2	-	2	100	0	100	EEC
Total		**18**	**1**	**10**	**23**	**29**	**-**	**-**	**-**	**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CS601	COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
21CS602	CLOUD COMPUTING	3	0	0	3	3	40	60	100	PC
21CS603	WEB TECHNOLOGY	3	0	0	3	3	40	60	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
21CS607	CLOUD COMPUTING LABORATORY	0	0	4	2	4	100	0	100	PC
21CS608	WEB TECHNOLOGY LABORATORY	0	0	4	2	4	100	0	100	PC
18GE601	SOFT SKILLS - APTITUDE II	0	0	2	-	2	100	0	100	EEC
Total		**18**	**1**	**10**	**23**	**29**	**-**	**-**	**-**	**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21HS002	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
21CS702	SOFTWARE TESTING	3	0	0	3	3	40	60	100	EEC
	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
21CS707	SOFTWARE TESTING LABORATORY	0	0	4	2	4	100	0	100	EEC
21CS708	PROJECT WORK I	0	0	6	3	6	50	50	100	EEC
Total		**17**	**0**	**10**	**22**	**27**	-	-	-	-
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CS801	PROJECT WORK II	0	0	18	9	18	50	50	100	EEC
Total		**0**	**0**	**18**	**9**	**18**	**-**	**-**	**-**	**-**

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HSC01	CHINESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
18HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
VERTICAL 1 - DATA SCIENCE										
21CS001	EXPLORATORY DATA ANALYSIS	2	0	2	3	2	50	50	100	PE
21CS002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
21CS003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
21CS004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	2	50	50	100	PE
21CS005	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
21CS006	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
21CS007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
21CS008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
21CS009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
21CS010	APP DEVELOPMENT	2	0	0	2	3	50	50	100	PE
21CS011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
21CS012	DEVOPS	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
21CS013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
21CS014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

21CS015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
21CS016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
21CS017	SOFTWARE DEFINED NETWORKS	2	0	2	3	3	50	50	100	PE
21CS018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
21CS019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
21CS020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
21CS021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
21CS022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
21CS023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	3	50	50	100	PE
21CS024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
21CS025	MULTIMEDIA AND ANIMATION	2	0	2	3	3	50	50	100	PE
21CS008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
21CS026	AUGMENTED REALITY/VIRTUAL REALITY	2	0	2	3	3	50	50	100	PE
21CS027	GAME DEVELOPMENT	2	0	2	3	3	50	50	100	PE
21CS028	VIDEO CREATION AND EDITING	2	0	2	3	3	50	50	100	PE
21CS029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING										
21CS030	KNOWLEDGE ENGINEERING	3	0	0	3	3	40	60	100	PE
21CS031	SOFT COMPUTING	3	0	0	3	3	40	60	100	PE
21CS032	TEXT AND SPEECH ANALYSIS	3	0	0	3	3	40	60	100	PE
21CS004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	3	50	50	100	PE
21CS033	OPTIMIZATION TECHNIQUES	3	0	0	3	3	40	60	100	PE
21CS034	ETHICS AND AI	3	0	0	3	3	40	60	100	PE
VERTICAL VII- DIVERSIFIED COURSES										
21CS035	SOFTWARE QUALITY ASSURANCE	3	0	0	3	3	40	60	100	PE
21CS036	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE

21CS037	INFORMATION STORAGE MANAGEMENT	3	0	0	3	3	40	60	100	PE
21CS038	MOBILE APPLICATION DEVELOPMENT	3	0	0	3	3	40	60	100	PE
21CS039	INTERNET OF THINGS	3	0	0	3	3	40	60	100	PE
21CS040	BUSINESS ANALYTICS	3	0	0	3	3	40	60	100	PE
MINOR DEGREE										
VERTICAL 1 - DATA SCIENCE										
21CSM01	EXPLORATORY DATA ANALYSIS	2	0	2	3	2	50	50	100	PE
21CSM02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
21CSM03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
21CSM04	NEURAL NETWORKS AND DEEPLEARNING	2	0	2	3	2	50	50	100	PE
21CSM05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
21CSM06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
HONOURS DEGREE										
VERTICAL 1 - DATA SCIENCE										
21CSH01	EXPLORATORY DATA ANALYSIS	2	0	2	3	2	50	50	100	PE
21CSH02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
21CSH03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
21CSH04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	2	50	50	100	PE
21CSH05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
21CSH06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
OPEN ELECTIVES										
21OCS01	OBJECT ORIENTED PROGRAMMING	3	0	0	3	3	40	60	100	PE
21OCS02	JAVA FUNDAMENTALS	3	0	0	3	3	40	60	100	PE
21OCS03	KNOWLEDGE DISCOVERY IN DATABASES	3	0	0	3	3	40	60	100	PE
21OCS04	E-LEARNING TECHNIQUES	3	0	0	3	3	40	60	100	PE
ONE CREDIT COURSES										
18CS0XA	3D ANIMATIONS	-	-	-	1	-	100	0	100	EEC
18CS0XB	QUANTUM COMPUTING	-	-	-	1	-	100	0	100	EEC
18CS0XC	AGILE PROGRAMMING	-	-	-	1	-	100	0	100	EEC
18CS0XD	MOBILE OPERATING SYSTEMS	-	-	-	1	-	100	0	100	EEC

18CS0XE	INTERNET MARKETING	-	-	-	1	-	100	0	100	EEC
18CS0XF	SCRIPTING LANGUAGES	-	-	-	1	-	100	0	100	EEC
18CS0XG	RASPBERRY PI	-	-	-	1	-	100	0	100	EEC
18CS0XH	AUTOMATION TESTING USING QTP	-	-	-	1	-	100	0	100	EEC
18CS0XI	AUGMENTED CODE REALITY	-	-	-	1	-	100	0	100	EEC
18CS0XJ	ANGULAR JAVA	-	-	-	1	-	100	0	100	EEC
18CS0XK	TENSOR FLOW	-	-	-	1	-	100	0	100	EEC
18CS0XL	STATISTICAL ANALYSIS USING R	-	-	-	1	-	100	0	100	EEC
18CS0XM	MACHINE LEARNING FOR ENGINEERS	-	-	-	1	-	100	0	100	EEC
18CS0XN	BLOCK CHAIN TECHNOLOGIES	-	-	-	1	-	100	0	100	EEC
18CS0XO	.NET PROGRAMMING	-	-	-	1	-	100	0	100	EEC
18CS0XP	GO PROGRAMMING	-	-	-	1	-	100	0	100	EEC
18CS0XQ	REACT JS	-	-	-	1	-	100	0	100	EEC
18CS0XR	NODE JS	-	-	-	1	-	100	0	100	EEC
18CS0XS	POSTGRESQL	-	-	-	1	-	100	0	100	EEC
18CS0XT	EMBEDDED IOT	-	-	-	1	-	100	0	100	EEC
18CS0XU	TABLEAU	-	-	-	1	-	100	0	100	EEC
18CS0XV	TYPE SCRIPT WITH JEST TESTING FRAMEWORK	-	-	-	1	-	100	0	100	EEC
21CS0XW	INDUSTRIAL METAVERSE	-	-	-	1	-	100	0	100	EEC
21CS0XX	WEB SERVICES SOLUTION ARCHITECT	-	-	-	1	-	100	0	100	EEC
21CS0XY	FLUTTER APPLICATION DEVELOPMENT	-	-	-	1	-	100	0	100	EEC
21CS0XZ	GUI DEVELOPMENT USING PYTHON	-	-	-	1	-	100	0	100	EEC

SUMMARY OF CREDIT DISTRIBUTION

S.No	Category	Credit per semester								Total Credit	Credits in %	Range of total credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	10	10	4	4					28	17	15%	20%
2	ES	5	9	4	5	4				27	17	15%	20%
3	HSS	2	2					2		6	4	5%	10%
4	PC			16	15	13	14			58	36	35%	45%
5	PE					6	9	12		27	17	15%	20%
6	EEC							8	9	17	10	5%	10%
Total		17	21	24	24	23	23	22	9	163	100	-	-

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social Sciences
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course

18CS101 ENGINEERING MATHEMATICS I 3 1 0 4

Course Objectives

- Understand the concepts of vectors and Eigenvectors for different matrices to describe the stability of the linear systems in engineering fields
- Exemplify the concepts of differentiation and integration to identify the area of 2D and 3D surfaces in engineering problems.
- Explain the concepts of analytic functions in complex domain to predict the nature of different engineering 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 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 (COs)

1. Represent the different forms of coordinate system in complex plane and characteristics of linear systems by Eigenvalues and Eigenvectors.
2. Analyse various types of functions and their differentiation techniques involved in engineering fields.
3. Implement different methods of integration used in engineering problems.
4. Execute the suitable integration technique to calculate the area and volume of different surfaces.
5. Apply the concept of analytic function to estimate the integral in complex plane.

Articulation Matrix

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

UNIT I **9 Hours**

COMPLEX NUMBERS, VECTORS AND MATRICES

Complex plane, polar coordinates and polar form of complex numbers, powers and roots, fundamental theorem of algebra. Vector algebra in 2-D and 3-D space, dot product and cross product. Matrices: Eigen values and Eigen vectors, Properties of eigen values and eigen vectors.

UNIT II **9 Hours**

CALCULUS

Limits and Continuity of Functions: Limits of functions, types of limits, evaluation of limits, continuity of functions, properties of continuous functions. Derivatives: Derivatives, differentiability, rules and properties, differentiation of transcendental functions, higher order derivatives, implicit differentiation, and differentiation of hyperbolic functions. Integration: Anti-derivatives, Riemann Sum, indefinite and definite integration, Mean Value Theorem for definite integral, Fundamental Theorem of Calculus.

UNIT III **9 Hours**

INTEGRATION METHODS

Basic integration formulae for algebraic and transcendental functions. Integration by special devices: integration by parts, rationalizing substitution or trigonometric substitution, partial fractions, reduction formulas, improper integrals, convergence tests.

UNIT IV **9 Hours**

APPLICATIONS OF DERIVATIVES AND INTEGRATIONS

Extreme values, points of inflection and curve sketching, Rolles Theorem, Mean Value Theorem, optimization, indeterminate forms, L Hospitals Rule. Area between curves, volume of a general solid by slicing and cylindrical shell methods, volume of a solid of revolution, length of plane curves, area of a surface of revolution.

UNIT V **9 Hours**

COMPLEX ANALYSIS

Analytic Functions- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method. Cauchys Integral Formula, Classification of Singularities, Cauchys Residue Theorem.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 45 Hours

Reference(s)

1 Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2 Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.
3 Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
4 Anton H, Calculus with Analytic Geometry, 5th edition, John Wiley & Sons, 1995.
5 Ayres F Jr and Mendelson E, Schaums Outline of Theory and Problems of Calculus, 4th edition, McGraw Hill, 1999.

18CS102 ENGINEERING PHYSICS I **2 0 2 3**

Course Objectives

- Illustrate the Newton's laws of motion and wave motion with applications.
- Understand the basic properties of electricity, magnetism and optics.
- Differentiate the special theory of relativity and quantum physics from classical physics.

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.

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.

m Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Illustrate the Newtons three laws of motion and apply the same to solve the real-world problems involving elevator, at wood machine and acceleration of objects
2. Exemplify the physical characteristics of simple harmonic motion, wave motion and find the solutions for wave equations
3. Infer the fundamental laws, properties of electricity and magnetism and apply the same to electric and magnetic elements.
4. Apply the principles of physical and geometrical optics in the mirrors, lenses, microscopes and diffraction gratings
5. Outline the importance of special theory of relativity, quantum physics and analyse the wave and particle nature of matter

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

UNIT I **6 Hours**

MECHANICS

Newtons laws of motion: Concept of force and its nature- Newtons first law and inertial frames- definition of mass- Newtons second law - gravitational force and weight- Newtons third law. Applications of Newtons laws: particle in equilibrium, particle under net force - weighing a mass in an elevator, the at wood machine and acceleration of two objects connected by a cord

UNIT II **6 Hours**

OSCILLATIONS AND WAVES

Fundamentals of simple harmonic motion - energy of simple harmonic oscillator - spring mass system- time period of simple pendulum, compound pendulum and torsional pendulum- Damped oscillations. Travelling wave motion - sinusoidal waves on strings - speed of a wave - reflection and transmission - rate of energy transfer in wave motion

UNIT III **6 Hours**

ELECTRICITY AND MAGNETISM

Point charges - electric fields- Gauss law and its applications- electric potential - capacitance – energy stored in a capacitor. Concept and source of magnetic fields- Amperes theorem- determination of magnetic field due to different current distributions - Faradays law - self-induction and mutual induction - energy stored in an inductor.

UNIT IV **6 Hours**

LIGHT AND OPTICS

Nature of light- laws of reflection and refraction- refractive index and Snells law - dispersion of light - total internal reflection - image formation: concave mirrors - convex mirrors- thin lenses - compound microscope-human eye. Conditions of interference - Youngs double slit experiment - intensity distribution of interference - phase chang due to reflection - diffraction - narrow slit diffraction - single slit and two slit - intensity distribution - diffraction grating – applications.

UNIT V **6 Hours**

MODERN OPTICS

Special theory of relativity - simultaneity and time dilation - twin paradox - length contraction - Relativistic mass variation-space time graph. Black body radiation and Planck hypothesis - allowed energy levels - thermal radiation from different objects - photoelectric and Compton effect. Matter waves - de-Broglie hypothesis - wave nature of particles - Davission-Germer experiment.

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 wavelength of mercury spectral lines-spectrometer

4 **4 Hours**

EXPERIMENT 4

Determination of refractive index of solid and liquid-travelling microscope

5 **3 Hours**

EXPERIMENT 5

Determination of wavelength of laser-diffraction grating

6 **4 Hours**

EXPERIMENT 6

Determination of frequency of a tuning fork-Meldes apparatus.

7 **4 Hours**

EXPERIMENT 7

Thickness of a thin wire using interference of light-Air wedge method.

Total: 60 Hours

Reference(s)

1 R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2011.
2 Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
3 H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017.
4 H D Young and R A Freedman, Sears and Zemanskys University Physics with Modern Physics, Pearson education, 2016.
5 R K Gaur and S L Gupta, Engineering Physics, Dhanpat Rai Publications, 2012.

18CS103 ENGINEERING CHEMISTRY I **2 0 2 3**

Course Objectives

- Identify the properties and applications of optical materials for smart screen
- Summarize the terminologies of electrochemistry and explain the applications of electrochemical instruments
- Classify the materials for data storage in electronic devices
- Outline the applications of organic materials in data storage
- Choose the suitable materials for the fabrications of microprocessors in 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.

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.

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. Compare the inorganic and organic materials used for smart screen fabrication.
2. Demonstrate the fabrication of smart screen using conducting material.
3. Analyze the type of materials for data storage in electronic devices.
4. Identify various organic nanoscale materials in data storage.
5. Select suitable materials for fabrication of microprocessor.

Articulation Matrix

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

UNIT I **6 Hours**

OPTICAL MATERIAL FOR SMART SCREEN

Types: Inorganic: Rare earth metals [yttrium, lanthanum, cerium, praseodymium, neodymium, europium, terbium and dysprosium] - organic: Organic dielectric material [Polystyrene, PMMA] - organic light emitting diodes [polythiopene].

UNIT II **6 Hours**

CONDUCTING MATERIALS FOR SMART SCREEN

Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive]. Chemical components in glass - alumino silicate - gorilla glass.

UNIT III **5 Hours**

MATERIALS FOR DATA STORAGE

Classification - magnetic storage [Iron oxide, cobalt alloy, chromium oxide and barium ferrite] – optical storage [photochromic materials] - solid storage.

UNIT IV **5 Hours**

ORGANIC NANOSCALE MATERIAL FOR DATA STORAGE

Data Storage - classification [media, access, information and volatility] - flexible data storage [transistor Structure] - flexible floating gate - flexible charge trap- flexible ferroelectric- flexible resistive memory with organic material.

UNIT V **7 Hours**

MATERIALS FOR MICROPROCESSOR FABRICATION

Micro electrical components: Fabrication (CVD method) and use of metal oxide materials. Integrated circuit manufacturing - preparation of silicon wafer - masking - photo-resistant materials - classification. Doping: Atomic diffusion, ion implantation, making successive layers. Microcapacitors: Types -electrochemical capacitors, electrolytic capacitors and supercapacitors. Soldering materials: copper, tin and silver.

1 **5 Hours**

EXPERIMENT 1

Estimation of copper content in a sample solution prepared from copper doped optical light emitting diodes

2 **5 Hours**

EXPERIMENT 2

Determination of conductivity of aluminium chloride, aluminium silicate and tin oxide compounds using conductivity meter

3 **5 Hours**

EXPERIMENT 3

Estimation of barium content in a sample solution prepared from iron alloy used in magnetic storage material.

4 **4 Hours**

EXPERIMENT 4

Estimation of iron content in sample solution prepared from ferro electric materials using

spectrophotometer

5 **6 Hours**

EXPERIMENT 5

Electroless plating of copper on polymeric material used in IC fabrication

6 **6 Hours**

EXPERIMENT 6

Electroless plating of nickel on polymeric material used in IC fabrication

FOR FURTHER READING

Applications of advanced data storage materials in electronic devices. Conducting materials for smart screen. Applications of smart material for microprocessor fabrication.

Total: 60 Hours

Reference(s)

1 Smart Materials Taxonomy, Victor Goldade, Serge Shil'ko, Aleksander Neverov, CRC publication, 2015.
2 https://www.dmccoltd.com/english/museum/touchscreens/technologies/projected.asp
3 Advanced Magnetic and Optical Materials, edited by Ashutosh Tiwari, Parameswar K. Iyer, Vijay Kumar, Hendrik Swart, wiley publication, 2016.
4 Recent Advances of Flexible Data Storage Devices Based on Organic Nanoscaled Materials- Li Zhou, Jingyu Mao, Yi Ren, Su-Ting Han, V A. L. Roy and Ye Zhou, Small 1703126, 2018.
5 Padma L Nayak, Polymer Science, 1st Edition, Kalyani Publishers, New Delhi, 2005.
6 G.M. Crean, R. Stuck, J.A. Woollam . Semiconductor Materials Analysis and Fabrication Process Control Elsevier publication, 2012.

18CS104 COMPUTER PROGRAMMING I **2 0 2 3**

Course Objectives

- Understand the history and basics of python.
- Gain knowledge about the different data types and control flow statements
- Impart knowledge about the functions, files, list, set tuples and dictionaries.

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 modelling to complex engineering activities with an understanding of the limitations
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
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.
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 global requirements.

Course Outcomes (COs)

1. Implement simple python programs using input output operations.
2. Develop python programs using expressions and statements.
3. Implement python programs using control flow statements and strings.
4. Apply the concepts of functions and files in python programming.
5. Design applications using list, sets, tuples and dictionaries in python.

Articulation Matrix

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

UNIT I **6 Hours**

INTRODUCTION

What is Python - History of Python - Features of Python - Simple Program in Python - Commenting in Python - Quotations in Python - Lines and Indentation - Multi-Line Statements - Input Operations - Output Operations.

UNIT II **4 Hours**

DATA, EXPRESSIONS, STATEMENTS

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points

UNIT III **8 Hours**

CONTROL FLOW STATEMENTS AND STRINGS

if statement - if-else statement - if-elif-else statement - Nested if - While loop - for loop - else statement used with loops - break statement - continue - pass statement - Strings: string slices - immutability - string functions and methods - In-built string methods - string formatting operations - string module.

UNIT IV **6 Hours**

FUNCTIONS AND FILES

Functions: return values - parameters - local and global scope - function composition - recursion; Files: Reading and Writing-Format Operators-Filenames and paths.

UNIT V **6 Hours**

LIST, SET, TUPLES AND DICTIONARIES

Lists as arrays - Lists: list operations - list slices -list methods - list loop - mutability - aliasing – cloning lists - list parameters; Set; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods.

1 **2 Hours**

EXPERIMENT 1

Program to implement basic operators.

2 **2 Hours**

EXPERIMENT 2

Program for Operator Precedence

3 **2 Hours**

EXPERIMENT 3

Program to implement the concept of function.

4

EXPERIMENT 4 **3 Hours**

Develop the program for selection statements.

5 **3 Hours**

EXPERIMENT 5

Program to implement looping statements.

6 **3 Hours**

EXPERIMENT 6

Program to implement break and continue statements.

7 **3 Hours**

EXPERIMENT 7

Develop a program to implement the concept of Recursion.

8 **3 Hours**

EXPERIMENT 8

Program to implement string functions.

9 **3 Hours**

EXPERIMENT 9

Implement the concept of list.

10 **3 Hours**

EXPERIMENT 10

Develop a program to implement tuples.

11 **3 Hours**

EXPERIMENT 11

Program to implement set, dictionaries.

Total: 60 Hours

Reference(s)

1 Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python)

2 Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python” Revised and updated for Python 3.2, Network Theory Ltd., 2014.

3 Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, Wiley India Edition, 2015.

4 John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press , 2017

18HS101 COMMUNICATIVE ENGLISH I **1 0 2 3**

Course Objectives

- Read and understand the main points on familiar matters regularly encountered in work, school, or leisure
- Listen and respond in most common situations where English is spoken
- Write simple connected texts on topics which are familiar or of personal interes
- Describe experiences and events, hopes and ambitions and briefly give reasons and explanations for opinions and plans

Programme Outcomes (POs)

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.

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

Course Outcomes (COs)

1. Use appropriate grammar & vocabulary that is expected at the BEC Preliminary exam level
2. Understand the general meaning of non-routine letters within own work area, and short reports of a predictable nature
3. Write straightforward, routine letters of a factual nature, and make notes on routine matters, such as taking/placing orders
4. Follow simple presentations/demonstrations
5. Deal with predictable requests from a visitor, state routine requirements, and offer advice within own job area on simple matters

Articulation Matrix

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

UNIT I **9 Hours**

GRAMMER

Tenses Future continuous, Past continuous, Past perfect, Past simple, Past tense responses, Present perfect continuous, Present perfect/past simple Reported speech Adverbs intensifiers Comparatives and superlatives Conditionals 2nd and 3rd Connecting words expressing cause and effect, contrast Phrasal verbs Prepositions of place Simple passive - Wh-questions in the past Question tags Will and going to, for prediction

UNIT II **9 Hours**

READING

Understanding short real-world notices, messages Detailed comprehension of factual material; skimming and scanning skills - Interpreting visual information Reading for detailed factual information Reading for gist and specific information - Grammatical accuracy and understanding of text structure - Reading and information transfer.

UNIT III **9 Hours**

WRITING

Internal communication including note, message, memo or email - arranging / rearranging appointments, asking for permission, giving instructions - Business correspondence including letter, fax, email apologising and offering compensation, making or altering reservations, dealing with requests, giving information about a product.

UNIT IV **9 Hours**

LISTENING

Listening for specific information Listening for numbers and letters Note completion Listening for gist listening to monologues (presentations, lectures, announcements and briefings) listening to interacting speakers (telephone conversations, face-to-face conversations, interviews and discussions).

UNIT V **9 Hours**

SPEAKING

Exchanging personal and factual information expressing and finding out about attitudes and opinions organise a larger unit of discourse Turn-taking, negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, comparing and contrasting, and decision-making.

1.Goodbye party for Miss Pushpa T S - Nissim Ezekiel
2.Our Casuarina Tree - Toru Dutt
3.Palanquin Bearers- Sarojini Naidu
4.The Tyger - William Blake
5.Ode on a Grecian Urn - John Keats

Total: 45 Hours

Reference(s)

1 Alexander Garrett, Cambridge BEC Preliminary Students Book with Answers, Cambridge University Press, 2016.
2 Lan Wood, Anne Williams and Anna Cowper. Pass Cambridge BEC Preliminary, Second Edition, New Delhi, 2014.
3 Norman Whitby. Cambridge Business Benchmark. Pre-Intermediate to Intermediate, Students Book. South Asian Edition, 2018.

18CS106 HARDWARE ASSEMBLING AND SOFTWARE TOOLS LABORATORY **0 0 4 2**

Course Objectives

- Understand the basic hardware components.
- Gain knowledge about installation of operating systems.
- Impart knowledge about hardware assembling and troubleshooting.

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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

Course Outcomes (COs)

1. Identify the basic hardware components.
2. Install and configure Windows and Linux operating systems.
3. Install and configure software packages and drivers.
4. Assemble and troubleshoot hardware devices.
5. Install and work with office automation software.

Articulation Matrix

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

1 **6 Hours**

EXPERIMENT 1

a) Study of desktop computer, motherboard and its interfacing components.

b) Install and configure computer drivers and system components.

2

EXPERIMENT 2

3 Hours

Disk formatting, partitioning and Disk operating system commands

3 **6 Hours**

EXPERIMENT 3

a) Install, upgrade and configure Windows/Linux operating systems.

b) Installation of Dual OS using Virtual Machine

4 **6 Hours**

EXPERIMENT 4

a) Installation Antivirus and configure the antivirus.

b) Installation of printer and scanner software.

5 **6 Hours**

EXPERIMENT 5

a) Assembly and Disassembly of hardware.

b) Troubleshooting and Managing Systems

6 **6 Hours**

EXPERIMENT 6

a) Recovering the root file system after corruption.

b) Create a FAT32 formatted partition on a disk in Windows 7, and convert the partition to NTFS

7 **3 Hours**

EXPERIMENT 7

Remote desktop connections and file sharing.

8 **3 Hours**

EXPERIMENT 8

Establish network connections, Configure IP address and Domain name system.

9 **3 Hours**

EXPERIMENT 9

Install two different kinds of network cards and connect two computers to campus LAN and download a file from a computer on the LAN

10 **6 Hours**

EXPERIMENT 10

a) Create an advertisement page in Word

b) Create a Mail Merge Letter and a macro for inserting a picture and formatting the text in Word

11 **3 Hours**

EXPERIMENT 11

Create a report in Excel containing the pay details of the Employee

12 **3 Hours**

EXPERIMENT 12

Create a simple bar chart to high light the sales of a company for 5 different periods

13 **3 Hours**

EXPERIMENT 13

Create a macro which creates a line chart using the data in the worksheet

14 **3 Hours**

EXPERIMENT 14

Make a presentation on Wild Life and apply the following:

a. Add audio and video effects

b. Apply various Colour Schemes

c. Apply various animation schemes.

d. Apply Slide Show

Total: 60 Hours

18CS201 ENGINEERING MATHEMATICS II 3 1 0 4

Course Objectives

- Understand the concepts of partial derivatives and multiple integrals to define the area, volume and extreme values of various surfaces in engineering fields
- Classify the sequences and series in linear systems is convergent or divergent.
- Formulate the real time engineering problem into mathematical model using ordinary differential equation and solve it by appropriate method.

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.
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. Illustrate the various parameters in partial differentiation and characterize the maxima and minima functions for signals and systems.
2. Apply multiple integral concepts to calculate the area and volume by appropriate vector integral theorems
3. Analyse the convergence and divergence of sequences and series by various tests.
4. Construct first order differential equations from real time phenomena and solve it by suitable method
5. Execute the appropriate method to solve the second order differential equations.

Articulation Matrix

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

UNIT I **9 Hours**

PARTIAL DIFFERENTIATION

Functions of several variables, plotting of 2-variable functions, introduction to cylindrical and spherical coordinates, chain rule, total differential, gradient, directional derivatives, normal lines and tangent planes, extreme of functions of two variables, applications.

UNIT II **9 Hours**

MULTIPLE INTEGRALS

Double integrals, regions of integrations, triple integrals, applications (Cartesian coordinates only- Greens theorem and Gauss Divergence theorem).

UNIT III

SEQUENCES AND SERIES **9 Hours**

Sequences and series, convergence and divergence of series, absolute convergence, conditional convergence, test for convergence and divergence. Power series for functions, interval of convergence, Taylor and Maclaurin series, Taylors Theorem with remainder.

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS

Separable differential equations, homogeneous differential equations, exact differential equations, integrating factor, Bernoulli equation, applications.

UNIT V **9 Hours**

SECOND ORDER DIFFERENTIAL EQUATIONS

Second order homogeneous and non-homogeneous equations with constant coefficients, variation of parameters, method of undetermined coefficients, series solutions of differential equations, applications.

FOR FURTHER READING

Applications to Data mining, Graphics and Machine learning.

Total: 60 Hours

Reference(s)

1 Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2 Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
3 Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
4 Peter V. O Neil, Advanced Engineering Mathematics, Seventh Edition, Cengage Learning India Private Limited, 2012.
5 Glyn James, Advanced Engineering Mathematics, Third Edition, Wiley India, 2014.

18CS202 ENGINEERING PHYSICS II **2 0 2 3**

Course Objectives

- Understand the applications of laser and fibre optics in the field of engineering
- Impart knowledge in crystallography and semiconductors
- Differentiate the different types of magnetic materials and their applications

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.
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
m Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Understand the principle, characteristics, different types of lasers and apply the same for optical data storage and retrieval techniques
2. Illustrate the propagation of light through different optical fibres, applications of optical fibers in communication and sensors
3. Identify the seven crystal systems, crystal planes and the stacking sequences in metallic crystal structures
4. Analyse the characteristics of semiconducting materials interms of crystal lattice, charge carriers and energy band diagrams
5. Outline the properties of magnetic materials, domain theory of ferro magnetism and the applications for recording and readout process

Articulation Matrix

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

UNIT I **7 Hours**

LASER

Principle - interaction of radiation with matter - characteristics of laser radiation - pumping mechanisms -types: CO2 laser-homo junction GaAs laser - applications: optical data storage and retrieval techniques - holography: principle - types - comparison of holography with photography - construction -reconstruction of hologram – applications.

UNIT II **7 Hours**

FIBER OPTICS

Principle- conditions to achieve total internal reflection- structure- acceptance angle and numerical aperture (qualitative treatment only)- types- modes of propagation- refractive index profile- block diagram of fiber optic communication system- fiber optic sensors- intensity modulated sensor- endoscopy- merits of fiber cables over conventional communication systems.

UNIT III **5 Hours**

CRYSTAL PHYSICS

Crystalline and amorphous materials - lattice point - basis - unit cell - crystal systems – Bravais lattices - planes in crystals- Miller indices - procedure for finding Miller indices- important features of Miller indices-unit cell characteristics of SC, BCC, FCC and HCP structures.

UNIT IV **6 Hours**

SEMICONDUCTING MATERIALS

Characteristics - elemental and compound semiconductors - energy band description and current conduction in intrinsic semiconductors- energy band description of n-type and p-type semiconductors- conductivity of extrinsic semiconductors - variation of Fermi level with temperature and impurity concentration- temperature dependence on carrier concentration - Hall effect-applications - solar cells - photodiodes.

UNIT V **5 Hours**

MAGNETIC MATERIALS

Fundamental definitions - Bohr magneton- classification of dia, para and ferromagnetic materials - domain theory - hysteresis curve - soft and hard magnetic materials - energy product and its importance - anti-ferromagnetic materials - ferrites - giant magneto resistance (GMR) effect- application: Principles of Magnetic Recording- Magnetic Digital Recording- Magneto-Optic Recording

1 **2 Hours**

EXPERIMENT 1

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 2

Determine the wavelength of given laser source by applying the principle of diffraction

3 **4 Hours**

EXPERIMENT 3

Determination of acceptance angle and numerical aperture of a given fiber

4 **4 Hours**

EXPERIMENT 4

Evaluation of bandgap of given material using bandgap kit.

5 **4 Hours**

EXPERIMENT 5

Determine the V-I characteristics of a solar cell.

6 **4 Hours**

EXPERIMENT 6

Using Hall effect, determine the nature of given material.

7 **4 Hours**

EXPERIMENT 7

Find the refractive index of a transparent solid with the aid of travelling microscope

8 **4 Hours**

EXPERIMENT 8

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

Total: 60 Hours

Reference(s)

1 Balasubramaniam, R. Callister's Materials Science and Engineering. Wiley India Pvt.Ltd., 2014.
2 Kasap, S.O. Principles of Electronic Materials and Devices. McGraw-Hill Education, 2017.
3 Wahab, M.A. Solid State Physics: Structure and Properties of Materials. Alpha Science International Ltd.,2017
4 Donald A. Neamen. Semiconductor Physics and Devices, Mc Graw-Hill, 2011.
5 K. Thiyagarajan and A. K. Ghatak, LASERS: Fundamentals and Applications, Springer, USA,2015
6 B.D. Cullity, Introduction to Magnetic Materials, Addison-Wesley

18CS203 ENGINEERING CHEMISTRY II **2 0 2 3**

Course Objectives

- Classify the traditional and advanced materials used to manage heat developed in electronic devices
- Summaries the terminologies of electrochemistry and explain the applications of energy storage devices for computers
- Indicate the types, properties and applications of nanochips and carbon nanotubes used in electronic devices
- Outline sources of e-wastes and its effects on environment and its management

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.
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

Course Outcomes (COs)

1. Compare the metals and alloys used as thermal management materials in electronic devices
2. Interpret the advanced thermal management materials for microelectronics and optoelectronic
3. Analyze the importance of primary, secondary batteries and fuel cells used in energy storage devices in computers
4. Identify suitable nanomaterial used for diverse applications in electronic devices
5. Select a suitable technology to manage e-wastes from various 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				
2	2	2						2	2	2				
3	2	1						2	2	2				
4	2	1						2	2	2				
5	2							2	2	2				

UNIT I **6 Hours**

THERMAL MANAGEMENT MATERIALS

Heat generation - purpose - classification of electronic packaging - types of thermal management materials - traditional thermal management materials : Metals [Cu, Al, W and Mo] - compounds [Al2O3, BeO, AlN, SiC and Kovar alloy]

UNIT II **7 Hours**

ADVANCED THERMAL MANAGEMENT MATERIALS

Alloys: W-Cu, Mo-Cu, Cu/MoCu/Cu, AlSiC, Cu/SiC and W85-Cu. Fiber-reinforced material - sandwich structure of composite - thermal management materials for microelectronics and optoelectronics: Carbon nanotubes and aluminium/diamond composites

UNIT III **7 Hours**

ENERGY STORAGE DEVICES FOR COMPUTERS

Cell - cell potential - determination of potential. Batteries - types: Primary battery [Zinccarbon]. Secondary battery: lead-sulphur. Modern battery: lithium polymer battery and fuel cells

UNIT IV **5 Hours**

NANO MATERIALS

Nano chips - types of material - properties - applications. Carbon nanotubes - fullerene, graphene Types and applications

UNIT V **5 Hours**

E-WASTE MANAGEMENTS

Sources - toxicity due hazardous substances - impact to environment. E-waste management- Hazardous materials recycling (Gallium and Arsenic)

1 **8 Hours**

EXPERIMENT 1

General introduction and Determination of thermal stability of aluminium oxide using thermos gravimetric analysis.

2 **4 Hours**

EXPERIMENT 2

Determination of thermal stability of copper alloys using thermo gravimetric analysis

3 **6 Hours**

EXPERIMENT 3

Determination of single electrode potential of zinc and copper electrodes.

4 **6 Hours**

EXPERIMENT 4

Preparation of cadmium nanoparticles and its characterization.

5 **6 Hours**

EXPERIMENT 5

Estimation of chromium and lead content in sample solution prepared from e-waste [PCB] using spectrophotometer

Total: 60 Hours

Reference(s)

1 Ravi Kandasamy, Arun S. Mujumdar. Thermal Management of Electronic Components. Lap Lambert Academic Publishing GmbH KG, 2010.
2 Guosheng Jiang, Liyong Diao, Ken Kuang. Advanced Thermal Management Materials. Springer Science & Business Media, 2012.
3 Nihal Kularatna. Energy Storage Devices for Electronic Systems: Rechargeable Batteries and Supercapacitors. Academic Press, 2014.
4 Odne Stokke Burheim. Engineering Energy Storage. Academic Press, 2017.
5 M. S. Dresselhaus, G. Dresselhaus, P. C. Eklund. Science of Fullerenes and Carbon Nanotubes: Their Properties and Applications. Elsevier, 1996.
6 Kazuyoshi Tanaka, S. Iijima. Carbon Nanotubes and Graphene. Edition 2, Newnes, 2014

18CS204 COMPUTER PROGRAMMING II **2 0 2 3**

Course Objectives

- Understand the basics of C primitives, operators and expressions
- Gain knowledge about the different primitive and user defined data types.
- Impart knowledge about the structural programming concepts.

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 modelling to complex engineering activities with an understanding of the limitations.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leaderin 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.
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 global requirements.

Course Outcomes (COs)

1. Implement C programs using operators, type conversion and input-output functions
2. Develop C Programs using decision making and looping statements.
3. Develop C programs using the concepts of arrays and strings.
4. Implement C Programs using functions and pointers.
5. Design applications using structures, unions and files in C.

Articulation Matrix

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

UNIT I **6 Hours**

INTRODUCTORY CONCEPTS

Problem Solving Techniques - C Primitives: Introduction to C- Planning and writing a C program- Compiling and executing the C program - Operators and Expressions - Type Conversion Formatted I/O functions.

UNIT II **4 Hours**

CONTROL STATEMENTS

Decision Making and Branching - Statement - Decision Making and Looping Jump Statements

UNIT III **6 Hours**

ARRAYS AND STRINGS

Arrays- one dimensional array - two-dimensional arrays - multi dimensional arrays. Strings - String handling functions.

UNIT IV **6 Hours**

FUNCTIONS AND POINTERS

User Defined Functions: - categories of function - call by value and call by reference - recursion. Pointers- Accessing a variable through its pointer

UNIT V **8 Hours**

STRUCTURES AND FILES

Storage Class Specifiers - Structures and Unions: Introduction - File Management in C - Defining and opening a file - closing a file - Input/output operations on files.

FOR FURTHER READING

Problem solving - Logical thinking - logic - symbolic logic - truth tables - Math puzzles - magic triangles - magic squares.

1 **3 Hours**

EXPERIMENT 1

Write a C program to perform arithmetic operations on integers and floatingpoint numbers.

2 **3 Hours**

EXPERIMENT 2

Write a C program to implement ternary operator and relational operators.

3 Hours

3

EXPERIMENT 3

Write a C program to read the values of A,B,C through the keyboard. Add them and after addition check if it is in the range of 100 to 200 or not. Print separate message for each.

4 **3 Hours**

EXPERIMENT 4

Write a C program to display the roots of a quadratic equation with their types using switch case.

5 **3 Hours**

EXPERIMENT 5

Write a C program to generate the following triangle.

1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7

6 **3 Hours**

EXPERIMENT 6

Write a C program to get a matrix of order 3x3 and display a matrix of order of 4x4, with the fourth row and column as the sum of rows and columns respectively.

7 **3 Hours**

EXPERIMENT 7

Write a C program to remove the occurrence of "the" word from entered string.

8 **3 Hours**

EXPERIMENT 8

Write a C program to find the factorial of given number.

9 **3 Hours**

EXPERIMENT 9

Design a structure to hold the following details of a student. Read the details of a student and display
them in the following format Student
details: rollno, name, branch, year, section, cgpa.
****
NAME:
ROLL NO:
BRANCH:
YEAR:
SECTION:
CGPA:

10 **3 Hours**

EXPERIMENT 10

Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt.

Total: 60 Hours

Reference(s)

1 Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
2 Byron Gottfried, Programming with C, Schaum's Outlines, Tata Mcgraw-Hill, 2013
3 E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4 Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009
5 Kelley A and I. Pohl, A Book on C : Programming in C, Pearson Education, 1998
6 Ashok.N.Kamthane, Programming in C,Pearson education,2013

18CS206 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 2 0 2 3

Course Objectives

- To understand the concept, layout of electrical supply system from SMPS to various computer accessories.
- To understand the operation memory devices and display system used in computers.
- To identify the types of connectors, cables and electric drives for computer 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 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Recognize the operation of power supply system and protection circuit used in computers.
2. Explain different types of memory devices and display system of computers.
3. Differentiate cables and connectors used for personal computers.
4. Classify the various Electric Drives used in Personal computers.
5. Attribute the different types of electronic devices used in computers.

Articulation Matrix

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

UNIT I **6 Hours**

POWER SUPPLY AND PROTECTION CIRCUIT

Power supply, rating of power supply and power supply back-up system: CPU, sensors and display systems. Protection: Types of fuses and fuse holders in CPU, Earthing and neutral connection in CPU. - Layout of power supply system from SMPS to various computer accessories and peripherals – Single input multiple output system SMPS - ATx power supply system.

UNIT II **6 Hours**

MEMORY DEVICES AND DISPLAY SYSTEMS

Primary memory: RAM: DRAM, SRAM ROM: PROM, EPROM, Cache memory Secondary memory, Displays Devices: LCD and LED monitors - Plasma monitors - HDTV.

UNIT III **6 Hours**

CABLES AND CONNECTORS

Cables: VT, Power, USB, Fiber optics, Multicore, SATA - Sensors: Optical fiber, Thermal, heat sinks. Types of connectors -Ethernet, fiber optic, rectangular, circular, audio, D-Shape, VSB, pluggable.

UNIT IV **6 Hours**

ELECTRICAL MOTORS AND DRIVES

Torque speed characteristics of Stepper motor and Servo motor. Drive system components, CD drive, Hard disk drive and cooling fan drive -Wiring layout of drive systems.

UNIT V **6 Hours**

ELECTRONIC DEVICES

PN junction diode, BJT, FET, IC555 timer, Basic Amplifier and Oscillator circuits.

1 **6 Hours**

EXPERIMENT 1

Design of power supply system for mobile charger.

2 **3 Hours**

EXPERIMENT 2

Display numbers and words using LED dot matrix.

3 **6 Hours**

EXPERIMENT 3

Identify and trouble shoot Ethernet and optical fiber cable.

4 **6 Hours**

EXPERIMENT 4

Develop a control system for servo motor/stepper motor drive.

5 **6 Hours**

EXPERIMENT 5

Develop a wiring layout form SMPS to various computer peripherals.

Total: 60 Hours

Reference(s)

1 B. Govindarajalu Ibm Pc And Clones: Hardware, Troubleshooting And Maintenance, Tata McGraw Hill Limited.

2 K. L. JAMES Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, PHI Learning Private Limited.

3 Robert Bruce Thompson, Barbara Fritchman Thompson PC Hardware in a Nutshell: A Desktop Quick Reference Oreilly Media Ltd.

4 Muzaffer A. Siddiqi, Dynamic RAM: Technology Advancements, CRC Press.
5 Sanjay K. Bose, Hardware and Software of Personal Computers, New Age International (P) Limited Publishers.
6 M. Morris Mano, Digital Logic and Computer Design, Pearson India Publishers.

18CS207 ENGINEERING GRAPHICS **1 0 4 3**

Course Objectives

- Provide knowledge on projection of points and lines.
- Impart skill in drawing projection of simple solids.
- Build the proficiency to create two dimensional sketches using software.

Programme Outcomes (POs)

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

h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

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.

Course Outcomes (COs)

1. Illustrate the projection of points and lines in different quadrants
2. Construct orthographic projections of simple solid
3. Create the orthographic and isometric projections of simple solids.
4. Sketch the two dimensional views of engineering components using software
5. Construct three dimensional models of engineering components and its orthographic views using software.

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		2				
5	2							2		2				

UNIT I **10 Hours**

PROJECTION OF POINTS

Practices on lettering, numbering and dimensioning of drawings. Principles of projection, Projection of points in four quadrants, first angle projection of straight lines Ã¢?? parallel, perpendicular and inclined to anyone plane.

UNIT II **12 Hours**

PROJECTION OF SOLIDS

Orthographic projection of simple solids Ã¢?? parallel, perpendicular and inclined to one plane using change of position method.

UNIT III **14 Hours**

ISOMETRIC AND PERSPECTIVE PROJECTION

Conversion of isometric to orthographic projection and vice versa. Perspective projection of simple solids.

UNIT IV **10 Hours**

CREATION OF 2D SKETCHES USING SOFTWARE

Sketch Entities Ã¢?? line, circle, arc, rectangle, slots, polygon, text, snap, and grid. Sketch Tools- fillet, chamfer, offset, convert entities, trim, extend, mirror, move, copy, rotate, scale, stretch, sketch pattern. Geometrical constraints, Dimensioning - smart, horizontal, vertical, ordinate.

UNIT V **14 Hours**

PART MODELING AND DRAFTING USING SOFTWARE

Part Modelling- extrude, cut, revolve, creation of planes, fillet, chamfer, shell, rib, pattern, mirror, loft, draft and swept. Drafting - Converting 3D models to orthographic views with dimensions.

Total: 60 Hours

Reference(s)

1 K Venugpoal, Engineering Drawing and Graphics, Third edition, New Age International, 2005.
2 BasantAgrawal, Mechanical drawing, Tata McGraw-Hill Education, 2008.
3 Engineering Drawing Practice for Schools & Colleges, Bureau of Indian Standards-Sp46, 2008.
4 N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House Pvt. Limited,2008.
5 K.V. Natarajan, A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 2013.

18CS301 ENGINEERING MATHEMATICS III 3 1 0 4

Course Objectives

- Interpret the introductory concepts of Logic, which will enable them to model and analyze physical phenomena involving continuous changes of variables
- Implement the definitions of relevant vocabulary from graph theory and Combinatory and be able to perform related calculations.
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of polynomial equations and Implement the mathematical ideas for interpolation numerically.

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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Interpret the concepts of direct proof, indirect proof and proof by contradiction and verify the validity of an argument using propositional and predicate logic.
2. Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction.
3. Demonstrate the equations into Algebraic, Transcendental or simultaneous and apply the techniques to solve them numerically and implement an appropriate numerical method for interpolation.
4. Apply numerical computational techniques to obtain the solutions of first order ordinary differential equations, numerically
5. Develop the identification of Numerical errors arise during computations due to round-off errors and truncation errors.

Articulation Matrix

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

UNIT I **12 Hours**

LOGIC

Propositional Logic- Truth tables- Tautologies and Contradictions- Rules of inference- Predicate Logic.

UNIT II **10 Hours**

SET THEORY AND GRAPHS

Sets: Relations- Equivalence relations- Functions- Graphs: Graph- Isomorphism- connected graphsTrees- Shortest path problem

UNIT III **9 Hours**

NUMERICAL SOLUTION OF LINEAR EQUATIONS AND INTERPOLATION

Algebraic and transcendental equations: Newton - Raphson method - Solution of system of linear equations: Gauss elimination method - Matrix inversion: Gauss- Jordan method - Eigen value of a matrix by power method-Polynomial interpolation and cubic spline interpolation.

UNIT IV **10 Hours**

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Single and multi-variable nonlinear equations- convergence of fixed point iterations- Least squares approximation- Normal equations- Single step methods- Runge-Kutta methods- Multi-step methods- Finite Difference Methods

UNIT V **4 Hours**

ERROR ANALYSIS

Errors- Truncation and round off errors- measurement errors- Chebychev Polynomial and data filtering.

Total: 60 Hours

Reference(s)

1 Greenberg Michael D,Advanced Engineering Mathematics, Prentice-Hall International Inc, 1998.
2 James Glyn, Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.
3 Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993
4 Kenneth H Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, Seventh Edition, Seventh Edition, Mc Graw Hill Education India Private Limited, New Delhi, 2013.
5 An Introduction to Error Analysis: The Study of Uncertainties Measurements, John R. Taylors University of Science Books, 1996.

18CS302 DATA STRUCTURES 3 0 0 3

Course Objectives

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Implement the abstract data type List using array and linked lists to solve the real-time applications
2. Apply the linear data structures stack and queue for real time applications.
3. Implement the non-linear data structure tree for real world applications.
4. Inspect abstract data types for graph data structures for problem solving.
5. Critically analyze the sorting, searching algorithms, and hashing techniques.

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

UNIT I **9 Hours**

LINEAR DATA STRUCTURES - LIST

Pseudo code-Algorithm efficiency -Designing recursive algorithms - Recursive examples.-Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation -singly linked lists- circularly linked lists- doubly-linked lists -applications of lists -Polynomial Manipulation -All operations(Insertion, Deletion, Merge, Traversal).

UNIT II **9 Hours**

LINEAR DATA STRUCTURES - STACKS, QUEUES

Stack ADT - Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT - Operations - Circular Queue - Priority Queue- deQueue - applications of queues.

UNIT III **9 Hours**

NON LINEAR DATA STRUCTURES - TREES

Tree ADT - tree traversals - Binary Tree ADT - expression trees - applications of trees - binary search tree ADT - AVL Trees - B-Tree - Heap - Applications of heap.

UNIT IV **9 Hours**

NON LINEAR DATA STRUCTURES – GRAPHS

Definition - Representation of Graph - Types of graph - Breadth-first traversal - Depth-first traversal -Topological Sort - Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm Kruskal's Algorithm.

UNIT V **9 Hours**

SEARCHING, SORTING AND HASHING TECHNIQUES

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort - Radix sort - Hashing- Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

FOR FURTHER READING

Applications of list - Red-Black trees - Splay trees- Bucket hashing - Introduction to NP Completeness

Total: 45 Hours

Reference(s)

1 Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,2016.

2 Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.

3 Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.

4 Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

18CS303 DIGITAL SYSTEM DESIGN **3 0 2 4**

Course Objectives

- Understand the fundamentals of digital logic.
- Understand the implementation of logic circuits.
- Analyse and design various combinational and sequential circuits.

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.
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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyse the basic operations used in digital systems.
2. Design and analyze combinational circuits.
3. Implement MSI devices for digital application
4. Construct state machines and flipflop in synchronous sequential circuits.
5. Analyse the basic operations in Asynchronous sequential circuits

Articulation Matrix

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

UNIT I **9 Hours**

BOOLEAN ALGEBRA AND LOGIC GATES

Number systems - Decimal, Binary, Octal and Hexadecimal - conversion from one system to

another - Representation of Negative numbers - Logic gates - Boolean Algebra - Postulates of Boolean algebra - Minterm - Maxterm - SOP and POS forms - NAND and NOR implementation - Simplification of Boolean functions: Two variable K Map - Three variable K Map - Four variable K Map - Five variable K map - Don't care conditions.

UNIT II **9 Hours**

COMBINATIONAL LOGIC

Combinational circuits - Analysis procedures - Design procedures - Adders - Subtractors - Binary adder - Carry Look Ahead Adder - BCD Adder - Magnitude comparator - Code Converters - Binary code - Gray code- Excess 3 code- BCD code

UNIT III **7 Hours**

DESIGN WITH MSI DEVICES

Multiplexers and Demultiplexers- Function realization using multiplexers - Decoders and encoders - Programmable Logic Devices (PLD) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) -Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT IV **10 Hours**

SYNCHRONOUS SEQUENTIAL LOGIC

Sequential circuits - Latches -Flip flops - RS, JK, D and T flipflops - Flip Flop Conversion – Analysis procedures - Design procedures - Moore and Mealy models - State reduction and state assignment – Shift Registers - Counters.

UNIT V **10 Hours**

ASYNCHRONOUS SEQUENTIAL LOGIC

Design of Asynchronous sequential circuits - Analysis procedure: Transition Table - Flow Table – Race Condition- stability, Design Procedure: Primitive Flow Table- Reduction- Transition Table- Race Free State Assignment- Hazards

1

EXPERIMENT 1

Implement Boolean Laws using Logic Gates **5 Hours**

2

EXPERIMENT 2

Implement adder and subtractor in combinational circuit **5 Hours**

3

EXPERIMENT 3

Construct Magnitude comparator **5 Hours**

4

EXPERIMENT 4

Demonstrate Multiplexer and Demultiplexer **5 Hours**

5

EXPERIMENT 5

Implement Encoder and Decoder **5 Hours**

6 **5 Hours**

EXPERIMENT 6

Implement shift register using sequential circuit

FOR FURTHER READING

HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog.

Total: 75 Hours

Reference(s)

1 M.Morris Mano and Michael D Ciletti, Digital Design with an introduction to the VHDL, Pearson Education, 5th Edition, 2013
2 A Anand Kumar, Fundamentals of Digital Circuits, 3rd Edition,2014
3 Charles H.Roth, Jr., Fundamentals of Logic Design, 4th Edition, Jaico Publishing House, 2000
4 Mandal , Digital Electronics Principles & Application, McGraw Hill Edu,2013.
5 Donald D.Givone, Digital Principles and Design, Tata McGraw-Hill, 2003
6 John M.Yarbrough, Digital Logic, Application & Design, Thomson, 2002.

18CS304 SOFTWARE ENGINEERING 3 0 0 3

Course Objectives

- Understand detailed concepts related to software engineering life cycle.
- Gain knowledge about the concepts of software designing and testing.
- Acquire knowledge about an quality management processes and methods

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 modelling 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.
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 global requirements.

Course Outcomes (COs)

1. Analyze the software development life cycle models for applications
2. Identify the software requirement models and cost estimations for software projects.
3. Apply the software design concepts, principles and practices to develop software.

4. Compare and contrast the testing techniques for the software projects
5. Analyze the quality of the software using software reviews and software configuration management process

Articulation Matrix

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

UNIT I **7 Hours**

SOFTWARE PROCESS MODELS

The Nature of Software-Software Process Models-Waterfall Model-Incremental Process Models- Evolutionary Process Models- Prototyping-Spiral Model-Concurrent Model-Introduction to Agile Process.

UNIT II **11 Hours**

REQUIREMENT ENGINEERING AND ESTIMATION

Requirements Engineering - Establishing the Groundwork - Eliciting Requirements - Building the Requirements Model - Requirements Analysis - Metrics in the Process and Project Domains – Software Measurements - Metrics for Software Quality - Software Project Estimation - Decomposition Techniques - Empirical Estimation Models - The Make/Buy Decision.

UNIT III **8 Hours**

DESIGN CONCEPTS AND PRINCIPLES

The Design Concepts - The Design Model - Architectural Design - User Interface Design: Interface Analysis - Interface Design Steps - Risk Management - Software Engineering Practice - Core Principles - Coding Principles and Concepts.

UNIT IV **10 Hours**

TESTING TACTICS

Software Testing Fundamentals - Internal and External Views of Testing - White-Box Testing – Basis Path Testing - Control Structure Testing - Black Box Testing - Unit Testing - Integration Testing – Validation Testing - System Testing - The Art of Debugging.

UNIT V **9 Hours**

QUALITY MANAGEMENT

Software Quality Assurance - Software Reviews - Formal Technical Reviews - Informal Reviews - Software Reliability - Software Configuration Management - The SCM Process - The Cleanroom Strategy - Software Reengineering Process Model - Reverse Engineering - Forward Engineering.

FOR FURTHER READING

Software Process Improvement - SPI Process - The CMMI - SPI Frameworks.

Total: 45 Hours

Reference(s)

1 Roger S.Pressman, Software Engineering: A Practitioners Approach, McGraw Hill International edition, Seventh edition, 2010
2 Ian Sommerville, Software Engineering, 8th Edition, Pearson Education,2008
3 Stephan Schach, Software Engineering, Tata McGraw Hill, 2007
4 Pfleeger and Lawrence Software Engineering: Theory and Practice, Pearson Education, second edition, 2001

18CS305 DATABASE MANAGEMENT SYSTEMS 3 0 0 3

Course Objectives

- Understand the data models, conceptualize and depict a database system using E-R diagram.
- Gain knowledge on the design principles of a relational database system and SQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Design ER model with constraints to perform database design effectively.
2. Apply the SQL queries, relational models and set operations for problem solutions.
3. Write queries using normalization criteria and optimize queries.
4. Compare and contrast the indexing strategies in database systems.
5. Analyze the issues involved in transaction processing, concurrency control, deadlock and its recovery schemes.

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

UNIT I **8 Hours**

INTRODUCTION

Introduction: Database system application, purpose of database system View of Data -Database Languages-Data Storage and Querying-Database Architecture - Database design and ER model: Overview of the design process-The ER Model - Constraints - Removing redundant attributes in Entity Sets-ER Diagram - Reduction to Relational Schemas - ER Design Issues.

UNIT II **9 Hours**

RELATIONAL MODEL AND DATABASE DESIGN

Introduction to Relational Model - Formal Relational Query Languages - Introduction to SQL: Data definition-Basic structure of SQL Queries-Additional Basic operations -Set operations-Aggregate functions Nested sub queries-Intermediate SQL: Joins-Views-Integrity Constraints.

UNIT III **8 Hours**

NORMAL FORMS

Functional Dependencies - Normal Forms Based on primary Keys-General Definition of Second and Third Normal Form - Boyce Codd Normal Form - Multi valued dependencies and Fourth Normal Form.

UNIT IV **9 Hours**

DATA STORAGE AND QUERY PROCESSING

Overview of Physical Storage Media - Magnetic Disk Flash storage -RAID-File and Record Organization - Indexing and Hashing: Ordered Indices - B+ Tree Index File-Static Hashing - Dynamic Hashing-Query Processing: Overview-measures of Query Cost.

UNIT V **11 Hours**

TRANSACTION MANAGEMENT

Transactions: Transaction concept-Transaction Atomicity and Durability-Transaction Isolation - Serializability - Transaction Isolation and Atomicity-Transaction Isolation levels-Implementation of Isolation Levels-Concurrency Control: Lock based protocols -Deadlock handling-Time stamp based protocols-Recovery system: Failure classification -Storage-Recovery and atomicity.

FOR FURTHER READING

Introduction to Parallel, Distributed and Object Oriented Databases- Introduction to MySQL and PHP.

Total: 45 Hours

Reference(s)

1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw - Hill, 2015
2 Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems,Pearson Education, 2008
3 Raghu Ramakrishnan, Database Management System, Tata McGraw-Hill Publishing Company, 2003
4 C.J.Date,An Introduction to Database system, Pearson Education, 2006
5 Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management , Thompson Learning Course Technology, 2003

18CS306 PROGRAMMING USING CPP **2 0 2 3**

Course Objectives

- Understand the features of Object oriented programming
- Recognize the need of the concepts inheritance and polymorphism
- Develop C++ applications using OOP concepts, files, templates and exceptions

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Identify classes and objects from the given problem description and able to create classes and objects using C++
2. Implement the C++ program using arrays and operator overloading
3. Achieve code reusability and extensibility by means of inheritance and polymorphism.
4. Apply the concept of run time polymorphism by using virtual functions and implement the streams in C++ program
5. Implement files, templates and exception handling for a given scenario using C++

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

UNIT I **6 Hours**

CLASSES AND OBJECTS

Need for object oriented programming - Characteristics of object oriented programming -Classes and Objects: Simple Class- Data members and member functions - Access specifiers - Static Data Members and Member Functions - Constructors and Destructors - Passing and Returning Objects from Functions.

UNIT II **6 Hours**

ARRAYS AND OVERLOADING

Array Fundamentals - Arrays as Class Member Data - Arrays of Objects - String Manipulations - Method overloading - Operator overloading: Unary Operators - Binary Operators - Special Operators - Pitfalls of Operator Overloading.

UNIT III **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 IV **6 Hours**

POINTERS AND STREAMS

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

UNIT V **6 Hours**

FILES, TEMPLATES AND EXCEPTION HANDLING

File Stream Operations - File Pointers Manipulation-Templates: Class Templates - Function Templates - Overloading Function Templates - Exception Handling Mechanism: Try Throw and Catch.

1

EXPERIMENT 1 **5 Hours**

Implementation of operator overloading with class and objects.

1. Write a program to find the square and cube of a number using class and object.
2. Write a program to find the area of rectangle and circle using class and object.
3. Write a program to find whether the given number is an Armstrong number using classes and objects.

2 **5 Hours**

EXPERIMENT 2

Implementation of operator and function overloading.

1. Write a program to perform conversion from integer to complex number by operator overloading.
2. Write a program to perform from complex number to integer using operator overloading.
3. Write a program to perform addition of two numbers using function overloading.

3 **5 Hours**

EXPERIMENT 3

Implementation of types of Inheritance.

1. Write a program to generate employee payroll using inheritance.
2. Write a program to student details using multilevel inheritances.
3. Write a program to employee details using multiple inheritance.

4 **5 Hours**

EXPERIMENT 4

Implementation of two different classes for adding a private data member using friend function.

1. Write a program to multiply two matrices using static member function with friend function.
2. Write a program to perform complex number subtraction by overloading an operator using friend function.
3. Write a program to perform arithmetic operations using friend function.

5 **5 Hours**

EXPERIMENT 5

Implementation of file handling operations.

1. Write a program to reading and writing a file contents.
2. Write a program to open a file and append data to the end of file.
3. Write a program to write the class objects to a file.

6 **5 Hours**

EXPERIMENT 6

Implementation of Class templates and Function templates.

1. Write a program to perform insertion sort using class template.
2. Write a program to perform quick sort using function template.
3. Write a program to perform merge sort using template.

Total: 60 Hours

Reference(s)

1 Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, 2010.
2 E.Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill Publishing, New Delhi, 2011
3 B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2010.
4 H.M Deitel and P.J Deitel, "C++ How to Program", Seventh Edition, Prentice Hall, 2010.
5 Herbert Schildt, "C++: The Complete Reference", Fourth Edition, Tata McGraw-Hill, 2010
6 K.R. Venugopal, Rajkumar and T.Ravishankar, "Mastering C++", Tata McGraw Hill Publishing, New Delhi, 2010.

18CS307 DATA STRUCTURES LABORATORY 0 0 4 2

Course Objectives

- Understand the principles of linear and nonlinear data structures.
- Build an applications using sorting and searching.

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Implement the concept of recursion.
2. Implement the programs to demonstrate the operations on stack and queue.
3. Implement the programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
4. Implement the sorting and searching algorithms.
5. Implement the techniques of hashing.

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

1 **4 Hours**

EXPERIMENT 1

Program to Solve Tower-of-Hanoi Problem using Recursion

2 **4 Hours**

EXPERIMENT 2

a) Write a C program to implement a Stack ADT using array and write the routine for push operation which represent a function PUSH(X, S), Check for the condition whether S-full or not, if yes display the message otherwise insert the elements into the Stack. Perform POP operation which represents a function POP(S), Check for the condition whether S-Empty, if stack is empty, display the message otherwise delete an element from the Stack. Test your program with at least 5 elements and provide the output.

b) Write a C program to implement the Queue ADT using array and write the routine to enqueue an element X into queue, Check for the conditions Q-full, if yes display the message otherwise insert the data into the queue and dequeue an element from queue, check for the conditions Q-empty, if yes display the message otherwise deleting the element from the queue and display the elements from the Queue ADT. Test your program with at least 6 elements and provide the output

3 **6 Hours**

EXPERIMENT 3

Linked List Implementation of stack and queue.

4 **4 Hours**

EXPERIMENT 4

Write a function program to perform the following operations on a singly linked list
i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order
v. Display the elements of the list
Write a main method to demonstrate the above functionalities.

5 **4 Hours**

EXPERIMENT 5

Write a function program to perform the following operations on a doubly linked list

i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order
v. Display the elements of the list
Write a main method to demonstrate the above functionalities.

6 **4 Hours**

EXPERIMENT 6

Program to sort the elements in ascending order using selection sort and bubble sort.

7 **4 Hours**

EXPERIMENT 7

Implementation of quick sort.

8 **4 Hours**

EXPERIMENT 8

Implementation of heap sort.

9 **4 Hours**

EXPERIMENT 9

Implementation of shell sort.

10 **4 Hours**

EXPERIMENT 10

Develop a program to perform linear and binary search

11 **4 Hours**

EXPERIMENT 11

Program to construct an expression tree for a given expression and perform various tree traversal methods.

12 **4 Hours**

EXPERIMENT 12

Implement Prims algorithm with the following functionalities
i. Read a set of vertices minimum of six from the keyboard
ii. Get the number of edges and form the graph
iii. Find the value of each edge by using distance formula for two points.
iv. Develop a Minimum Spanning Tree for the graph
v. Find the total length of all edges.
Write a main method to execute the above functionalities

13 **4 Hours**

EXPERIMENT 13

Implementation of hashing technique

Total: 60 Hours

18CS308 DATABASE MANAGEMENT SYSTEMS LABORATORY 0 0 4 2

Course Objectives

- Understand the DDL, DML, TCL and DCL commands in SQL.
- Understand the design principles of a relational database system and SQL.
- Implement programs using SQL and PL/SQL.

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Differentiate database systems from file system by understanding the features of database system and design a ER model for a database system
2. Develop solutions to a broad range of query and data update problems using relational algebra, relational calculus and SQL.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Compare database storage and access techniques for file organization, indexing methods and Query Processing.
5. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes

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

1 **4 Hours**

EXPERIMENT 1

Working with SQL commands like DDL, DML, TCL, and DCL.

2 **8 Hours**

EXPERIMENT 2

Performing Single- row functions and group functions in SQL.

3 **4 Hours**

EXPERIMENT 3

Execute simple queries using joins and Integrity constraints.

4 **8 Hours**

EXPERIMENT 4

Creation and manipulation of database objects.

5 **4 Hours**

EXPERIMENT 5

Simple programs using PL/SQL block.

6 **8 Hours**

EXPERIMENT 6

Implementation of cursor in PL/SQL block.

7 **8 Hours**

EXPERIMENT 7

Generate trigger in PL/SQL block.

8 **6 Hours**

EXPERIMENT 8

Write PL/SQL block Programs using exception handling.

9 **8 Hours**

EXPERIMENT 9

Design a PL/SQL blocks using subprograms namely functions and procedures.

Total: 60 Hours

Reference(s)

1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw - Hill, 2015

2 C.J.Date,An Introduction to Database system, Pearson Education, 2006

18GE301 SOFT SKILLS - VERBAL ABILITY **2 0 0 0**

Course Objectives

- To help students gain adequate proficiency in vocabulary
- To read and understand unabridged text
- To help students become proficient in basic writing skills related to work place communication

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Take up verbal ability part of the placement tests with confidence
2. Write with confidence in professional and workplace communication
3. Distinguish fact from opinion by reading passages from a text

Articulation Matrix

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

UNIT I **15 Hours**

INTRODUCTION

Synonyms - Antonyms - Word Groups - Verbal Analogies - Etymology - Critical Reasoning - Cloze Test - One Word Substitution - Idioms and Phrases - Text & Paragraph Completion.

UNIT II **15 Hours**

BASICS OF VERBAL APTITUDE

Sentence Formation - Paragraph Formation - Change of Voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors - Homophones Homonyms - Commonly Mispronounced/Misspelt Words.

Total: 30 Hours

Reference(s)

1 Murphy, Raymond. English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English. IV Edition. United Kingdom: Cambridge University Press. 2012

2 Lewis, Norman. Word Power Made Easy. New York: Pocket Books. 1991.

3 Baron"s The Official Guide for New GMAT Review, New Jersey: John Wiley & Sons, Inc.

18CS401 ENGINEERING MATHEMATICS IV 3 1 0 4

Course Objectives

- Understand the concepts of Fourier series, Transforms and Boundary Conditions, which will enable them to model and analyze the physical phenomena
- Implement the Fourier analysis, an elegant method in the study of heat flow, fluid mechanics and electromagnetic fields.
- Summarize and apply the mathematical aspects that contribute to the solution of one dimensional wave equation

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. Identify the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series and Fourier transform, which converts the time function into a sum of sine waves of different frequencies, each of which represents a frequency component.
2. Formulate a function in frequency domain whenever the function is defined in time domain.
3. Interpret the classification of a partial differential equation and able to solve them.
4. Demonstrate and apply the basic probability axioms and concepts of probability distributions in an appropriate place of science and Engineering.
5. Apply basic statistical inference techniques, including confidence intervals, hypothesis testing to science/engineering problems.

Articulation Matrix

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

UNIT I **10 Hours**

FOURIER ANALYSIS

Fourier series for periodic functions. Orthogonal functions. The Euler coefficients. Fourier transforms. Properties of Fourier transform. Applications of Fourier series and transform analysis

UNIT II **11 Hours**

PARTIAL DIFFERENTIAL EQUATION

Introduction to partial differential equations. One-dimensional wave equation. Method of separation of variables. D Alemberts solution of the wave equation. Heat equation. Laplace equation. Telegraph equations. Laplace transforms method of solution.

UNIT III **9 Hours**

LAPLACE TRANSFORM

Properties and theorems of Laplace transform. Shifting theorems. Convolution. Applications to ordinary differential equations. Applications to linear system analysis.

UNIT IV **8 Hours**

PROBABILITY THEORY

Probability. Random variables, probability densities and distributions, mean and variance of a distribution. Conditional probability. Bayes theorem. Binomial, Poisson and normal distributions.

UNIT V **7 Hours**

MATHEMATICAL STATISTICS

Sample mean and variance. Sampling distributions. Statistical estimation of parameters, confidence intervals. Testing of hypotheses, one-sample and two-sample inferences. Applications to statistical quality control and reliability analysis.

Total: 60 Hours

Reference(s)

1 Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993.
2 Johnson Richard A. and Bhaltacharyya Gouri K., Statistics, Principles and Methods, 3rd Edition, John Wiley, 1996.
3 O Neil Peter V, Advanced Engineering Mathematics, 4th Edition, PWS-Kent, 1995.
4 James Glyn, Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.
5 Milton J. S. and Arnold Jesse C., Introduction to Probability and Statistics: Principles and Applications for Engineering and The Computing Sciences, McGraw Hill Inc, 3rd Edition, 1995.

18CS402 DESIGN AND ANALYSIS OF ALGORITHMS 3 1 0 4

Course Objectives

- Identify various algorithm design techniques
- Impart knowledge on runtime analysis of algorithms
- Empathize the limits of computation.

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.
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.
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 global requirements.

Course Outcomes (COs)

1. Analyse the basics of Algorithmic problem solving methods based on Data structures
2. Analyze the algorithm efficiency by means of mathematical notations
3. Develop and analyze the types of sorting and searching algorithms
4. Distinguish the different techniques in the design of Graph Algorithms
5. Examine NP complete with NP hard problems based on algorithms design techniques

Articulation Matrix

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

UNIT I **7 Hours**

INTRODUCTION

Introduction Fundamentals of Algorithmic Problem Solving Important Problem types: Sorting problem- searching problems - string processing - graph problems - combinatorial problems- Geometric Problems - Numerical problems Fundamental Data structures-Trees and Graphs

UNIT II **9 Hours**

FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY

Analysis Framework - Asymptotic notations - Basic Efficiency classes - Mathematical Analysis of Non-recursive Algorithm - Mathematical Analysis of Recursive Algorithm - Example: Fibonacci Numbers - Empirical Analysis of Algorithms-Algorithm visualization

UNIT III **10 Hours**

ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

Brute Force Strategy: Selection Sort and Bubble Sort, Sequential Search and Brute-force string matching - Divide and conquer: Merge sort, Quick Sort, Binary Search, Binary tree Traversal and Related Properties Decrease and Conquer: Insertion Sort, Depth first Search and Breadth First Search-Pair and Convex-Hull

UNIT IV **10 Hours**

ANALYSIS OF GRAPH ALGORITHMS

Transform and conquer: Presorting, Balanced Search trees AVL Trees, Heaps and Heap sort Dynamic Programming: Warshalls and Floyd Algorithm, Optimal Binary Search trees Greedy Technique: Prims Algorithm, Kruskals Algorithm, Dijkstra Algorithm Huffman trees-The Simplex Method-The Maximum- Flow Problem Ã¢?? Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V **9 Hours**

ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS

NP Complete problems Backtracking: n-Queens Problem Hamiltonian Circuit problem Subset-Sum problem Branch and bound: Assignment problem, Knapsack problem Traveling salesman problem- Approximation algorithms for NP hard problems: Travelling salesman and knapsack problem-Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations.

Total: 60 Hours

Reference(s)

1 Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011

2 T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009

3 Sara Baase and Allen Van Gelder, Computer Algorithms Introduction to Design and Analysis, Pearson Education Asia, 2010

4 A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education Asia, 2003

18CS403 MICROPROCESSORS AND MICROCONTROLLER 3 0 0 3

Course Objectives

- Understand the architecture and software aspects of 8085, 8086 microprocessors and 8051 microcontroller
- Implement assembly language programs for various applications using the instructions of 8085, 8086 microprocessors and 8051 microcontroller
- Impart knowledge on the methods of interfacing 8085 and 8086 microprocessors with various peripheral 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.
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.
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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the programming techniques and instruction set of 8085 microprocessor.
2. Analyze the instruction set and addressing modes of 8086 microprocessor
3. Develop assembly language programs using 8086 microprocessor instructions
4. Analyze the operating modes of I/O interface devices
5. Design and implement 8051 microcontroller based systems.

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

UNIT I **8 Hours**

THE 8085 MICROPROCESSOR

Microprocessor Architecture and its Operations - The 8085 MPU - 8085 Instruction Set – Programming Techniques with Additional Instructions of 8085 microprocessor - The 8085 Interrupt Process – 8085 Vectored Interrupts

UNIT II **11 Hours**

THE 8086 MICROPROCESSOR

Register Organisation of 8086 - Architecture - Signal Descriptions of 8086 - Physical memory organization - General bus Operation - I/O Addressing Capability - Special Processor Activities - Minimum Mode 8086 Architecture - Read/Write Cycle Timing Diagram for Minimum mode - Maximum Mode 8086 Architecture - Read/Write Cycle Timing Diagram for Maximum Mode - Addressing Modes of 8086 - Instruction set of 8086

UNIT III **7 Hours**

8086 SYSTEM DESIGN AND RECENT ADVANCES IN

MICROPROCESSORSSOR ARCHITECTURES

The Art of Assembly Language Programming with 8086: A few Machine Level Programs – Programming with an Assembler - Special Architecture Features and Related Programming: Introduction to stack - Stack Structure of 8086 - Interrupt and Interrupt Service Routines - Non-Maskable Interrupt – Maskable interrupt - Interrupt programming - Macros. Intel Pentium 80586 architecture-Branch prediction-Instruction set of Pentium-MMX-Architecture-Data types and Instruction set.

UNIT IV **10 Hours**

PERIPHERAL DEVICES AND I/O INTERFACING

Programmable Interrupt Controller 8259A: Architecture and Signal Descriptions of 8259A – Command Words of 8259A - Operating modes of 8259A - The Keyboard/Display Controller 8279: Architecture and Signal Descriptions of 8279 - Modes of Operation of 8279 - DMA Controller 8257: Internal Architecture and Signal Descriptions of 8257 - DMA Transfers and Operations.

UNIT V **9 Hours**

8051 MICROCONTROLLER

Architecture of 8051 - Signal Descriptions of 8051 - Register Set of 8051 - Memory Addressing - External I/O Interfacing - Addressing modes of 8051 - Instruction Set of 8051.

FOR FURTHER READING

Introduction to PIC Microcontrollers - Architecture of PIC Microcontrollers - Instruction Set of PIC Microcontroller - I/O Port Configuration - PIC Programming.

Total: 45 Hours

Reference(s)

1 Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International publishing private limited, 2013
2 A.K.Ray and K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing, Tata McGraw Hill Education Private Limited, 2013
3 Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, TMH, 2010
4 Yu-cheng Liu and Glenn A. Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, PHI, 2011.
5 Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 microcontroller and embedded systems, Pearson education, 2009.

18CS404 OPERATING SYSTEM 3 0 0 3

Course Objectives

- To make the students to learn different types of operating systems along with the components and services provided.
- To understand the concept of process management and implementation of process scheduling in a multi-programming environment using scheduling algorithms.
- To provide knowledge on the structure and operations of memory management and storage management.

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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Analyze the evolution of operating system, components and the usage of system calls & programs
2. Analyze the operation of processes and CPU scheduling algorithms in process management
3. Analyze the activities involved in process synchronization and deadlock mechanism
4. Apply the techniques to allocate and manage the memory for a specific system
5. Apply the mechanisms of disk scheduling to manage files on a secondary storage structure

Articulation Matrix

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

UNIT I **10 Hours**

INTRODUCTION

Components of Computer System - Evolution of operating System. Operating System Components & Services: Process management -Memory Management- Storage Management - Protection & Security - Operating System Services. Computing Environments-Open source operating systems - System Calls & System programs

UNIT II **9 Hours**

PROCESS MANAGEMENT

Process Concepts: The process - Process State - Process Control Block. Process Scheduling: Scheduling Queues -Scheduler - Context Switch. Operations on Processes - Process creation - Process Termination - Cooperating Processes. Interprocess Communication. CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms.

UNIT III **9 Hours**

PROCESS SYNCHRONIZATION AND DEADLOCK

Process Synchronization: The Critical-Section Problem - Synchronization Hardware - Semaphores - Classic problems of Synchronization. Deadlock: System Model - Deadlock Characterization - methods for handling Deadlocks –Deadlock Prevention - Deadlock avoidance - Deadlock detection - Recovery from Deadlocks.

UNIT IV **9 Hours**

MEMORY MANAGEMENT

Address Binding - Logical Versus Physical Address Space - Swapping- Contiguous Memory allocation – Fragmentation- Paging - Segmentation. Virtual Memory: Demand Paging - Page Replacement Algorithms - Allocation of frames-Thrashing.

UNIT V **8 Hours**

STORAGE MANAGEMENT

File Management: File Concept - Access Methods - Directory and Disk Structure - File System Mounting- File Sharing. File System Implementation: File system structure - Directory implementation- Allocation Methods - Free-space Management. Secondary Storage Structure: Disk Structure - Disk Scheduling - Disk Management.

FOR FURTHER READING

Case Studies: The Linux System, Windows 7, Influential Operating Systems

Total: 45 Hours

Reference(s)

1 Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2 Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. td, 2014
3 William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4 Harvey M. DeitelM ,Operating Systems, Pearson Education Pvt. Ltd, 2007

18CS405 DATA WAREHOUSING AND DATA MINING 3 0 0 3

Course Objectives

- Understand the basic concepts of data mining.
- Apply the data mining functionalities
- Assess the strengths and weaknesses of various data mining techniques

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 modelling 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.
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.
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 global requirements.

Course Outcomes (COs)

1. Design the data warehouse architecture and schemas and implement the OLAP operations.
2. Classify the functionalities, patterns, tasks and issues of data mining.
3. Apply the data pre-processing techniques in the KDD process
4. Identify the association rules using frequent itemset mining algorithms and advanced pattern mining in multi-level and multi-dimensional space
5. Apply the classification and clustering algorithms to mine the patterns

Articulation Matrix

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

UNIT I **7 Hours**

DATA WAREHOUSING

Data Warehouse: Basic Concepts, Differences between Operational Database Systems and Data Warehouses- A Multitiered Architecture - Data Warehouse Models : Extraction, Transformation and Loading - Metadata Repository -Data Cube and OLAP -Data Warehouse Design and Usage - Data warehouse implementation

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction - The evolution of database system technology - Steps in knowledge discovery from database process - Architecture of a data mining systems - Data mining on different kinds of data - Different kinds of pattern - Technologies used - Applications - Major issues in data mining - Classification of data mining systems - Data mining task primitives - Integration of a data mining system with a database or datawarehouse system

UNIT III **10 Hours**

DATA PREPROCESSING

Data Objects and attribute types - Basic statistical description of data - Data visualization – Measuring data similarity and dissimilarity - Data cleaning - Integration - Data reduction - Data transformation and data discretization

UNIT IV **9 Hours**

ASSOCIATION RULE MINING

Basic concepts - Frequent itemset mining methods - Apriori algorithm, APattern growth approach for mining frequent itemsets, Mining frequent itemsets using vertical data format, Mining closed and max patterns - Pattern mining in multilevel and multidimensional space – Constraint based Frequent pattern mining - Mining High-Dimensional Data and Colossal Patterns

UNIT V **10 Hours**

CLASSIFICATION AND CLUSTERING

Classification: Basic concepts - Decision tree induction - Bayes classification Methods-Rule Based Classification- Model Evaluation and Selection - Techniques to Improve Classification Accuracy - Bayesian Belief Networks - Classification by Backpropagation - Cluster Analysis – Partitioning methods - Hierarchical methods

FOR FURTHER READING

Applications of data Mining-Social impacts of data Mining-Tools

Total: 45 Hours

Reference(s)

1 Jiawei Han, Micheline Kamber and Jian Pai, Data Mining: Concepts and Techniques, Morgan Kauffman, 2013

2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Mcgraw- Hill,2008

3 David Hand, Heikki Manila, PadhraicSymth, Principles of Data Mining, MIT Press, 2004

4 Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2008

18CS406 JAVA PROGRAMMING **2 0 2 4**

Course Objectives

- Understand the basic features of OOP in Java
- Summarize the types of Inheritance supported by Java
- Recognize the multithreading process supported by Java.

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 modelling 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.
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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Analyze the basic statements in Java program
2. Analyze various types of inheritance and packages under different accessibility
3. Analyze the concept of interfaces, exceptions and multithreading nature of Java
4. Develop applications in Java with files and Strings handling
5. Design desktop based java applications using Java Applet, AWT and its components

Articulation Matrix

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

UNIT I **6 Hours**

JAVA BASICS

The Genesis of Java - Overview of Java - Data Types, Variables, and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes. I/O Basics - Reading Console Input –Writing Console output.

UNIT II **6 Hours**

INHERITANCE AND PACKAGES

Inheritance: Basics - Using Super - Creating a Multilevel Hierarchy - Method overriding - Using Abstract Classes - Packages and Interfaces: Packages - Access Protection - Importing Packages

UNIT III **6 Hours**

INTERFACES, EXCEPTIONS AND THREAD

Interfaces Definitions and Implementations - Exception Handling: Types - Try and Catch - Throw - Multi-threaded Programming: Creating Threads - Inter Thread Communication

UNIT IV **6 Hours**

INTERFACES, EXCEPTIONS AND THREAD

File - The Byte Streams - The Character Streams - Using Stream I/ O - Serialization. String Handling: Special String operations and Methods - String Buffer - Exploring java.lang: Simple type Wrappers - System - Math - Utility Classes: String Tokenizer - Date and Time - Collection Interfaces –Collection Classes

UNIT V **6 Hours**

APPLETS, EVENT HANDLING AND AWT

Applet Basics - Applet Architecture - Applet Display Methods - Event Handling Mechanisms – Event Classes - Event Listener - Working with Windows , Graphics , Colors and Fonts - AWT Controls - Layout Managers and Menus - JDBC Concepts

1 **3 Hours**

EXPERIMENT 1

Program on Classes and Method

2 **2 Hours**

EXPERIMENT 2

Implementation of Inheritance

3 **3 Hours**

EXPERIMENT 3

Implementation of Interfaces and Packages

4 **3 Hours**

EXPERIMENT 4

Implementation of Multithreaded Programming

5 **2 Hours**

EXPERIMENT 5

Develop a program to implement String Handling Methods

6 **2 Hours**

EXPERIMENT 6

Implementation of Exception handling mechanisms

7 **3 Hours**

EXPERIMENT 7

Implementation of Collections Interfaces and Classes

8 **2 Hours**

EXPERIMENT 8

Implementation of I/O Streams

9 **2 Hours**

EXPERIMENT 9

Implementation of Applet Programs

10 **3 Hours**

EXPERIMENT 10

Implementation of AWT controls

11 **2 Hours**

EXPERIMENT 11

Write a program to implement Event classes implementation of JDBC concepts

12 **3 Hours**

EXPERIMENT 12

Implementation of JDBC concepts

Total: 60 Hours

FOR FURTHER READING

Spring framework - Container concepts - DAO Support and JDBC Framework - An introduction to Hibernate 3.5 - Integrating and configuring Hibernate - Building a Sample Application

Reference(s)

1 Herbert Schildt, Java 2-Complete Reference, Tata Mc Graw Hill, 2015
2 Deitel & Deitel, Java How to Program, Prentice Hall of India, 2010
3 Gary Cornell and Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems Press, 2008
4 Jeff Linwood and Dave Minter, Beginning Hibernate Second Edition, Apress 2010
5 Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu, Java Development with the Spring Framework, Wiley-India, 2012

18CS407 MICROPROCESSORS AND MICROCONTROLLER LABORATORY

0 0 4 2

Course Objectives

- Understand the working of 85x86 microprocessors and 8051 microcontroller
- Develop ability in assembly language programming using 85x86 microprocessors and 8051 microcontroller.
- Work with I/O interfacing 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.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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.

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. Develop assembly language programs using 8085/86 microprocessors and 8051 microcontroller
2. Implement interface between 8085 microprocessor and peripheral devices
3. Design an interface between LED and 8051 microcontroller.

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				3
2	2	2	3	2					2	2				2
3	2	2	3	3			3		2	2				3

1 **3 Hours**

EXPERIMENT 1

8085-Arithmetic operations

2 **3 Hours**

EXPERIMENT 2

8085-Code conversions

3 **3 Hours**

EXPERIMENT 3

8085-Matrix Multiplication

4 **6 Hours**

EXPERIMENT 4

8086-Arithmetic operations

5 **3 Hours**

EXPERIMENT 5

8086-String Manipulation

6 **6 Hours**

EXPERIMENT 6

Stepper motor interfacing with 8086

7 **6 Hours**

EXPERIMENT 7

Counters and time delay using 8086

8 **6 Hours**

EXPERIMENT 8

Interfcaing 8085 with 8255

9 **6 Hours**

EXPERIMENT 9

Interfcaing 8085 with 8279

10 **6 Hours**

EXPERIMENT 10

8051-Arithmetic operations

11 **3 Hours**

EXPERIMENT 11

8051-Fibonacci series and square of a number

12 **3 Hours**

EXPERIMENT 12

Unpacked BCD to ASCII

13 **6 Hours**

EXPERIMENT 13

Interfacing LED with 8051

Total: 60 Hours

Reference(s)

1 Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International publishing private limited, 2013

2 K.Ray and K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing, Tata McGraw Hill Education Private Limited, 2013

3 Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, TMH, 2010

4 Yu-cheng Liu and Glenn A. Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, PHI 2011

5 Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 microcontroller and embedded systems, Pearson education, 2009

18CS408 DATA MINING AND DATA WAREHOUSING LABORATORY 0 0 4 2

Course Objectives

- Understand the basic concepts of data mining.
- Apply the data mining functionalities
- Assess the strengths and weaknesses of various data mining techniques

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 modelling 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.
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.
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 global requirements.

Course Outcomes (COs)

1. Implement the data warehouse architecture
2. Explain the functionalities of data mining
3. Explore the different data preprocessing techniques
4. Identify the association rules using frequent itemset mining algorithms

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	2	2	2	2	2	2	2	2	2		2	2	2
3	2	3	3	2	3	3	2	2	2	2		2	3	2
4	2	3	3	2	3	3	2	2	2	2		2	3	3

1 **8 Hours**

EXPERIMENT 1

Working with attributes and filters

2 **8 Hours**

EXPERIMENT 2

Associating - Apriori algorithm and FP-Growth

a. Learning Associations

3 **8 Hours**

EXPERIMENT 3

Classification - Bayesian, Decision tree, SVM

a. Selecting Classifier,

b. Test Options,

c. Training a Classifier,

d. Classifier Output,

e. Result list

4 **8 Hours**

EXPERIMENT 4

Clustering - K-means clustering, Agglomerative clustering

a. Selecting a Cluster

b. Cluster Modes

c. Ignoring Attributes

d. Working with Filters

e. Learning Clusters

5 **8 Hours**

EXPERIMENT 5

Visualizing methods in data mining

6 **10 Hours**

EXPERIMENT 6

Applications of classification for web mining

7 **10 Hours**

EXPERIMENT 7

Case Study on Text Mining or any commercial application

Total: 60 Hours

Reference(s)

1 Jiawei Han, Micheline Kamber and Jian Pai, Data Mining: Concepts and Techniques, Morgan Kauffman, 2013

2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Mcgraw- Hill,2008

3 David Hand, Heikki Manila, PadhraicSymth, Principles of Data Mining, MIT Press, 2004

4 Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2008

18HS001 ENVIRONMENTAL SCIENCE 2 0 0 2

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)

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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

Course Outcomes (COs)

1. Explain the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Identify the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Correlate 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	1	2												
2	1	1												
3	2	2					1							
4	1													
5	2													

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) - water logging - salinity - case studies. Energy resources: renewable(solar, wind, tidal, geothermal and hydroelectric power) - non renewable energy sources

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: forest ecosystem - desert ecosystem - ecological succession. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex- situ conservation of biodiversity - field study

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) - marine pollution - thermal pollution - noise pollution. Disaster management: causes - effects - control measures of floods - earthquake – cyclone - landslides

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development: Definition - Unsustainable to sustainable development - urban problems related to energy. Environmental ethics - issues and possible solutions - solid waste management - causes- effects - 3R Principles (landfills, incineration, composting). Water conservation - rain water harvesting - watershed management. Climate change - global warming - acid rain - ozone layer depletion. Environment protection act: Air (Prevention and control of pollution) act - wildlife protection act

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

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

FOR FURTHER READING

Human rights: E - waste and biomedical waste -Identification of adulterants in food materials

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

18GE401 SOFT SKILLS-BUSINESS ENGLISH 2 0 0 2

Course Objectives

- To acquire command of both the receptive skills (Listening, Reading) and the productive skills(Writing and Speaking) of English language
- To understand and make effective use of English language in business contexts

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Listen, Read, Speak, and Write Business English at the level of independent users
2. Appear for the Business English Certificate (BEC) Vantage level examination conducted by the Cambridge Assessment English

Articulation Matrix

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

UNIT I **15 Hours**

LISTENING AND READING

Listening for writing short answers - filling gaps in sentences - identifying topic, context and function -identify different functions of language in business situations - identify prompts - identify paraphrases of required information Scanning - reading for gist - understanding sentence structure - error identification - identify paraphrases -cohesive words and phrases - understand the importance of analysing the distractors - identify grammatical and semantic relationships

UNIT II **15 Hours**

WRITING AND SPEAKING

Business emails - notes - memos to colleagues or friends - giving instructions - explaining a development- asking for comments - requesting information - agreeing to requests - explaining - apologising - reassuring - complaining - describing - summarising - recommending - persuading turn - taking - sustaining interaction - initiating - responding - giving personal information - talking about present circumstances, past experiences and future plans - expressing opinion - speculating - organising a larger unit of discourse - giving information - expressing and justifying opinions - speculating - comparing and contrasting - agreeing and disagreeing

Total: 30 Hours

21CS501 THEORY OF COMPUTATION 3 1 0 4

Course Objectives

- Understand the mathematical models of computation and design grammars and recognizer for different formal languages
- Identify the relation among regular language, context free language and the corresponding recognizers
- Determine the decidability and intractability of computational problems

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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Classify the proofing techniques and construct finite automata
2. Construct finite automata for any given regular expression
3. Apply context free grammars and languages
4. Construct Push down Automata and Turing machine
5. Analyze the undecidability of languages

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

UNIT I **9 Hours**

AUTOMATA

Introduction to formal proof - Additional forms of proof - Inductive proofs - Finite Automata (FA) -Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) - Finite Automata with Epsilon transitions.

UNIT II **9 Hours**

REGULAR EXPRESSIONS AND LANGUAGES

Regular Expression - FA and Regular Expressions - Arden's theorem - Applications of Regular Expression - Algebraic Laws for Regular Expression - Proving languages not to be regular - Closure properties of regular languages.

UNIT III **9 Hours**

CONTEXT-FREE GRAMMAR AND LANGUAGES

Grammar Introduction- Types of Grammar - Context-Free Grammar (CFG) - Parse Trees – Applications of Context-Free Grammar -Ambiguity in grammars and languages - Normal forms for CFG – Pumping Lemma for CFL - Closure Properties of CFL.

UNIT IV **9 Hours**

PUSH DOWN AUTOMATA AND TURING MACHINES

Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG. Turing Machines (TM)- Programming Techniques for TM - Storage in finite control - Multiple tracks - Checking off symbols – Subroutines.

UNIT V **9 Hours**

UNDECIDABILITY

A language that is not Recursively Enumerable (RE) - An undecidable problem that is RE – Undecidable problems about Turing Machine - Post's Correspondence Problem - Rice Theorem.

FOR FURTHER READING

Application of Finite Automata - Text Search Decision Properties of Regular Languages – Ambiguity Resolution in YACC- Extensions to the Basic Turing Machine Introduction to classes- P and NP- completeness.

Total: 60 Hours

Reference(s)

1 John E.Hopcroft, Rajeev Motwani and Jeffrey.D Ullman, Introduction to Automata Theory, Languages and Computations, Pearson Education, Third Edition, 2014
2 Harry R.Lewis and Christos.H. Papadimitriou, Elements of The theory of Computation, Pearson Education/PHI, 2007
3 C.Martin, Introduction to Languages and the Theory of Computation, TMH, 2007
4 Micheal Sipser, Introduction of the Theory and Computation, Thomson Brokecole, 2005

21CS502 COMPUTER ARCHITECTURE **3 0 0 3**

Course Objectives

- Understand of the basic structure and operation of a digital computer
- Impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division.
- Acquire knowledge about the diverse ways of communicating with I/O devices and standard I/O Interfaces

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.
c. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Classify the basic operational concepts of a digital computer, instruction sets with addressing modes
2. Design the arithmetic operations addition, subtraction, multiplication and division of signed numbers
3. Analyze the execution of instruction, Bus organization, pipelining and hazards
4. Illustrate the standard I/O devices and interfaces
5. Analyze the primary and secondary memories and their performance consideration

Articulation Matrix

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

UNIT I **9 Hours**

STRUCTURE OF COMPUTERS

Functional units-Basic operational concepts- Bus structures - Software-performance-Memory locations and addresses- Memory operations- Instruction and instruction sequencing- Addressing

modes- Basic I/O operations.

UNIT II **9 Hours**

ARITHMETIC OPERATIONS

Addition and subtraction of signed numbers- Design of fast adders- Multiplication of positive numbers- Signed operand multiplication and fast multiplication-Integer division

UNIT III **11 Hours**

BASIC PROCESSING UNIT

Fundamental concepts-Execution of a complete instruction-Multiple bus organization-Hardwired control -Microprogrammed control -Pipelining: Basic concepts -Data hazards -Instruction hazards -Influence on Instruction sets -Data path and control consideration-Superscalar operation

UNIT IV **8 Hours**

INPUT/OUTPUT ORGANIZATION

Accessing I/O devices -Interrupts-Direct Interfaces (PCI, SCSI, USB)

UNIT V **8 Hours**

MEMORY UNIT

Basic concepts- Semiconductor RAMs-ROM's-Speed-size and cost-Cache memories -Performance consideration-Virtual memory-Memory Management requirements-Secondary storage.

FOR FURTHER READING

Categories of Instruction Set Architectures (ISA)- Multistage pipelines with variable latencies-branch prediction- Very large Instruction Word (VLIW) architectures- Instruction Level Parallelism (ILP)-Examples of modern processors- Hyper threading (HT)- Simultaneous Multithreading (SMT)- Multicore chips (Chip Multiprocessing).

Total: 45 Hours

Reference(s)

1 Carl Hamacher, Zvonko Vranesicand Safwat Zaky, Computer Organization, McGraw-Hill, Third Reprint2015
2 William Stallings, Computer Organization and Architecture Designing for Performance, Pearson Education,2003
3 David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/software interface, MorganKaufmann,4th edition, 2014.
4 John P.Hayes, Computer Architecture and Organization, McGraw Hill,3rd edition, 2002.

21CS503 COMPUTER NETWORKS **3 0 0 3**

Course Objectives

- Understand the state-of-the-art in network protocols, architectures and applications
- Gain knowledge about the functions of different network layers
- Familiarize in the various aspects of computer networks

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 modelling to complex engineering activities with an understanding of the limitations.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Classify the network models OSI and TCP/IP, Transmission media and circuit and packet switching
2. Apply framing, error and flow control techniques
3. Analyze and design the routing algorithms
4. Illustrate the process-to-process delivery, congestion control and quality of services
5. Interpret the working of application layer protocols

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

UNIT I **10 Hours**

INTRODUCTION

Data Communications - Data Flow - Networks - The Internet - Protocols and Standards – Network Models: Layered Tasks - The OSI Model - TCP/IP Protocol Suite - Addressing - Transmission Media - Connecting LANs, Backbone Networks, and Virtual LANs: Connecting Devices-Circuit Switching and Packet Switching

UNIT II **10 Hours**

DATA LINK LAYER

Introduction - Block Coding - Cyclic codes - Checksum -Data Link Control: Framing - Flow and Error Control - Noiseless Channels - Noisy Channels - HDLC -Multiple Access: Random Access - Channelization -Wired LANs: IEEE Standards- Standard Ethernet - Encoding (NRZ, NRZI, Manchester,4B/5B- WiMax.

UNIT III **9 Hours**

NETWORK LAYER

IPv4 Addresses- IPv6 Addresses - Internetworking - IPv4 - IPv6 - Transition from IPv4 to IPv6 - Network Layer: Delivery, Forwarding, and Routing: Address Mapping - Internet Control Message Protocol (ICMP) - Internet Group Management Protocol (IGMP) - Network Layer: Delivery, Forwarding, and Routing.

UNIT IV **9 Hours**

TRANSPORT LAYER

Process-to-Process Delivery - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) -Stream Control Transmission Protocol (SCTP) - Congestion Control and Quality of Service: Data Traffic - Congestion Control - Quality of Services (QoS)-POP3- IMAP.

UNIT V **7 Hours**

APPLICATION LAYER

Domain Name System (DNS): Domain Name Space - Distribution of Name Space - DNS in the Internet World Wide Web and HTTP - Simple Mail Transfer Protocol - File Transfer Protocol -Secure Shell (SSH)- TELNET - PGP - Firewalls.

FOR FURTHER READING

Network Management: Simple Network Management Protocol (SNMP) - Symmetric key cryptography - Security services - PGP - Firewalls.

Total: 45 Hours

Reference(s)

1 Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill,2014
2 James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3 Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4 Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5 William Stallings, Data and Computer Communication, Pearson Education, 2007
6 Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education,2008

21CS504 MACHINE LEARNING 3 0 0 3

Course Objectives

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

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 modelling to complex engineering activities with an understanding of the limitations.

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.

m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Identify the perspective and issues of machine learning and comprehend concept learning
2. Apply the decision tree on a dataset and find the issues in decision tree algorithm
3. Implement perceptron and back propagation neutal networks
4. Classify Bayes, Bayesian network and EM classifiers
5. Apply the Instance based and Reinforcement learning for solving real time problems

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT II **9 Hours**

DECISION TREE LEARNING

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT III **9 Hours**

ARTIFICIAL NEURAL NETWORKS

Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm.

UNIT IV **9 Hours**

BAYESIAN LEARNING

Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.

UNIT V **9 Hours**

HYPOTHESIS, INSTANCE BASED AND REINFORCEMENT LEARNING

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning.Reinforcement Learning: Introduction, Learning Task, Q Learning.

Total: 45 Hours

Reference(s)

1 Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2 Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3 Ethem Alpayd, Introduction to machine learning, second edition, MIT press.

21CS507 COMPUTER NETWORKS LABORATORY 0 0 4 2

Course Objectives

- Understand the concepts of computer networks and to study the functions of different layers.
- Familiarize with different protocols and network components.
- Familiarize in the various aspects of computer networks.

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 modelling to complex engineering activities with an understanding of the limitations.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement the client server communication using socket connection.
2. Implement data link layer protocols
3. Design network routing protocols
4. Configure a Network topology using Packet tracer software.

Articulation Matrix

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

1 **4 Hours**

EXPERIMENT 1

Study of Color coding Jack RJ45 and do the following Cabling works in a network

a. Cable Crimping
b. Standard Cabling
c. Cross Cabling and
d. Establish a LAN connection using three systems using any topology.

2 **4 Hours**

EXPERIMENT 2

Configure IP Address in a system in LAN (TCP/IP Configuration) and implement the client server communication using socket connection.

3 **6 Hours**

EXPERIMENT 3

Write a program for transferring a file between nodes in a network.

4 **4 Hours**

EXPERIMENT 4

Perform Bit Stuffing and CRC computation.

5 **4 Hours**

EXPERIMENT 5

By varying the no of frames, design the Sliding Window Protocol.

6 **6 Hours**

EXPERIMENT 6

Simulation of ARP/RARP

7 **4 Hours**

EXPERIMENT 7

Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.

8 **4 Hours**

EXPERIMENT 8

Find the minimum cost in the node to node communication by Open Shortest Path First (OSPF) protocol.

9 **6 Hours**

EXPERIMENT 9

Write a program for downloading a file from HTTP server.

10 **6 Hours**

EXPERIMENT 10

Develop a client that contacts a given DNS server to resolve a given host name.

11 **6 Hours**

EXPERIMENT 11

Configure a Network topology using Packet tracer software.

12 **6 Hours**

EXPERIMENT 12

Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.

Total: 60 Hours

Reference(s)

1 Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill,2014

2 James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005

3 Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009

4 Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008

21CS508 MACHINE LEARNING LABORATORY 0 0 4 2

Course Objectives

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice

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 modelling 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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Consider a set of training data examples and implement algorithms to find the most specific hypothesis and set of all hypotheses that are consistent with the training examples.
2. Apply decision tree model, bayesian learning, instance based learning and reinforcement learning for approximation of classification, clustering, prediction algorithms to get the desired output.
3. Apply neural networks for approximation of classification, clustering, prediction algorithms to get the desired output.

Articulation Matrix

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

1 **6 Hours**

EXPERIMENT 1

Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.

2 **6 Hours**

EXPERIMENT 2

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3 **6 Hours**

EXPERIMENT 3

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4 **6 Hours**

EXPERIMENT 4

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5 **6 Hours**

EXPERIMENT 5

Write a program to implement the naive Bayesian classifier for a sample training data set stored as a.CSV file. Compute the accuracy of the classifier, considering few test data sets.

6 **6 Hours**

EXPERIMENT 6

Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7 **6 Hours**

EXPERIMENT 7

Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8 **6 Hours**

EXPERIMENT 8

Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9 **6 Hours**

EXPERIMENT 9

Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10 **6 Hours**

EXPERIMENT 10

Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Total: 60 Hours

18GE501 SOFT SKILLS - APTITUDE I **0 0 2 0**

Course Objectives

- Expose the undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values. It will provide a lot of activities and examples for a student to learn and develop these life skills.

Course Outcomes (COs)

1. Explain various concepts of number systems and their techniques in solving the percentage, average and age problems.
2. Analyse the profit and loss of real time situations and the relation between ratio, proportion and variation.
3. Apply different techniques to find the distance, speed and time of various moving objects.
4. Understand the concepts of coding, sequences and series, data interpretation and critical reasoning to solve real time logical reasoning problems.

1 **2 Hours**

NUMBER SYSTEMS

Introduction - Definition - Classification on Numbers- Power cycles and remainders - Short cut process- Concept of Highest Common Factor-Concept of Least Common Multiple- Divisibility-Number of zeros in an expression

2 **2 Hours**

PERCENTAGE

Introduction - Definition and Utility of Percentage - Importance of base/denominator for percentage calculations-Concept of percentage values through additions-Fraction to percentage conversion table.

3 **3 Hours**

AVERAGES AND AGES

Introduction-Average of different groups-Addition or removal of items and change in average-Replacement of some of the items.

4 **3 Hours**

RATIO, PROPORTIONS AND VARIATION

Introduction- Ratio- Properties-Dividing a given number in the given ratio-Comparison of ratios-Proportions-Useful results on proportion- Continued proportion-Relation among the quantities more than two-Variation

5 **2 Hours**

PROFIT AND LOSS

Gain/Loss and percentage gain or percentage loss-Multiplying equivalents to find sale price-Relation among cost price, sale price, gain/loss and percentage gain or percentage loss-An article sold at two different selling price-Two different articles sold at same selling price-Percentage gain or percentage loss on selling price-Percentage gain or percentage loss on whole property.

6 **2 Hours**

TIME AND WORK

Introduction-Basic concepts-Concepts on working with different efficiencies-Pipes and Cisterns-Work Equivalence (Man Days) -Alternative approach.

7 **2 Hours**

TIME, SPEED AND DISTANCE

Definition-Basics of Time, Speed and Distance - Relative speed-Problems based on Trains-Problems based on Boats and Streams-Problems based on Races-Time taken with two difference modes of transport-Time and distance between two moving bodies.

8 **3 Hours**

CODING AND DECODING

Introduction-Description of Coding method-Coding patterns - Concepts of Coding and Decoding-Problems involving Coding and Decoding methods.

9 **2 Hours**

SEQUENCE AND SERIES

Introduction-Sequences of real numbers - Number and Alphabet series-Description of Number and Alphabet series-Analogy-Odd man out-Power series.

10 **3 Hours**

DATA SUFFICIENCY

Introduction to Data Sufficiency - Overview of the wide variety of Data Sufficiency problems - Basic introduction on how to determine what information is sufficient to solve a given problem - Common pitfalls to avoid.

11 **3 Hours**

DIRECTION

Introduction to Direction - sense test - Overview of the wide variety of Direction problems-Direction-Plotting diagrams.

12 **3 Hours**

CRITICAL REASONING

Introduction-Basic concept of critical reasoning- Weaken the argument-Strengthen the argument-Flaw in the argument-Evaluate the conclusion.

Total: 30 Hours

Reference(s)

1 Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Mc Graw Hill Publications.
2 U. Mohan Rao, Quantitative Aptitude for Competitive Examinations, Scitech Publications Pvt Ltd, India.
3 Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Third Edition, Pearson Education Pvt Ltd, India, 2016.
4 Dr. R S Aggarwal, A Modern Approach to Verbal and Non Verbal Reasoning, Revised Edition, S Chand Publications.

5 Arun Sharma, How to prepare for Logical Reasoning for CAT & other Management Exams, Fifth Edition, Mc Graw Hill Publications.
6 Jaikishan and Premkishan, How to Crack Test of Reasoning in all Competitive Examinations, Revised Edition, Arihant Publications

21CS601 COMPILER DESIGN 3 1 0 4

Course Objectives

- Acquire knowledge in different phases of a Compiler and its applications.
- Understand the categorization of tokens using lexical analyzer and pattern recognition using parsers.
- Familiar with the code generation schemes and optimization methods.

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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Analyze the output generated in each phase of the compiler
2. Construct finite automata for regular expression and apply state minimization techniques
3 Construct Top down and Bottom up parser for context free grammars
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

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

UNIT I **8 Hours**

INTRODUCTION TO COMPILER

Language processors - Structure of a compiler - Grouping of phases into passes- Compiler construction tools - Applications of compiler technology: Implementation of high-level programming languages - Optimizations for computer architectures-Design of new computer architecture - Program Translations-Software productivity tools.

UNIT II **9 Hours**

LEXICAL ANALYSIS

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Lexical Errors - Specification of tokens - Recognition of Tokens - Finite automata - Regular expression to finite automation- Optimization of DFA based Pattern Matchers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III **11 Hours**

SYNTAX ANALYSIS

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-Top Down parsing -Recursive Descent Parsing - Nonrecursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing- LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

UNIT IV **8 Hours**

SEMANTIC ANALYSIS

Syntax Directed Translation - Construction of Syntax Tree - Variants of Syntax Trees -Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow – Back patching - Switch- Statements - Intermediate Code for Procedures.

UNIT V **9 Hours**

CODE OPTIMIZATION

Principal Sources of Optimization-DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

FOR FURTHER READING

The evolution of programming languages-The science of building a compiler - Run time Environments -Storage Organization - Stack Allocation of Space- Heap Management.

Total: 60 Hours

Reference(s)

1 Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools ,2nd Edition, Pearson, 2012.
2 D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008.
3 Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2003.
4 Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2003.

21CS602 CLOUD COMPUTING 3 0 0 3

Course Objectives

- Understand the architecture and features of different cloud models
- Be familiar with the underlying principles of virtualization, cloud applications and cloud storage
- Gain knowledge on security issues and risk management

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.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the types of cloud model suitable for building an efficient cloud computing environment
2. Analyze the virtualization technologies and capacity planning techniques to create shared resource pools
3. Illustrate the cloud based applications and the cloud storages using CDMI and OCCI
4. Analyze the basics of information security in cloud computing
5. Examine the risks involved in virtualization security management

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Defining Cloud Computing-Cloud Types: The NIST Model-The Cloud Cube Model -Deployment Models-Service Models-Essential Characteristics of Cloud Computing-Benefits of Cloud Computing-Measuring the Cloud's Value: Measuring Cloud Computing Costs-Understanding Services and Applications by Type: Defining IaaS-Defining PaaS-Defining SaaS.

UNIT II **8 Hours**

VIRTUALIZATION AND CAPACITY PLANNING

Using Virtualization Technologies-Load Balancing and Virtualization-Advanced Load Balancing-Understanding Hypervisors: Virtual Machine Types-VMware vSphere-Capacity Planning: Defining Baseline and Metrics-Network Capacity.

UNIT III **10 Hours**

CLOUD APPLICATIONS AND CLOUD STORAGE

Moving Applications to the Cloud: Applications in the Cloud-Functionality Mapping-Application Attributes-Cloud Service Attributes-System Abstraction-Cloud Bursting-Cloud APIs-Working with Cloud-Based Storage: Cloud Storage Definition-Provisioning Cloud Storage-Cloud Backup Types-Cloud Backup Features-Cloud Data Management Interface (CDMI)-Open Cloud Computing Interface (OCCI).

UNIT IV **10 Hours**

CLOUD SECURITY FUNDAMENTALS

Cloud Information Security Objectives-Cloud Security Services-Cloud Security Design Principles-Secure Cloud Software Requirements: Secure Development Practices-Approaches to Cloud Secure Software Requirements Engineering-Cloud Computing and Business Continuity Planning/Disaster Recovery.

UNIT V **8 Hours**

CLOUD RISK MANAGEMENT

Cloud Computing Risk Issues: The CIA Triad-Threats to Infrastructure, Data and Access Control-Cloud Service Provider Risks-Cloud Computing Security Challenges: Security Policy Implementation- Virtualization Security Management.

FOR FURTHER READING

Cloud evolution- Data center requirements- vmware virtualization- Google Infrastructure- Google Cloud Security.

Total: 45 Hours

Reference(s)

1 Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.
2 Ronald L.Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2013.
3 Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2009.

21CS603 WEB TECHNOLOGY 3 0 0 3

Course Objectives

- Understand the scripting languages XHTML, JavaScript and PHP.
- Familiar with the different server technologies.
- Gain knowledge in the concepts of web services.

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 modelling 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.
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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Demonstrate the technologies used to create web pages
2. Design dynamic and interactive web pages by embedding Java Script in XHTML
3. Implement server side programming and build web applications using PHP
4. Develop interactive web applications using ASP.Net
5. Interpret web services and its technologies

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

UNIT I **10 Hours**

INTRODUCTION TO WEB AND XHTML

Introduction - Blogging - Social Networking - Socialmedia - Tagging - Software development - Introduction to XHTML and Editing XHTML Headings - Linking - Images - Special characters and Horizon rules - Lists - Tables - Forms -Internal Linking- Meta Elements - Cascading Style Sheets.

UNIT II **10 Hours**

JAVASCRIPT

Introduction to scripting - Control statements I, II - Functions: Definition - Random Number Generation -Global function - Recursion - Arrays: Declaring and allocating arrays Multidimensional arrays - Objects: Math object - String object - Date object - Boolean, Number object - Document object - Window object - Events.

UNIT III **8 Hours**

INTERNET APPLICATION SERVER TECHNOLOGIES

Web server (IIS and Apache): Multitier Architecture - Client/ Server side scripting - Accessing web services - Microsoft IIS - Apache HTTP server - Database: Relational database - SQL - PHP: Basics - String and Form Processing - connecting to database.

UNIT IV **9 Hours**

ASP .NET AND JSP WEB APPLICATIONS

Introduction - creating and running a simple web form - Web controls - session tracking - case study: Connecting to a database in ASP.NET. - Introduction to AJAX- AJAX XML Http request- AJAX Events- Java web technologies(Servlets, JSP)-creating and running a simple application in Netbeans-JSF components.

UNIT V **8 Hours**

WEB SERVICES

Introduction - Java web services Basics - Creating Publishing, Testing and describing web service - Consuming web service - SOAP - Session Tracking in web services - Consuming a Database driven web service from a web application - Passing an object of a User defined type to a web service.

FOR FURTHER READING

Introduction - Java web technologies - Creating and running a simple application in Netbeans – JSF components - Session tracking: cookies.

Total: 45 Hours

Reference(s)

1 P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2 Deitel, Deitel and Nieto, Internet and World Wide Web How to Program, Pearson Education,2002.
3 Uttam K.Roy, Web Technologies, Oxford University Press, 2010.
4 Rajkamal, Web Technology, Tata McGraw-Hill, 2009.
5 www.w3schools.com/ajax.

21CS607 CLOUD COMPUTING LABORATORY 0 0 4 2

Course Objectives

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

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 modelling to complex engineering activities with an understanding of the limitations.
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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment

Articulation Matrix

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

1 **8 Hours**

EXPERIMENT 1

Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

2 **8 Hours**

EXPERIMENT 2

Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3 **8 Hours**

EXPERIMENT 3

Install Google App Engine. Create hello world app and other simple web applications using python/java.

4 **7 Hours**

EXPERIMENT 4

Use GAE launcher to launch the web applications.

5 **7 Hours**

EXPERIMENT 5

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

6 **7 Hours**

EXPERIMENT 6

Find a procedure to transfer the files from one virtual machine to another virtual machine.

7 **7 Hours**

EXPERIMENT 7

Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

8 **8 Hours**

EXPERIMENT 8

Install Hadoop single node cluster and run simple applications like word count.

Total: 80 Hours

Reference(s)

1 Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2009.

2 Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies, Wiley India, 2009.

3 Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014

21CS608 WEB TECHNOLOGY LABORATORY 0 0 4 2

Course Objectives

- Understand and apply the role of scripting languages like XHTML, CSS, JavaScript, ASP, JSP and PHP for designing interactive web applications.
- Familiar with the different types of server technologies.
- Gain knowledge about the concepts of web services.

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 modelling to complex engineering activities with an understanding of the limitations
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.
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.
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 global requirements.

Course Outcomes (COs)

1. Implement with presentation effects in XHTML and CSS
2. Create dynamic webpages using java script and PHP in XHTML
3. Design the interactive web applications by connecting SQL with ASP.Net
4. Develop SOAP based web services for real time applications

Articulation Matrix

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

1 **6 Hours**

EXPERIMENT 1

Create a XHTML document for the college website with Text styling, Linking, Images, Lists, Table by highlighting the facilities in the department.

2 **6 Hours**

EXPERIMENT 2

Create an XHTML document for an online Bookstore that has a Registration form with text box, Radio Button, Selection box, Checkbox, Submit and reset buttons.

3 **6 Hours**

EXPERIMENT 3

Design a web page using CSS which includes the following:

a) Use different font styles

b) Set background image for both the page and single elements on page.

c) Control the repetition of image with background-repeat property

d) Define style for links as a: link, a: active, a: hover, a: visited

4 **6 Hours**

EXPERIMENT 4

Write a java script to validate the following fields in a registration page

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

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

c) E-mail (should not contain invalid addresses)

5 **6 Hours**

EXPERIMENT 5

Write a JavaScript function to get nth largest element from an unsorted array.

6 **6 Hours**

EXPERIMENT 6

Create a web page with real time clock using Java script event handling mechanism.

7 **6 Hours**

EXPERIMENT 7

Write a JSP code to retrieve the XHTML form values and print those values in JSP pages.

8 **6 Hours**

EXPERIMENT 8

Write a program with ASP .net by connecting with SQL

a. Create login form to enter into website

b. Building web form that displays data from a database

9 **6 Hours**

EXPERIMENT 9

Write a PHP program for an web application that

a. takes a name as input and on submit it shows a hello page where is taken from the request

b. shows a start time at the right top corner of the page and

c. provides the logout button on clicking this button it should show a logout page with thank you message along with the duration of usage session

10 **6 Hours**

EXPERIMENT 10

Create a SOAP based web service for a simple Java Calculator class with operations add and subtract then create a web service client which then consumes the web service and displays the result of the invoked web service.

Total: 60 Hours

18GE601 SOFT SKILLS-APTITUDE II **0 0 2 0**

Course Objectives

- Expose the undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values. It will provide a lot of activities and examples for a student to learn and develop these life skills.

Course Outcomes (COs)

1. Apply the concepts of probability, Sets, Permutation and Combinations in estimating data for real time problems.
2. Understand the concept of logarithms, progressions and Simple and Compound interest to solve various practical problems.
3. Analyse objects involving cubes and cuboids in determining the number of sides colored.
4. Interpret various data from graphs and tables to determine ratio, percentage and averages.
5. Apply the logical reasoning skills for identifying age, relations, visual relations and puzzles.

1 **2 Hours**

PERMUTATION AND COMBINATION

Definition-Fundamental rules-Theorems on Permutation-Theorems on Combination.

2 **2 Hours**

PROBABILITY

Concept and Importance of Probability-Underlying factors for real Life estimation of probability-Basic facts about probability-Some important consideration while defining event.

3 **3 Hours**

SYLLOGISM AND VENN DIAGRAM

Concepts on Syllogisms-Venn diagram-Interpretation-Venn diagram-solving.

4 **3 Hours**

SIMPLE INTEREST AND COMPOUND INTEREST

Introduction-Definition - Effect of change of P, R, T on simple interest-Amount-Amount becomes N times the principle-Repayment of debt in equal installments-Rate and time are numerically equal-Compound Interest-Conversion period-Basic formula-Special cases-To find the principle / Time /Rate-Difference between Compound Interest and Simple Interest-Equal annual installment to pay the borrowed amount.

5 **2 Hours**

MIXTURES AND ALLIGATION

Definition-Alligation rule-Mean value (cost price) of the mixture-Some typical situations where allegation can be used.

6 **2 Hours**

CUBE AND LOGARITHM

Introduction-Basic Concepts of Cube and Cuboid-Problems involving cubes and cuboids of various dimensions-Problems involving coloured cubes and cuboids - Basic concepts of Logarithm-Laws of

Logarithms including change of base-Common logarithm (base 10) - Properties of Logarithms to solve equations involving logarithmic expressions.

7 **2 Hours**

DATA INTERPRETATION

Introduction-Ratio-Percentage-Average-Tables - Graphs and Charts.

8 **3 Hours**

PROGRESSION AND LOGICAL REASONING

Arithmetic progression-Geometric progression -Harmonic progression -Theorems related with progressions.

9 **2 Hours**

PROBLEM ON AGES

Introduction-Basic concept-Usage of Percentage and Averages -Applications

10 **2 Hours**

ANALYTICAL REASONING

Introduction-Basic concept-Non verbal Analytical Reasoning -Arrangements.

11 **2 Hours**

BLOOD RELATION

Introduction-Basic concept-Kinds of relation-Tree diagram -Relations.

12 **3 Hours**

VISUAL REASONING

Introduction-Basic concepts-Odd man out-Next series-Mirror image and water image

13 **2 Hours**

SIMPLIFICATIONS

Introduction-Basic concepts-Arithmetic operations-Equation solving methods-Puzzles.

Total: 30 Hours

Reference(s)

1 Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Mc Graw Hill Publications.
2 U. Mohan Rao, Quantitative Aptitude for Competitive Examinations, Scitech Publications Pvt Ltd, India.
3 Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Third Edition, Pearson Education Pvt Ltd, India, 2016.
4 Dr. R S Aggarwal, A Modern Approach to Verbal and Non Verbal Reasoning, Revised Edition, S Chand Publications.
5 Arun Sharma, How to prepare for Logical Reasoning for CAT & other Management Exams, Fifth Edition, Mc Graw Hill Publications.
6 Jaikishan and Premkishan, How to Crack Test of Reasoning in all Competitive Examinations, Revised Edition, Arihant Publications.

21HS002 HUMAN VALUES AND ETHICS **2 0 0 2**

Course Objectives

- Understand the basic concepts of data mining
- Apply the data mining functionalities
- Assess the strengths and weaknesses of various data mining techniques

Programme Outcomes (POs)

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 modelling to complex engineering activities with an understanding of the limitations.
e. 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.
f. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
g. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
h. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
i. 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.
j. 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.
k. 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. Articulate engineering ethics theory with sustained lifelong learning.
2. Analyse the scope of engineering ethics in professionalism
3. Apply the social experimentation process for solving real world problems.
4. Analyze the rights and responsibilities of employees in creating safe and healthy workplace
5. Differentiate the global issues encountered in multinational corporation and environmental context.

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

UNIT I **6 Hours**

SOFTWARE TESTING FUNDAMENTALS

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others – Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment - Empathy

UNIT II **6 Hours**

TESTING DESIGN STRATEGIES

Scope of Engineering Ethics- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlbergs and Gilligan's theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse

UNIT III **6 Hours**

LEVELS OF TESTING

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study- Bhopal Gas Tragedy - The Three Mile Island and Chernobyl

UNIT IV **6 Hours**

TEST MANAGEMENT

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate Climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality Conflicts of interest - Occupational crime - Professional rights - Employee rights

UNIT V **6 Hours**

TEST MEASUREMENTS AND REVIEWS

Multinational corporations: Technology transfer and appropriate technology - International rights - promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership

FOR FURTHER READING

Sample code of ethics like IETE,ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management

Total: 30 Hours

Reference(s)

1 Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2 M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3 R S Naagarazan, A text book on professional ethics and human values, New age international(P)limited, New Delhi,2006.
4 Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
5 Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
6 http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics

21CS702 SOFTWARE TESTING 3 0 0 3

Course Objectives

- Familiarize with the various test design strategies.
- Understand the levels of testing and defect classes.
- Impart knowledge on the testing and debugging policies with the types of review.

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. 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.
f. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the testing principles involved in ensuring the software quality
2. Analyze the testing design strategies in software testing
3. Compare the software testing level with respect to System design and coding
4. Examine the testing activities to deliver high quality software applications.
5. Implement the testing and debugging policies with the types of review.

Articulation Matrix

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

UNIT I **8 Hours**

SOFTWARE TESTING FUNDAMENTALS

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process-

The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of Defects- Defect Classes the Defect Repository

UNIT II **8 Hours**

TESTING DESIGN STRATEGIES

Introduction to Testing Design Strategies - The Smarter Tester - Test Case Design Strategies - Black Box testing - Random Testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing - Error Guessing - Black-box testing and COTS - White-Box testing -Test Adequacy Criteria - Coverage and Control Flow Graphs.

UNIT III **9 Hours**

LEVELS OF TESTING

The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests. The Class as a Testable Unit - The Test Harness - Running the Unit tests and Recording results- Integration tests- Designing Integration Tests - Integration Test Planning - System Test - Types-of system testing - Regression Testing.

UNIT IV **10 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 - The role of three groups in Test Planning and Policy Development - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group.

UNIT V **10 Hours**

TEST MEASUREMENTS AND REVIEWS

Defining Terms - Measurements and Milestones for Controlling and Monitoring- Status Meetings- Reports and Control Issues - Criteria for Test Completion- SCM - Types of reviews - developing a review program - Components of Review Plans- Reporting review results. Testing Tools-Case Selenium, Autoit

FOR FURTHER READING

Software test automation, skills needed for automation scope of automation, design and architecture for automation, requirements for a test tool challenges in automation.

Total: 45 Hours

Reference(s)

1 S Limaye, Software Testing Principles, Techniques and Tools, McGraw Hill, 2009.
2 Ilene Burnstein, Practical Software Testing, Springer International, 2003.
3 Boris Beiser, Software Testing Techniques, Dreamtech press, New Delhi, 2009.
4 Aditya P.Mathur, Foundations of Software Testing, Pearson Education,2008.
5 Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing, Principles and Practices, pearson Education,2008.

21CS707 SOFTWARE TESTING LABORATORY 0 0 4 2

Course Objectives

- Analyse the requirements for the given problem statement
- Design and implement various solutions for the given problem
- Employ various design strategies for problem solving.
- Construct control flow graphs for the solution that is implemented
- Create appropriate document for the software artefact

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 modelling 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.
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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Apply boundary value testing and equivalence class value testing for the given test cases.
2. Apply decision table, data flow and basis path testing for the given test cases.
3. Apply basis path testing on sorting and searching algorithms

Articulation Matrix

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

1 **5 Hours**

EXPERIMENT 1

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.

2 **5 Hours**

EXPERIMENT 2

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

3 **5 Hours**

EXPERIMENT 3

Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

4 **5 Hours**

EXPERIMENT 4

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.

5 **5 Hours**

EXPERIMENT 5

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.

6 **5 Hours**

EXPERIMENT 6

Design, develop, code and run the program in any suitable language to implement the Next Date function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results

7 **5 Hours**

EXPERIMENT 7

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.

8 **5 Hours**

EXPERIMENT 8

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.

9 **5 Hours**

EXPERIMENT 9

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.

10 **5 Hours**

EXPERIMENT 10

Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

11 **5 Hours**

EXPERIMENT 11

Design, develop, code and run the program in any suitable language to implement the quicksort algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

12 **5 Hours**

EXPERIMENT 12

Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

Total: 60 Hours

Reference(s)

1 William E Perry, Effective Methods for Software Testing, John Wiley & Sons, USA, Third Edition 2014.

21CS708 PROJECT WORK I **0 0 6 3**

Course Objectives

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Program 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 modelling 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 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.
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 global requirements.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Express the technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

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

21CS801 PROJECT WORK II 0 0 18 9

Course Objectives

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Program 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 modelling 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.
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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 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.
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 global requirements.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Express the technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

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

LANGUAGE ELECTIVES

1 0 2 2

18HSC01 CHINESE

Course Objectives

- To help students appear for HSK Level 1 Exam
- To help students acquire the basics of Chinese language
- To teach the students how to converse in Chinese in various situations

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Listen and identify individual sounds of Chinese
2. Use basic sounds and words while speaking
3. Read and understand short passages on familiar topics
4. Use basic sentence structures while writing
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

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

UNIT I **9 Hours**

Hello 1Initials and Finals of Chinese b,p,m,f,d,,n,l,g,k,h,j,q,x 2. Tones Four 3Chinese Syllables 4.Tone S

UNIT II **9 Hours**

Thank you Initials and Finals of Chinese The Neutral Tone Rules of Tone Marking and Abbreviation

UNIT III **9 Hours**

What'"s your name - In the school; -In the classroom; -In the school The Interrogative Pronoun 2 The Sentence 3 Interrogative Sentences with

UNIT IV **9 Hours**

She is my Chinese teacher In the library The Interrogative Pronouns The Structural Particle The interrogative Particle

UNIT V **9 Hours**

Her daughter is 20 years old this year 1.The Interrogative Pronoun | 2. Numbers below 100 | 3.Indicating a Change | The Interrogative Phrase

Total: 45 Hours

18HSF01 FRENCH **3 0 0 3**

Course Objectives

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. To help students acquire familiarity in the French alphabet & basic vocabulary
2. Listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

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

9 Hours

UNIT I

ENTRER EN CONTACT

La langue francaise, alphabets, les numeros, les jours, les mois.| Grammaire Les verbes s appeler,etre, avoir, les articles definis, indefinis | Communication - Saluer, s informer sur quelquun, demander de se presenter | Lexique - Les alphabets, les nationalites, age, les pays, les couleurs, les jours de la semaine, les mois de l annee, les professions

UNIT II **9 Hours**

PARTAGER SON LIEU DE VIE

Les francais et leur habitat, des habitations insolites | Grammaire - Verbes - Conjugaison : Present (Avoir / etre / ER, IR, RE : Regulier et Irregulier) - Adjectifs les propositions de lieu | Communication - Chercher un logement, d ecrire son voisin, s informer sur un logement | Lexique - L habitat, les pieces, l equipement, la description physique

UNIT III **9 Hours**

VIVRE AU QUOTIDIEN

Grammaire - Articles contractes, verbes vouloir, pouvoir, devoir, adjective interrogative, future proche Communication- Exprimer ses gouts, parler de ses loisirs, justifier un choix, exprimer une envie Lexique - le temps libre et les loisirs, les saisons, les activites quotidiennes, le temps (le matin, le soir, la nuit)

UNIT IV **9 Hours**

COMPRENDRE SON ENVIRONNEMENT - OUVRIR - LA CULTURE

Grammaire - Verbes - Finir, Sortir, les adjectifs demonstratifs, le passe compose, l imparfait Communication - Propose quelqu un de faire quelque chose, raconteur une sortie au passe parler un film | Lexique - Les sorties, la famille, art, les vetements et les accessoires

UNIT V **9 Hours**

GOUTER A LA CAMPAGNE

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantite | Communication Accepter et refuse rune invitation, donner des instructions, commander au restaurant | Lexique Les services et les commerces, les aliments, les ustensiles, argent

Total: 45 Hours

Reference(s)

1 Saison A1, Methode de francais
2 Hachette FLE

18HSG01 GERMAN **3 0 0 3**

Course Objectives

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Listen and identify individual sounds of German
2. Use basic sounds and words while speaking
3. Read and understand short passages on familiar topics
4. Use basic sentence structures while writing
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

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

UNIT I **9 Hours**

Introduction to German language: Alphabet - Numbers - Greetings - Days and Seasons- Working with Dictionary.

UNIT II **9 Hours**

Nouns - articles - Speaking about one self - Listening to CD supplied with the books, paying special attention to pronunciation

UNIT III **9 Hours**

Regular & Irregular verbs - Personal pronouns - family - Introduction to types of sentences

UNIT IV **9 Hours**

Question words-Types of Questions - Nominative case- Verb Conjugation - country - nationalities

UNIT V **9 Hours**

Verbs - to be & to have - conjugation - Hobbys - Framing basic Questions and answers

Total: 45 Hours

Reference(s)

1 Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal

Publishers & Distributers Pvt. Ltd., New Delhi, 2015

2 Langenscheidt Eurodictionary - German - English / English - German,Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009

3 Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.

18HSH01 HINDI **3 0 0 3**

Course Objectives

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day-to-day situations
- To help students acquire the ability to understand a simple technical text in Hindi

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Construct simple sentences and use vocabulary required for day-to-day conversation.
2. Distinguish and understand the basic sounds of Hindi language
3. Appear for Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha

Articulation Matrix

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

UNIT I **9 Hours**

Hindi Alphabet: Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs- Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

Nouns: Genders (Masculine & Feminine Nouns long vowels and short vowels - -Masculine & Feminine -Reading Exercises.

UNIT III **9 Hours**

Pronouns and Tenses: Categories of Pronouns - Personal Pronouns - Second person (you & honorific) -Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense – Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV **9 Hours**

Classified Vocabulary: Parts of body - Relatives - Spices - Eatables - Fruit & Vegetables - Clothes -Directions - Seasons - Professions.

UNIT V **9 Hours**

Speaking: Model Sentences and Rhymes - Speaking practice for various occasions.

Total: 45 Hours

18HSJ01 JAPANESE **3 0 0 3**

Course Objectives

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquettes

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Recognise and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

Articulation Matrix

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

UNIT I **9 Hours**

Introduction to Japanese - Japanese script- Pronunciation of Japanese (Hiragana)- (Katakana) Long vowels- Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 wa N2 desu - N1 wa N2 ja arimasen - S ka N1 mo - N1 no N2 - san - Kore - Sore - Are -Kono N - Sono N - Ano N - Sou desu - Sou ja Arimasen - S1 ka - S2 ka - N1 no N2 - Sou desu ka - Koko- Soko - Asoko - Kochira - Sochira Achira - N1 wa N2 (place) desu - Doko - Dochira - N1 no N2 - Ko - So - A - Do (Demonstrative words) - O kuni Kanji10 - Technical Japanese Vocabulary (30 Numbers)

UNIT II **9 Hours**

Introduction to time - Ji - Fun - Pun - Introduction of verbs - V Masu - V Masen - V Mashita - VMasendeshita N (Time) Ni V - N1 Kara - N2 Made - N1 to N2 - S Ne - N (Place) e Ikimasu - Kimasu - Kaerimasu - Doko (e) Mo Ikimasen - Ikimasendeshita - N (Vechile) de Ikimasu - Kimasu - Kaerimasu - N (Person / Animal) to V - Itsu - S Yo N o (transitive) - N o Shimasu - Nani o Shimasuka - Nan and Nani - N (place) de V - V Masenka - V Mashou - o - Kanji 10 - Technical Japanese Vocabulary (30 Numbers) .

UNIT III **9 Hours**

N (tool/means) de V - Word/Sentence wa Go de Nani desu ka - N (person) Ni Agemasu, etc - N (person)Ni Moraimasu etc - Mou V Mashita - Introduction to Adjectives - N wa Na adj (Na) desu - N wa II adj(II) desu - Na adj Na n - II adj (II) N - Totemo - Amari - N wa Dou desuka - N1 wa

Donna N2 desuka - S1 Ga S2 - Dore N ga Arimasu - Wakarimasu - N Ga Sukidesu - Kiraidesu - Jozu desu - Heta desu - Donna N - Yoku - Daitai - Takusan - Sukoshi - Amari - Zenzen - S1 kara S2 - Doushite - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT IV **9 Hours**

N ga Arimasu - Imasu - N1 (place) Ni N2 ga Arimasu - Imasu - N1 (thing/person/place) no N2 (position)- N1 ya N2 - Word (s) desuka - Chirisosu wa Arimasuka - Saying numbers - Quantifier (period) Ni kai V- Quantifier Dake - N dake - Past tense of Noun sentences and Na adjective sentences - Past tense of ii adjective sentences - N1 wa N2 yori adjective desu - N1 to N2 to dochira ga adjective desu ka - N1/N2 nohouga adjective desu - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT V **9 Hours**

N ga hoshi desu - V masu form tai desu - N (place) e V masu form - N Ni - ikimasu - kimasu – kaerimasu N ni V - N o V - dou ko ka - nani ka - go chuu mon - Verb conjugation - Verb groups - Verb te form - V te form kudasai - V te form imasu - V masu from mashouka - S1 ga S2 - N ga V - V te form mo ii desu - V te form wa ikemasen - V te form imasu Shrimasen - Kanji 10 - Technical Japanese Vocabulary (30Numbers)

Total: 45 Hours

Reference(s)

1 Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

18HS201 COMMUNICATIVE ENGLISH II **3 0 0 3**

Course Objectives

- Read and understand ideas of complex text on both concrete and abstract topics
- Listen and understand technical discussions in his/her field of specialisation
- Produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various option
- Interact with a degree of fluency and spontaneity that makes regular interaction without strain

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Use appropriate grammar & vocabulary that is expected at the BEC Vantage exam level.
2. Understand the general meaning of non-routine letters, and of a report of predictable unpredictable topic
3. Write simple reports of factual nature and factual non-routine letters
4. Ask for factual information and understand the answer; and take/pass on workplace messages
5. Express opinions and present arguments to a limited extent; and give simple, prepared presentations on familiar topics

Articulation Matrix

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

UNIT I **9 Hours**

GRAMMAR3

Tenses - Future continuous, Future perfect, Future perfect continuous, Past perfect, Past perfect continuous - Adjectives and adverbs - Mixed conditionals - Modals - can't have, needn't have - Modals of deduction and speculation - Narrative tenses - Passives - Phrasal verbs, extended - Relative clauses -Reported speech - Will and going to, for prediction - Wish - Would expressing habits, in the past.

UNIT II **9 Hours**

READING

Scanning and reading for gist - Understanding text structure - Reading for gist and specific information -Vocabulary and structure - Understanding sentence structure and error identification

UNIT III **9 Hours**

WRITING

A message, memo or email, giving instructions, explaining a development, asking for comments, requesting information, agreeing to requests - Business correspondence: explaining, apologising, reassuring, complaining, short report: describing, summarising - proposal: describing, summarising, recommending, persuading.

UNIT IV **9 Hours**

LISTENING

Listening for and noting specific information - Listening to identify topic, context, Function – Following the main points and retrieving specific information from the text.

UNIT V **9 Hours**

SPEAKING

Giving personal information: Talking about present circumstances, past experiences and future plans, expressing opinions, speculating - Organising a larger unit of discourse: Giving information and expressing and justifying opinions - Turn-taking: negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing/disagreeing, suggesting, speculating, comparing and contrasting, and decision-making.

1.A Horse and Two Goats-R K Narayan
2.My Lord the Baby - Rabindranath Tagore
3.Twist in the Tale-Jeffery Archer
4.The Third and Final Continent – Jhumpa Lahiri
5.The Gift of the Magi - O Henry

Total: 45 Hours

Reference(s)

1 Guy Brook-Hart, "BEC Vantage: Business Benchmark Upper-Intermediate- Student's Books" 1st Edition, Cambridge University Press, New Delhi, 2006.

2 Ian Wood, Paul Sanderson, Anne Williams with Marjorie Rosenberg, "Pass Cambridge BEC Vantage- Student's Book" 2nd Edition, Cengage Learning, New Delhi, 2014

3 Michael Handford, Martin Lisboa, Almut Koester, Angela Pitt, "Business Advantage - Student's Book Upper-Intermediate" Cambridge University Press, New Delhi, 2014.

4 Cambridge Examination Publishing, "Cambridge BEC VANTAGE - Self-study Edition", Cambridge University Press, UK, 2005

PROFESSIONAL ELECTIVES

21CS001 / 21CSM01 / 21CSH01 EXPLORATORY DATA ANALYSIS 2 0 2 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 analysistechniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high-dimensional data.

Program Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan 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 publichealth 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 engineeringand IT tools including prediction and modeling to complex engineering activities with an understanding ofthe 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), tosimplify 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

FOR FURTHER READING

Text Analysis and Natural Language Processing (NLP)- Advanced Data Visualization- Plotly, Bokeh, and D3.js- Handling Imbalanced Data.

EXPERIMENT 1 **5 Hours**

Explore the Titanic dataset using descriptive statistics and data visualization.

1. Load the Titanic dataset.
2. Calculate the descriptive statistics for each variable.
3. Create a variety of data visualizations to explore the relationships between variables.
4. Interpret the results of the descriptive statistics and data visualizations.

EXPERIMENT 2 **5 Hours**

Clean and prepare the California housing dataset for analysis.

1. Identify and handle missing data.
2. Identify and remove outliers.
3. Convert categorical variables to numerical variables.
4. Explore the distribution of the data after cleaning and preparing it.

EXPERIMENT 3 **5 Hours**

Perform univariate analysis on the Iris dataset.

1. Calculate the descriptive statistics for each variable.
2. Create a variety of data visualizations to explore the distribution of each variable.
3. Interpret the results of the descriptive statistics and data visualizations.

EXPERIMENT 4 **5 Hours**

Perform bivariate analysis on the Boston housing dataset.

1. Explore the relationship between housing prices and different features of the houses, such as the number of rooms, the lot size, and the crime rate.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the bivariate analysis.

EXPERIMENT 5 **5 Hours**

Perform multivariate analysis on the Wine dataset.

1. Explore the relationships between different features of the wine, such as the color, the acidity, andthe alcohol content.
2. Use data visualization to explore the relationships between variables.
3. Interpret the results of the multivariate analysis.

EXPERIMENT 6 **5 Hours**

Apply dimensionality reduction techniques to the MNIST dataset.

1. Use PCA to reduce the dimensionality of the dataset from 784 dimensions to 2 dimensions.
2. Visualize the reduced data using a scatter plot.
3. Interpret the results of the dimensionality reduction.

Total: 60 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 makeyour life easier. " O'Reilly 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.

21CS002 / 21CSM02 / 21CSH02 RECOMMENDER SYSTEM 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.

Program Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan 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, andengineering 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 toprovide 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. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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

21CS003 / 21CSM03/ 21CSH03 BIG DATA ANALYTICS 3 0 0 3

Course Objectives

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

Program 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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

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 **10 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.

FOR FURTHER READING

Selecting NoSQL / SQL based on applications – Bigquery – Data analytics with R language – Connecting to Mongo DB – Connecting to Cassandra – Linear Regression – Clustering – Collaborative filtering – Association rule mining – Decision tree.

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.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.

21CS004/ 21CSM04/ 21CSH04 NEURAL NETWORKS AND DEEP LEARNING 2 0 2 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 networksfor various tasks.

Program 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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

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 **9 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 **9 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 **10 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 – Motivation – 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 **9 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 **8 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.

FOR FURTHER READING

Neocognition architecture – Neocognition Data processing – Generative Deep Learning- Deep Learning for Time Series

Total: 45 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
7. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.

21CS005/21CSM05/21CSH05 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.

Program 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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

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 usingthe 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- Naïve 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 – Earley's 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. 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. Jacob Eisenstein. “Natural Language Processing “, MIT Press, 2019.
3. Samuel Burns “Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press,2009.
5. Nitin Indurkhya,Fred J. Damerau, “Handbook of Natural Language Processing”, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

21CS006/ 21CSM06/ 21CSH06 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

Program 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. 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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

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		1		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 & MOTION ESTIMATION

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)

a. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
b. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
c. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
d. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
e. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21CS007 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 Outcome(POs)

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

b. Identify, formulate, 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 public health and safety, and cultural, societal, and environmental considerations.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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 global requirements.

Course Outcomes(COs)

- Understand genesis of Agile and driving forces for choosing Agile techniques.
- Apply the Agile Scrum framework and development practices.
- Apply iterative software development processes by planning and executing them.
- Analyze the impact of the success of social aspects behind the software testing.
- 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	2	2	2											2
3	1		2		2								2	2
4	1		2		2								2	2
5	1		2		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 - Earl_s 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 Hours: 45

Reference:

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 management‖, Butterworth-Heinemann, 2007.

21CS008 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

Program Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
b. Identify, formulate, 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 public health and safety, and cultural, societal, and environmental considerations.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

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 & WIREFRAMING

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

6. Alan Cooper, “The Essential Of User Interface Design”, Wiley – Dream Tech Ltd.,2002.
7. Baecker, Ronald M., Jonathan Grudin, et al. Readings in Human-Computer Interaction: Toward the Year 2000. 2nd ed. Morgan Kaufmann, 1995. ISBN: 9781558602465.
8. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.
9. Dix, Alan J., Janet E. Finlay, et al. Human-Computer Interaction. 2nd ed. Prentice Hall, 1998. ISBN: 9780132398640.
10. Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998. ISBN: 9781558604186.

21CS009 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

Program Outcomes(POs)

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

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

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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 Hours: 45

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

21CS010 APP DEVELOPMENT 2023

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

Program Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identity, 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.
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.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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.

Total: 38 Hours

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.

Text Books

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (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 6Development: Exploring the iOS SDK", Apress, 2013.55.

21CS011 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

Program 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.
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.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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

Text Books

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.

Reference(s)

1. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.
2. Edward Kit,” Software Testing in the Real World – Improving the Process”, Pearson Education, 1995.
3. Boris Beizer,” Software Testing Techniques” – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, “Foundations of Software Testing _ Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

21CS012 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

Program 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 limitation.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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 & GRADLE

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. 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
4. (English Edition) Paperback – 1 January 2020 by Mitesh Soni.
5. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
6. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
7. 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.
8. https://www.jenkins.io/user-handbook.pdf
9. https://maven.apache.org/guides/getting-started/

21CS013 VIRTUALIZATION IN CLOUD COMPUTING 3 0 0 3

Course Objectives

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

Program 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.
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 global requirements.

Course Outcomes (COs)

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

UNIT I 9 Hours

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moore's Law-

Understanding the Importance of Virtualization -Examining Today's Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications

9 Hours

UNIT II

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 Today's Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

UNIT III **9 Hours**

VIRTUAL MACHINES

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 & CONFIGURATIONS

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 & APPLICATIONS IN A VIRTUAL MACHINE

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

21CS014 CLOUD SERVICES AND DATA MANAGEMENT 3 0 0 3

Course Objectives

- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models.
- Analyze virtualization technology to derive the best practice model for deploying cloud-based applications.
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and Open Stack.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment.

Program 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.
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 global requirements.

Course Outcomes (COs)

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

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. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011.
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013.
3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'reilly, SPD, 2011.

21CS015 CLOUD STORAGE TECHNOLOGIES 3 0 0 3

Course Objectives

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

Program 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 modelling to complex engineering activities with an understanding of the limitations.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

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

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**

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. 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. 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. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013.
4. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata Mcgraw Hill, 2009.

21CS016 CLOUD AUTOMATION TOOLS AND APPLICATIONS 3 0 0 3

Course Objectives

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

Program 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 modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

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

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 **9 Hours**

AWS CLOUDFORMATION USE-CASE

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

21CS017 SOFTWARE DEFINED NETWORKS 2 0 2 3

Course Objectives

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

Program 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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											2
2		1	3	2										2
3		2	1	3										2
4	1	2	1	3										2
5	1	3		2										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, Open Daylight, ONOS - Distributed Controllers.

UNIT III **6 Hours**

VIRTUALMACHINES 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 Core, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV.

1 **6 Hours**

EXPERIMENT 1

Setup your own virtual SDN lab

i) Virtual box/Mininet Environment for SDN - http://mininet.org

ii) https://www.kathara.org

iii) GNS3

2 **6 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: 60 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.
6. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud, Pearson Education, 1st Edition, 2015.

21CS018 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

Program 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 modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

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

UNIT I **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 **8 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: 45 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.

21CS019 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.

Program 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.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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

INTRUSION DETECTION **9 Hours**

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

INTRUSION PREVENTION **9 Hours**

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.

21CS020 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.

Program Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
b. Identify, formulate, 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 public health and safety, and 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 modelling to complex engineering activities with an understanding of the limitations.
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.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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 Hours: 45

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.

21CS021 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.

Program Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
b. Identify, formulate, 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 public health and safety, and 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 modelling to complex engineering activities with an understanding of the limitations.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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	PSO 1	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 & FIREWALLS

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 Hours: 45

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.

21CS022 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

Program 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. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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

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.

21CS023 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES 2023

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.

Program 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 modelling to complex engineering activities with an understanding of the limitations.
m. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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 & ETHEREUM

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

Reference(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.
3. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
5. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
7. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

21CS024 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.

Program Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for 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. Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

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 **10 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 **10 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 **8 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 **8 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

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, SébastienJosse, "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.
7. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.

21CS025 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.

Program Outcomes (POs)

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

Course Outcomes

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

UNIT I

INTRODUCTION TO MULTIMEDIA ELEMENTS **6 Hours**

Multimedia - Medium - Properties of a Multimedia System - Traditional Data Stream Characteristics - Text - Basic Sound Concepts – Speech. Image – 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, MPEG 3, MPEG 7, MPEG 21.

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 & basics, Layout & 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.

References

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.
3. Multimedia: Making It Work, Tay Vaughan, 9th Edition,
4. The Illusion of Life: Disney Animation - Frank Thomas and Ollie Johnston
5. Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls. New Riders, 2008.
6. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
7. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
8. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
9. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.

1 **3 Hours**

EXPERIMENT 1

Image Editing and Manipulation.

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 & Primitive Modelling

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 & Rendering

21CS026 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.

Program 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.
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.
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.
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 tools and technologies related to AR/VR.
2. Design various models using modeling 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 **9 Hours**

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's 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 **9 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 **9 Hours**

VR PROGRAMMING

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

UNIT IV **9 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 **9 Hours**

AUGMENTED REALITY

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

Total: 45 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.

21CS027 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

Program 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.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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 global requirements.

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 **9 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 **9 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 **9 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 **9 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 **9 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.

Total: 45 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.

21CS028 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.

Program 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 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 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 global requirements.

Course Outcomes

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 **8 Hours**

FUNDAMENTALS

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

UNIT II **10 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 **9 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 **9 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 **9 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.

Total: 45 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.

21CS029 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

Program 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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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 global requirements.

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for today's Marketer.
2. Compare the strengths and limitations of search engine optimization.
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 toyour 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 III **9 Hours**

E- MAIL MARKETING

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

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: 45 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; first

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.

21CS030 KNOWLEDGE ENGINEERING 3 0 0 3

Course Objectives

- To understand the basics of Knowledge Engineering.
- To discuss the knowledge representation and reasoning methods.
- To apply reasoning and uncertainty for intelligent systems.
- To design and develop ontologies.
- To understand learning and rule learning.

Program 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.

Course Outcome (COs)

1. Understand the basics of Knowledge Engineering.
2. Interpret the knowledge representation and reasoning methods.
3. Apply reasoning and uncertainty for intelligent systems.
4. Design and develop ontologies.
5. Understand learning and rule learning.

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 **9 Hours**

INTRODUCTION TO KNOWLEDGE ENGINEERING

Introduction – Data, Information and Knowledge – Skills of Knowledge Engineer – Knowledge based systems – Types of Knowledge based systems – Expert Systems – Neural Networks – Case Based

Reasoning – Genetic Algorithms – Intelligent Systems – Data Mining

UNIT II **9 Hours**

KNOWLEDGE REPRESENTATION AND REASONING

Knowledge Acquisition – Knowledge Representation and Reasoning – Using Knowledge – Logic, Rules and Representation – Developing Rule based Systems – Semantic Networks – Frames

UNIT III **9 Hours**

REASONING UNDER UNCERTAINTY

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT IV **9 Hours**

ONTOLOGIES – DESIGN AND DEVELOPMENT

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development

UNIT V **9 Hours**

LEARNING AND RULE LEARNING

Machine Learning – Concepts – Generalization and Specialization Rules – Types of Generalization and Specialization – Formal definition of Generalization. Modelling, Learning and Problem Solving

Total: 45 Hours

Reference(s)

1. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.
3. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
4. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
5. King, Knowledge Management and Organizational Learning, Springer, 2009.
6. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.

21CS031 SOFT COMPUTING **3 0 0 3**

Course Objectives

- Apply suitable soft computing techniques for various applications
- Integrate various soft computing techniques for complex problems

Program 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.
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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Understand the basic concepts of soft computing
2. Classify the architecture and working principles of specialized neural networks
3. Apply the concept of fuzzification and defuzzification in fuzzy systems
4. Analyze the fundamental concepts of genetic algorithm and classify its types
5. Apply hybrid soft computing techniques to solve real time problem

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

UNIT I **10 Hours**

INTRODUCTION TO SOFT COMPUTING

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II **10 Hours**

ARTIFICIAL NEURAL NETWORKS

Back propagation Neural Networks- Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III **9 Hours**

FUZZY SYSTEMS

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations - Membership Functions -Defuzzification- Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making

UNIT IV **8 Hours**

GENETIC ALGORITHMS

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction -Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator- Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V **8 Hours**

HYBRID OF SYSTEMS

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron- Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

FOR FURTHER READING

Neural network implementation - Fuzzy logic implementation - Genetic algorithm implementation - MATLAB environment for Soft Computing Techniques.

Total: 45 Hours

Reference(s)

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press,2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 3rd Edition,2018.
3. Kwang H.Lee, "First course on Fuzzy Theory and Applications, Springer, 2005.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and programming Techniques, Addison Wesley, 2003.

21CS032 TEXT AND SPEECH ANALYSIS 3 0 0 3

Course Objectives

- Acquire a deep understanding of natural language processing (NLP) techniques.
- Develop expertise in text analysis through practical implementation of advanced techniques.
- Explore the fundamentals of speech processing.

Program 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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Understand the foundations of natural language processing and speech analysis
2. Apply classification algorithms to text documents
3. Build question-answering and dialogue systems
4. Develop speech recognition and speech synthesis systems
5. Develop and construct a robust text classification model by exploring advanced techniques in textand speech analysis

Articulation Matrix

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

NATURAL LANGUAGE PROCESSING BASICS

Introduction to natural language processing-Language syntax and structure-Text pre-processing and wrangling-Text tokenization-Stemming and lemmatization-Stop-word removal-Feature engineering for text representation-Bag-of-Words model-Bag-of-N-Grams model-TF-IDF model.

UNIT II **9 Hours**

TEXT CLASSIFICATION AND SENTIMENT ANALYSIS

Vector semantics and word embeddings-Word2Vec model-GloVe model-FastText model-Deep learning models for text classification-Recurrent Neural -Networks (RNN)-Transformers-Text summarization techniques-Topic modelling.

UNIT III **9 Hours**

QUESTION ANSWERING AND DIALOGUE SYSTEMS

Information retrieval techniques-IR-based question Answering-Knowledge-based question Answering-Language models for question Answering-Classic -question answering Models-Introduction to Chabots and dialogue Systems-Designing Dialogue Systems-Evaluating dialogue systems.

UNIT IV **9 Hours**

SPEECH RECOGNITION AND SYNTHESIS

Introduction to speech Processing-Speech signal analysis and pre-Processing-Acoustic modelling for speech Recognition-Hidden Markov Models (HMM)-Deep learning-based speech Recognition-Automatic Speech Recognition (ASR) Systems-Text normalization and letter-to-sound Conversion-Speech Synthesis Techniques-Concatenative and parametric Approaches-Wave Net and other neural TTS systems.

UNIT V **12 Hours**

TEXT AND SPEECH ANALYSIS MODELLING

Named Entity Recognition (NER)-Coreference resolution-Text coherence and cohesion-Advanced sentiment analysis-Advanced language modelling-Machine translation-Multi-modal analysis (text and speech)-Ethical considerations in text and speech analysis.

FOR FURTHER READING

Named Entity Recognition (NER) and Entity Linking- Sentiment Analysis in Social Media- Deep Learning for Natural Language Processing- Multimodal Analysis- Dialogue Management and Reinforcement Learning- Speech Emotion Recognition Cross-Lingual Text and Speech Analysis.

Total: 45 Hours

Reference(s)

1. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit" by Steven Bird, Ewan Klein, and Edward Loper.
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" by Daniel Jurafsky and James H. Martin.
3. Text Mining: Classification, Clustering, and Applications" by Ashok N. Srivastava and Mehran Sahami.
4. Deep Learning for Natural Language Processing: Creating Neural Networks with Python" by Palash Goyal, Sumit Pandey, and Karan Jain.
5. Speech and Language Processing for Human-Machine Communications" by Joseph Mariani, Gérard Chollet, and Jacques Lévy.
6. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from

Your Data" by Dipanjan Sarkar.
7. Natural Language Processing in Action: Understanding, Analyzing, and Generating Text with Python" by Hobson Lane, Cole Howard, and Hannes Hapke.
8. Speech and Language Processing: A Gentle Introduction" by Gokhan Tur and Renato De Mori.
9. Ethics of Artificial Intelligence and Robotics: A Human-Centered Approach" by Vincent C. Müller.
10. Text to Speech Synthesis" by Paul Taylor.

21CS033 OPTIMIZATION TECHNIQUES 3 0 0 3

Course Objectives

- Formulate and solve linear programming problems (LPP), Integer Programming Problems and Transportation Problems.
- Solve the dynamic programming and its simulation and obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints and solve problems under Markovian queuing models.

Program 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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes

1. Formulate and solve linear programming problems (LPP).
2. Evaluate Integer Programming Problems and Transportation Problems.
3. Solve dynamic programming and its simulation.
4. Obtain a solution to network problems using CPM and PERT techniques.
5. Optimize the function subject to the constraints and solve problems under Markovian queuing models.
6.

Articulation Matrix

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

UNIT I **9 hours**

LINEAR MODELS

Introduction of Operations Research: Development, definition, characteristics and phases, types of operation research models, applications; Linear Programming: mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method

UNIT II **9 hours**

INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS

Integer programming: Integer Programming Formulations- the Cutting-plane Algorithm - Branch and bound method - Zero-One Implicit Enumeration Algorithm – Transportation problem - Types of Transportation Problem - Methods to Solve Transportation Problem - Transshipment Model - Modelling the Transportation Problem with Quantity Discounts.

UNIT III **9 hours**

DYNAMIC PROGRAMMING AND SIMULATION

Dynamic Programming: Introduction, Terminology, Bellman's Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem. Simulation: Introduction, Definition, types of simulation models, steps involved in the simulation process - Advantages and Disadvantages, Application of Simulation to queuing and inventory.

UNIT IV **9 hours**

PROJECT SCHEDULING

Introduction – Phases of project management – Guidelines for network construction - Critical path method (CPM) – Gantt Chart - PERT- Crashing of project network - Project Scheduling with Constrained Resources - Cost considerations in PERT and CPM.

UNIT V **9 hours**

CLASSICAL OPTIMIZATION THEORY

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.

Total: 45 hours

References

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.
2. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
3. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
4. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
5. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
6. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

21CS034 ETHICS AND AI **3 0 0 3**

Course Objectives

- Understand the fundamental concepts of morality and ethics in AI.
- Explore the AI standards and Regulations in the field of AI.
- Determine the problems to solve societal issues using ethics and artificial intelligence.

Program 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.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Understand the morality and ethics in AI
2. Acquire knowledge in application ethics, issues, and its challenges.
3. Design Autonomous and semi-Autonomous System based on AI standards and Regulations.
4. Develop the concepts of Robo ethics and Morality with professional responsibilities.
5. Construct the applications related to societal issues in AI with National and InternationalStrategies on AI.

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			2					2	
5	2	2	1		3			2					1	

UNIT I **9 Hours**

INTRODUCTION

Definition of morality and ethics in AI-Impact on Society-Impact on human Psychology-Impact on the legal System-Impact on the environment and the Planet-Impact on trust.

UNIT II **9 Hours**

ETHICAL INITIATIVES IN AI

International ethical Initiatives-Ethical harms and Concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III **9 Hours**

AI STANDARDS AND REGULATION

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV **9 Hours**

ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology – Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy.

UNIT V **9 Hours**

AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in Industries-National and International Strategies on AI.

FOR FURTHER READING

Information Retrieval - Information Extraction - Data security and privacy.

Total: 45 Hours

Reference(s)

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April.
3. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield," The ethics of artificial intelligence: Issues and initiatives", EPRS | European 189 Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
4. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

21CS035 SOFTWARE QUALITY ASSURANCE 3 0 0 3

Course Objectives

- Understand the standards and components of software quality assurance.
- Understand software quality assurance activities with tools and techniques
- Study the metrics for software quality assurance.

Course Outcomes (COs)

1. Illustrate the components of software quality assurance system and its challenges
2. Identify the SQA components and the quality activities in the project life cycle
3. Analyze the procedures required to ensure software quality
4. Illustrate the project process control and its metrics in software quality assurance
5. Examine the standards and certifications of software quality assurance

Program 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.
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.
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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

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

UNIT I

INTRODUCTION **7 Hours**

Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development andQuality Plans

UNIT II

SQA COMPONENTS IN THE PROJECT LIFE CYCLE **10 Hours**

Integrating Quality Activities in the Project Life Cycle - Reviews - Software Testing – Strategies - Software Testing -Implementation - Assuring the Quality of Software Maintenance - Assuring The Quality of External Participants' Parts - Case Tools and their effect on Software Quality.

UNIT III

SOFTWARE QUALITY INFRASTRUCTURE COMPONENTS **9 Hours**

Procedures and Work Instructions - Supporting Quality Devices - Staff Training Instructing and Certification - Preventive and Corrective Actions - Configuration Management - Documentation and Quality Records Controls.

UNIT IV

SOFTWARE QUALITY MANAGEMENT COMPONENTS **10 Hours**

Project Progress Control - components of project progress control- Progress control of internal projects and external participants- Implementation of project progress control. Software Quality Metrics - Objectives of quality measurement- Process metrics- Product metrics. Software Quality Costs - Objectives of cost of software quality metrics- classic model of cost of software quality.

UNIT V

STANDARDS- CERTIFICATION AND ASSESSMENT **9 Hours**

SQA Standards - ISO 9001 Certification - Software Process Assessment. Organizing for Quality Assurance -Management and its Role in Quality Assurance - The Software Quality Assurance Unit -SQA Trustees and Committees

Total: 45 Hours

Reference(s)

1 Daniel Galin – “Software Quality Assurance: From Theory to Implementation” - Pearson Addison-Wesley, 2012.
2 Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
3 Y.Langsam, M.J.Augenstein and A.M.Tenenbaum, Data Structures using C, PHI, 2007.
4 Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education,Asia, 2010.
5 Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2009.

21CS036 XML AND WEB SERVICES **3 0 0 3**

Course Objectives

- Construct the web page using XML and service-oriented architecture
- Implement the real time applications using XML technologies
- Analyze the design principles and applications of SOAP based Web Services
- Use the key technologies in web services.
- Evaluate the security issues in XML.

Program 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 modelling 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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Construct the web page using XML and service oriented architecture.
2. Apply DTD and Schema for structuring XML page and use presentation techniques and transformation in web page creation.
3. Analyze the design principles and applications of SOAP based Web Services.
4. Analyze the paradigms needed for designing the standards of web services.
5. Apply XML security standards in web pages.

Articulation Matrix

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

UNIT I INTRODUCTION **8 Hours**

Role of XML - XML and the Web - XML Language Basics - SOAP - Web Services – Revolutions of XML - Service Oriented Architecture (SOA)

UNIT II

XML TECHNOLOGY **8 Hours**

XML - Name Spaces - Structuring with Schemas and DTD - Presentation Techniques - Transformation.

UNIT III

SOAP SERVICES **9 Hours**

Overview of SOAP - HTTP - XML - RPC - SOAP: Protocol - Message Structure - Intermediaries -Actors - Design Patterns and Faults - SOAP with Attachments.

UNIT IV

WEB SERVICES **11 Hours**

Overview - Architecture - Key Technologies - UDDI - WSDL - ebXML - SOAP and Web Services in ECom - Overview of .NET and J2EE.

UNIT V

XML SECURITY **8 Hours**

Security Overview - Canonicalization - XML Security Framework - XML Encryption - XML Digital Signature - XKMS Structure - Guidelines for Signing XML Documents - XML in Practice.

Total: 45 Hours

Reference(s)

1. Frank. P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2007.
2. David Hunter, Jeff Rafter, Joe Fawcett, Eric Van der Vlist, Danny Ayers, Jon Duckett,Andrew Watt, Linda McKinnon, Begining XML , Fourth Edition, Wrox publication.
3. Deitel H M, Deitel P J, Nirto T R, Lin T M, XML How to Program, Pearson Edition, 2011.

21CS037 INFORMATION STORAGE MANAGEMENT 3 0 0 3

Course Objectives

- Understand the challenges in information storage and management.
- Describe the core elements in a data center.
- Understand RAID and its various levels for data backup.

Program 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Illustrate physical and logical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems
2. Describe storage networking technologies such as FC-SAN, IP-SAN, FCoE, NAS and object-based and unified storage
3. Illustrate and articulate business continuity solutions, backup and replications, along with archive for managing fixed content
4. Identify key characteristics, services, deployment models, and infrastructure components for acloud computing
5. Implement the concept of security storage infrastructure management

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

UNIT I

STORAGE SYSTEM **9Hours**

Introduction to information storage, Virtualization and cloud computing, Key data center elements,

Compute, application, and storage virtualization, Disk dive & flash drive components and performance, RAID, Intelligent storage system and storage provisioning (including virtualprovisioning).

UNIT II

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION **9 Hours**

Fibre Channel SAN components, FC protocol and operations, Block level storage virtualization, iSCL and FCIP as an IP-SAN solutions, Converged networking option FcoE, Network Attached Storage (NAS) components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.

UNIT III

BACKUP, ARCHIVE AND REPLICATION **9 Hours**

Business continuity terminologies, planning and solutions, Clustering and multipathing to avoid single points of failure, Backup and recovery methods, targets and topologies, data deduplication and backup in virtualized environment, fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection.

UNIT IV

CLOUD COMPUTING CHARACTERISTICS AND BENEFITS **9 Hours**

Cloud Enabling Technologies - Characteristics of Cloud Computing- Benefits of Cloud Computing-Cloud Service Models Cloud deployment models- Cloud Computing Infrastructure-Cloud Challenges, Cloud migration considerations.

UNIT V

SECURING AND MANAGING STORAGE INFRASTRUCTURE **9 Hours**

Security threats, and countermeasures in various domains, Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle Management (ILM) and storage tiering.

FOR FURTHER READING

EMC Infrastructure Management Tools-Parallel SCSI-SAN Design Exercises-Network Technologies for Remote Replication-Information Availability.

Total: 45 Hours

Reference(s)

1 Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments, 2nd Edition, EMC Educations Services, Wiley, May 2012.

2 Information Storage and Management: Storing, Managing, and Protecting Digital Information, EMC Education Services, Wiley, January 2010.

3 Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009.

21CS038 MOBILE APPLICATION DEVELOPMENT 3 0 0 3

Course Objectives

- Understand the basics of mobile application development.
- Work with mobile app development platforms.

Program 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.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Understand the basics of mobile application development.
2. Design the architecture of android application development.
3. Develop software using android.
4. Develop applications using components of android framework.
5. Develop android applications including files and databases.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Introduction to Android, Android versions and its feature set The various Android devices on the market , The Android Market application store, Android Development Environment - System Requirements,

Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs).

UNIT II **9 Hours**

ANDROID ARCHITECTURE OVERVIEW AND CREATING AN EXAMPLE ANDROID APPLICATION

The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Creating a New Android Project ,Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application, Reviewing the Layout and Resource Files.

UNIT III **9 Hours**

ANDROID SOFTWARE DEVELOPMENT PLATFORM

Understanding Java SE and the Dalvik Virtual Machine , The Directory Structure of an Android Project , Common Default Resources Folders , The Values Folder , Leveraging Android XML, Screen Sizes , Launching Your Application: The AndroidManifest.xml File ,Creating Your First Android Application.

UNIT IV **9 Hours**

ANDROID FRAMEWORK OVERVIEW

Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components, Views and View Groups, Android Layout Managers,The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool.

UNIT V **9 Hours**

FILES, CONTENT PROVIDERS, AND DATABASES

Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers.

FOR FURTHER READING

Mobile networking applications-network emulators.

Total: 45 Hours

Reference(s)

1 Code Complete: A Practical Handbook of Software Construction, 2nd Edition by Steve McConnell.
2 Mobile Apps Made Simple: The Ultimate Guide to Quickly Creating, Designing and Utilizing Mobile Apps for Your Business, 2nd Edition by Jonathan McCallister.
3 Android Application Development Cookbook- Second Edition by Rick Boyer and Kyle Mew.

21CS039 INTERNET OF THINGS **3 0 0 3**

Course Objectives

- Understand the components and protocols used in IOT.
- To Understand the IoT Reference Architecture and Real World Design Constraints
- Ability to understand the Security requirements in IoT.

Program 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 modelling 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Identify physical design, communication and Technologies used in IOT.
2. Illustrate the IoT reference models and IoT protocols.
3. Examine the components, interfacing devices and communication models of IoT
4. Analyze the cloud storage models and web service and data analytics for IoT
5. Analyse the security requirements and threats in IOT.

Articulation Matrix

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

UNIT I

INTRODUCTION TO INTERNET OF THINGS **8 Hours**

IOT Fundamentals - Characteristics of IoT - Physical Design of IoT - IoT Protocols - IoT communication models - IOT Communication APIs -IOT enabled Technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, and Communication protocols, EmbeddedSystems, IOT Levels and Templates.

UNIT II

IOT REFERENCE ARCHITECTURE **10 Hours**

Introduction- State of the art - Architecture Reference Model- IOT reference Model-IOT Protocols: Zigbee, RFID, BLE, NFC, BACnet, 6LowPAN, RPL, XMPP, CoAP, and MQTT.

UNIT III

IOT DEVICES AND INTERFACING **9 Hours**

IOT components - Sensors - Actuators - Hardware Platforms - Interfacing with devices: Settingup the board -Programming for IOT - Reading from Sensors, Communication: Connecting microcontroller with mobile devices - communication through Bluetooth, wifi, Ethernet.

UNIT IV

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS **9 Hours**

Introduction to Cloud Storage models - Cloud services and IOT - communication APIs -Cloud forIOT - Web server: Web server for IOT - Amazon Web services for IOT- Data analytics for IOT.

UNIT V

IOT SECURITY **9 Hours**

Security Requirements in IOT - Security Concerns in IOT Applications - Security Architecturein the Internet of Things - Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IOT. Vulnerabilities - Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption.

Total: 45 Hours

Reference(s)

1 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

2 Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1stEdition, VPT, 2014.

3 Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things Key applications and Protocols, Wiley, 2012

4 Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers tothe Cloud (Make: Projects) [Kindle Edition] by CunoPfister,2011 Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren.

21CS040 BUSINESS ANALYTICS **3 0 0 3**

Course Objectives

- Understand data analytics.
- Understand and apply open source modelling.
- Analyzing and develop techniques to solve data analytics problems.

Program 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 modelling 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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Illustrate the fundamental Concepts of Data Science and its related theories
2. Implement R programming for Bayes model for real-time applications
3. Implement R program for discriminate and factor analysis for problem solving
4. Apply clustering and classification techniques in real-time scenario
5. Analyse the techniques involved in growth of Big Data and its future inventions.

Articulation Matrix

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

UNIT I

THE ART OF DATA SCIENCE **8 Hours**

Volume, Velocity, Variety - Machine Learning -Supervised and Unsupervised Learning -Predictions and Forecasts -Innovation and Experimentation - The Dark Side - Big Errors -Privacy -

Theories, Models, Intuition, Causality, Prediction, Correlation -Normal Distribution - Poisson Distribution-Statistical Regression.

UNIT II

OPEN SOURCE MODELLING **10 Hours**

Introducing to R - R Data Structures - Help functions in R - Vectors - Scalars - Declarations - recycling - Common Vector operations - Learning from Experience: Bayes Theorem - Introduction - Bayes and Joint Probability Distributions- Bayes Nets - Bayes Rule in Marketing - Bayes Models in Credit Rating Transitions Accounting Fraud.

UNIT III

DISCRIMINANT AND FACTOR ANALYSIS **9 Hours**

Discriminant Analysis - Notation and assumptions -Discriminant Function - Implementationusing R - Confusion Matrix -Multiple groups - Eigen Systems - Factor Analysis.

UNIT IV

CLUSTER ANALYSIS AND PREDICTION TREES **9 Hours**

Introduction -Clustering using k-means -Example: Randomly generated data in kmeans- Hierarchical Clustering - Prediction Trees- Classification Trees - The C4.5 Classifier - Regression Trees.

UNIT V

BIG DATA ANALYTICS: INTRODUCTION **9 Hours**

Big Data Ecosystem-Future trends in Big Data Analytics: Growth of social medium, Creation of Data Lakes, Visualization tools at the hands of business users , Prescriptive Analytics, IoT, Artificial Intelligence, Whole data processing, Vertical and Horizontal Applications, Real-time Analytics, Putting the Analytics in the hands of business users, Migration of solutions from one toolto another, Cloud cloud Everywhere the cloud, In-Database Analytics, In-memory Analytics, Autonomous services for machine Learning, Addressing Security & compliance, Healthcare.

Total: 45 Hours

Reference(s)

1. Data science for Business ,Foster Provost & Tom Fowcett ,O Reilly,2013.
2. Mark Gardener, " Beginning R- The Statistical Programming Language", Wiley, 2013.
3. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
4. Umesha Nayak, Umesh R Hodeghatta, Business Analytics using R, A Press.

21OCS01 OBJECT ORIENTED PROGRAMMING 3 0 0 3

Course Objectives

- Understand the concepts of Object Oriented Programming
- Study the concepts of objects and classes.
- Familiarize in the types of constructors.

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.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

m Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Identify the characteristics and data types of C++ language.
2. Develop programs using objects and classes for real world applications
3. Construct programs to implement operator overloading and inheritance techniques
4. Apply Polymorphism and File streams concepts to develop C++ program
5. Design applications using templates and apply exception handling mechanisms

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Need for object oriented programming - Procedural Languages vs. Object oriented approach - Characteristics Object oriented programming - C++ Programming Basics: Basic Program Construction - Output Using cout - Input with cin - Data types- Variables and Constants - Operators - Control Statements-Manipulators - Type conversion. Function Prototyping- call by reference, return by reference-

Inline function- Default arguments - Function overloading.(sona)

UNIT II **8 Hours**

OBJECTS AND CLASSES

Objects and Classes Simple Class - C++ Objects as Physical Objects - C++ Object as Data types- CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors - Destructors(PSG) - Structures and Classes - Arrays and Strings

UNIT III **10 Hours**

OPERATOR OVERLOADING AND INHERITANCE

Operator Overloading and Inheritance Need of operator overloading- Overloading Unary Operators- Overloading binary Operators - Overloading Special Operators - Data Conversion Inheritance: Derived Class and Base Class - Derived Class Constructors-Overriding Member Functions-Class Hierarchies- Public and Private Inheritance-Levels of Inheritance-Multiple Inheritance.

UNIT IV **10 Hours**

POLYMORPHISM AND FILE STREAMS

Polymorphism and File Streams Virtual Function - Friend Function - Static Function-Assignment and Copy Initialization- Memory Management: new and delete Pointers to Objects, this Pointer- Streams - String I/O - Character I/O - Object I/O - I/O with Multiple Objects - File Pointers - Disk I/O with Member Functions- Error Handling in File I/O.

UNIT V **10 Hours**

TEMPLATES AND EXCEPTION HANDLING

Templates: Introduction - Function Templates - Overloading Function Templates-, user defined template arguments(sona) - Class Templates - Exception Handling - Syntax, multiple exceptions, exceptions with arguments.

Total: 45 Hours

Reference(s)

1 Deitel & Deitel, C++ How to program, Prentice Hall,2005
2 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication.
3 D.S.Malik, C++ Programming, Thomson, 2007.
4 K.R. Venugopal, Rajkumar and T.Ravishankar, Mastering C++, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2006.
5 E.Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing,New.

21OCS02 JAVA FUNDAMENTALS 3 0 0 3

Course Objectives

- Implement applications based on core Java Concepts with examples
- Construct application using inheritance, packages and exception handling for real time problems.
- Integrate the Java I/O concepts to handle input and output operations.
- Develop programs to perform string manipulation in java.
- Design GUI with Java for event handling and database applications.

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.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

m Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Demonstrate applications based on core Java Concepts with examples
2. Construct application using inheritance, packages and exception handling for real time problem
3. Explain the Java I/O concepts to handle input and output operations.
4. Develop programs to perform string manipulation in Java.
5. Design GUI with Java for event handling and database applications.

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

UNIT I **9 Hours**

BASICS OF JAVA

The Genesis of Java - Overview of Java - Data Types, Variables, and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes.

UNIT II **9 Hours**

INHERITANCE, PACKAGES AND EXCEPTIONS

Inheritance: Basics - Using Super - Creating a Multilevel Hierarchy - Method overriding - Using Abstract Classes - Packages and Interfaces: Packages - Access Protection - Importing Packages- Interfaces Definitions and Implementations - Exception Handling: Types - Try and Catch - Throw.

UNIT III **9 Hours**

EXPLORING JAVA I/O

I/O Basics - Reading Console Input -Writing Console output - Native Methods - I/ O Classes and Interfaces - File - The Byte Streams - The Character Streams - Using Stream I/ O - Serialization.

UNIT IV **9 Hours**

JAVA STRINGS

String Handling: Special String operations and Methods - String Buffer - Exploring java.lang: Simple type Wrappers - System - Math - Collections Framework: Collections Interfaces and Classes – Utility Classes: String Tokenizer - Date and Time.

UNIT V **9 Hours**

GUI WITH JAVA

Applet Basics - Applet Architecture - Applet Display Methods - Parameter Passing - Event Handling Mechanisms - Event Classes - Event Listener - Working with Windows, Graphics, Colors and Fonts - AWT Controls - Layout Managers and Menus – JDBC

FOR FURTHERREADING

Developing GUI applications using Swing controls - Container concepts - DAO and JDBC

Total: 45 Hours

Reference(s)

1. Herbert Schildt, Java 2-Complete Reference, Tata Mc Graw Hill, 2015.
2. Deitel & Deitel, Java How to Program, Prentice Hall of India, 2010.
3. Gary Cornell and Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems Press, 2008.

21OCS03 KNOWLEDGE DISCOVERY IN DATABASES 3 0 0 3

Course Objectives

- Introduce the basic concepts of data warehousing.
- Impart knowledge about the data mining functionalities.
- Assess the strengths and weaknesses of association mining and cluster analysis.

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.
m Apply suitable algorithmic thinking and data management practices to design develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Explain the concepts of Data Warehousing architecture and business analysis process.
2. Illustrate the process of Data Mining and preprocessing techniques for data cleansing.
3. Apply the association rules for mining the various kinds of data
4. Analyze Classification and Clustering algorithms for various problems with high dimensional data.
5. Illustrate the various data mining techniques on complex data objects.

Articulation Matrix

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

UNIT I **10 Hours**

DATA WAREHOUSING AND BUSINESS ANALYSIS

Data warehousing Components -Building a Data warehouse -Data Warehouse and DBMS- Metadata-Multidimensional data model - Data Extraction, Cleanup and Transformation Tools -Reporting, Query tools and Applications - OLAP vs OLTP - OLAP operations - Data Warehouse Schemas: Stars, Snowflakes and Fact constellations.

UNIT II **8 Hours**

INTRODUCTION TO DATA MINING

Introduction - Steps in knowledge discovery from databases process - Architecture of a Typical Data Mining Systems - Data Mining Functionalities - Classification of Data Mining Systems - Data mining on different kinds of data - Different kinds of pattern - Task Primitives - Integration of a Data Mining System with a Data Warehouse - Major issues in Data mining.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis- Frequent Item Set Mining methods: Apriori algorithm - Generating Association Rules - A Pattern Growth Approach- Pattern mining in multilevel and multidimensional space - Mining Various Kinds Of Association Rules - Association Analysis to Correlation Analysis - Constraint Based Association Mining.

UNIT IV **10 Hours**

CLASSIFICATION AND CLUSTERING

Decision Tree Induction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines - Clustering: Types of data - Partitioning methods: k-means, k-medoid - Hierarchical Methods: distance based agglomerative and divisible clustering, BIRCH – Density Based Method: DBSCAN - Grid Based Method: STING.

UNIT V **10 Hours**

DATA MINING APPLICATIONS

Mining complex data objects - Text Mining - Graph mining - Web mining - Spatial Data mining - Application and trends in data mining - Social impacts of Data mining.

Total: 45 Hours

Reference(s)

1 Jiawei Han, Micheline Kamber and Jian Pai , Data Mining: Concepts and Techniques, Morgan Kauffman, 3rd Edition, 2013.
2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Tata Mcgraw-Hill, 1997.
3 David Hand, Heikki Manila, Padhraic Symth, Principles of Data Mining, MIT Press, 2001.
4 Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2003.

21OCS03 E-LEARNING TECHNIQUES **3 0 0 3**

Course Objectives

- Understand the technologies involved in e-learning.
- Gain the fundamentals of e-learning techniques
- Determine the characteristics of Teaching-Learning Process

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.

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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Acquire knowledge about the basic concepts of e-learning.
2. Explain the technology mediated communication in e-learning
3. Exemplify of e-learning and content the process management.
4. Analyze the teaching and learning processes in e-learning environment.
5. Assess the various applications of e-learning.

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

UNIT I **9 Hours**

INTRODUCTION

Evolution of Education - Generations of Distance Educational Technology - Role of E-Learning - Components of e-learning: CBT, WBT, Virtual Classroom - Barriers to e-Learning Roles and Responsibilities: Subject Matter Expert - Instructional Designer - Graphic Designer - Multimedia Author - Programmer - System Administrator - Web Master

UNIT II **9 Hours**

TECHNOLOGIES

Satellite Broadcasting - Interactive Television - Call Centers - Whiteboard Environment -

Teleconferencing: Audio Conferencing - Video Conferencing -Computer Conferencing. Internet: E-mail, Instant Messaging, Chat, Discussion Forums, Bulletin Boards, Voice Mail, File Sharing, Streaming Audio and Video.

UNIT III **9 Hours**

MANAGEMENT

Content: E-Content, Dynamic Content, Trends - Technology: Authoring, Delivery, Collaboration - Services: Expert Service, Information Search Service, Knowledge Creation Service - Learning Objects and E-Learning Standards. Process of E-Learning: Knowledge acquisition and creation, Sharing of knowledge, Utilization of knowledge - Knowledge Management in E-Learning.

UNIT IV **9 Hours**

TEACHING-LEARNING PROCESS

Interactions: Teacher-Student - Student-Student - Student-Content - Teacher- Content - Teacher-Teacher - Content-Content Role of Teachers in E-Learning - Blended Learning -Cooperative Learning - Collaborative Learning - Multi Channel learning -Virtual University - Virtual Library.

UNIT V **9 Hours**

APPLICATIONS

Customer service training - Sales training - Customer training - Safety training - IT training – Product training - Healthcare training.

FOR FURTHERREADING

Course delivery and evaluation: Components of an instructor led or facilitated course – Facilitating learners - activities - Using communication tools for e-learning – Course evaluation - Learning platforms - Proprietary vs. open-source LMS - Moodle and other open-source LMS solutions - Solutions for limited or no connectivity.

Total: 45 Hours

Reference(s)

1. E-Learning: An Expression of the Knowledge Economy, Gaurav Chadha, S.M. Nafay Kumail, Tata McGraw-Hill Publication, 2002.
2. E-Learning: New Trends and Innovations, P.P. Singh, Sandhir Sharma, Deep & Deep Publications, 2005.
3. E-Learning: Concepts, Trends and Applications, Epignosis LLC, LLC publications, 2014.
4. Michael Allen's Guide to E-Learning, Michael W. Allen, Michael Allen, Wiley Publication, 2002.

18CS0XA 3D ANIMATIONS 1 0 0 1

Course Objectives

- Demonstrate the basic and fundamental concepts in 3D animation.
- Understand the texture operations in 3D objects.
- Learn the basics of Modeling with 3D animation.

Course Outcomes (COs)

1. Explain the basic concepts of 3D animation.
2. Explore the visual effects, lights and rendering of 3D objects.
3. Illustrate modelling with 3D.

UNIT I **20 Hours**

3D ANIMATION

3D Animation Overview - 3D Animation Preproduction - Postproduction - Understanding digital imaging - digital video - Exploring animation, story and pre -visualization - Understanding modeling and Texturing - Rigging and Animation - Understanding visual effects, lights and rendering - Modeling with 3D- Lights - camera and materials - 3D Motion Graphics - FX Rendering and V-Ray - Digital FX - 3D Animation - Architectural Visualization Portfolio - Stop Motion Pro - 3Ds Max 2010 - Adobe After Effects CS4 Professional - texture operations in 3D - Pre-production.

Total: 20 Hours

Reference(s)

1 Andy Beane, 3D Animation Essentials, John Wiley & Sons, 2012.

18CS0XB QUANTUM COMPUTING 1 0 0 1

Course Objectives

- Understand the building blocks of a quantum computer.
- Understand the principles, quantum information and limitation of quantum operations formalizing.
- Gain knowledge about the quantum error and its correction.

Course Outcomes (COs)

1. Explain the basic concepts of quantum computing.
2. Explore the quantum computing algorithms an operations.
3. Describe the various types of quantum computers.

UNIT I **20 Hours**

QUANTUM COMPUTING

Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. Quantum Computation: Quantum Circuits - Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms - Quantum counting- Speeding up the solution of NP complete problems - Quantum Search for an unstructured database.

Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

Total: 20 Hours

Reference(s)

1 Micheal A. Nielsen. & Issac L. Chuang - Quantum Computation and Quantum Information, Cambridge University Press,2011.

18CS0XC AGILE PROGRAMMING 1 0 0 1

Course Objectives

- Understand the internal of the agile programming.
- Understand the implementation of agile project development.

Course Outcomes (COs)

1. Explore the basic concepts of agile programming.
2. Illustrate the methodology used in extreme programming.
3. Describe the unified process.

UNIT I **20 Hours**

ITERATIVE AND EVOLUTIONARY

Iterative and Evolutionary: Definition - comparison - major activities. Agile: Basic concepts – Major activities - available agile methods. Motivation: Change on software projects - key motivation-requirement challenge -problems of water fall. Evidence: Research and early historical standard and though leader-business case -water fall validity. Serum: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common mistakes and misunderstandings, Process Mixtures, Adaption Strategies, Fact versus Fantasy, Strength Versus Other, Sample Projects Extreme Programming: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common Mistakes and Misunderstandings, Sample Projects Unified Process: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common mistakes and misunderstandings, , Process Mixtures, Adaption Strategies, Fact versus Fantasy, Strength Versus Other, Sample Projects. Practice Tips: Project - management - environment - requirements - tests - Frequently raised questions and answers.

Total: 20 Hours

Reference(s)

1 Craig Lannan, "Agile and Iterative Development A Manger's Guide" Pearson Education, FirstEdition, India, 2004.

2 I.Shore, "Art of Agile Development", Shroff Publishers & Distributors, 2007

18CS0XD MOBILE OPERATING SYSTEMS 1 0 0 1

Course Objectives

- Acquire knowledge about mobile operating systems.
- Understand the architectures of emerging mobile OS.
- Develop applications using mobile OS.

Course Outcomes (COs)

1. Explore the architecture and features of Android OS.
2. Illustrate the features of MeeGO OS.
3. Explicate the features of Symbian OS.

UNIT I **20 Hours**

INTRODUCTION TO ANDROID:

Android - Features - Architecture - Applications - Application framework - Libraries – Application fundamentals - Application components - The Manifest file - Application resources. MeeGo: Introduction to the MeeGo project - MeeGo architecture - MeeGo notebook UX – benefits of the MeeGo software platform - MeeGo applications. Symbian: Introduction to symbian OS - versions of symbian - user interfaces - Features – Architecture - Application development.

Total: 20 Hours

Reference(s)

1. http://developer.android.com/guide/topics/fundamentals.html
2. http://wiki.meego.com/images/MeeGo_Introduction.pdf
3. http://www.symbioosi.net/English/symbian_os_en.html
4. http://en.wikipedia.org/wiki/Symbian

18CS0XE INTERNET MARKETING 1 0 0 1

Course Objectives

- Understand the E- Marketing context.
- Gain knowledge about the marketing strategies of segmenting, targeting, positioning, and differentiation.
- Evaluate several customer relationship management (CRM) strategies using internet technology.

Course Outcomes (COs)

1. Explain the theories involved in e-marketing.
2. Implement a e-commerce website for a company.

UNIT I **20 Hours**

INTERNET MARKETING

Theories of E-Marketing - Introduction to E-Marketing - E-Marketing Plan - Strategic E-Marketing and Performance Metrics - The E-Marketing Plan - Internet Marketing Overview - Website Planning & Development - Let Companies Search you on Google for Jobs - Internet Marketing Strategy and Planning - Search Engine Optimization - Social Media Marketing - Make E-Commerce website in 20 Minutes - Introduction- ATM - Selling Products Through Online Modes - Making Money via Adsense and Blogging - Explore your Talent to earn money through Internet - Affiliate Marketing- Making Tons of Money Part Time - Making Money as a FreeLancer.

Total: 20 Hours

Reference(s)

1 Mary lou Roberts, Debra Zahay Internet Marketing: Integrating Online and Offline Strategies, TataMcGrawHill,2012.

18CS0XF SCRIPTING LANGUAGES 1 0 0 1

Course Objectives

- Gain knowledge about the scripting languages such as PERL, TCL/TK, Python and BASH.
- Create and run scripts using Perl / TCL / Python.
- Creation of programs in the Linux environment.

Course Outcomes (COs)

1. Illustrate the basic concepts of Linux Administration.
2. Implement programs using PERL scripts.
3. Explore the concepts of TCL.

UNIT I **20 Hours**

SCRIPTING LANGUAGES

Introduction to Linux- File System of the Linux-General usage of Linux kernel & basic commands- Linux users and group- Permissions for file- directory and users- Searching a file & directory- zipping and unzipping concepts Introduction to Perl Scripting, working with Simple Values- Lists and Hashes- Loops and Decisions- Regular Expressions, Files and Data in Perl Scripting- Tcl Fundamentals- String and Pattern Matching- Tcl Data Structures- Control Flow Commands- Tk Fundamentals- TK by Examples- Introduction to Python- Using the Python Interpreter.

Total: 20 Hours

Reference(s)

1 David Barron, The World of Scripting Languages, 1st Edition, Wiley publications, 2000

18CS0XG RASPBERRY PI 1 0 0 1

Course Objectives

- Demonstrate the basic and fundamental concepts in Raspberry PI tool.
- Gain knowledge about Linux system administration commands.
- Understand the implementation of understanding game programming.

Course Outcomes (COs)

1. Explain the basic concepts of Raspberry PI tool.
2. Explore the Linux Shell Programming model.
3. Describe the Game Programming.

UNIT I **20 Hours**

INTRODUCTION TO RASPBERRY PI

Introduction to Raspberry Pi - Hardware aspects - Board details - Overview of available hardware resources - Operating systems available - Pre-requisites of using raspberry pi - Installation of OS on Raspberry Pi - Download Image and Prepare SD Card - Install Raspberry Pi operating system- Linux Commands - Basic Operations of Linux and commands understanding - Raspberry Pi Configuration - Installing and uninstalling software - Boot and Display Options. Programming the Pi - Introduction to Compilers - GCC, and C programming - Python Programming for Pi - Shell Programming - Accessing resources of Raspberry pi using shell - GPIO programming over shell. Hardware Interfacing - GPIO interfacing through Python - LED, Buzzer, Switch interfacing - Sensors Interfacing. Understanding Game Programming - Learning About Game Frameworks and Libraries - Setting Up the PyGame Library - Using PyGame - Learning More About PyGame - Dealing with PyGame Action.

Total: 20 Hours

Reference(s)

1 Matt Richardson and Shawn Wallace, "Getting started with Raspberry pi", O'Reilly, 2013.
2 Simon Monk, "Programming the raspberry pi", Second Edition: Getting Started with Python, Tata McGraw Hill Publishing Co. Ltd., 2015.
3 Simon Monk, "Raspberry pi Cookbook", O'Reilly, 2014.

18CS0XH AUTOMATION TESTING USING QTP 1 0 0 1

Course Objectives

- To describe the basic concepts of QTP automation testing
- To analyze the syntax and styles
- To create test path runner, win runner scripts and QTP object model.

Course Outcomes (COs)

1. Illustrate the basic concepts of QTP automation testing.
2. Solve the testing oriented problems using QTP.

UNIT I **20 Hours**

Introduction to Automation - Architecture – Introduction to Framework and QTP - Versions - Object Repository - Object Spy - Object Identification - QTP Testing Process Phases - Working with Dynamic Objects and Data - Types of Parameters - Working with Actions - Environment Parameters and Variables - Random Number Parameters - Library Files and User- Functions - Regular Expressions - Virtual Object Configuration - Recovery Scenario Manager - Transaction Statements - Step Generator - Merge Repositories Utility - Test Bath Runner - Calling Win Runner Scripts from QTP - Quick Test Automation Object Model .

Total: 20 Hours

Reference(s)

1 Rajeev Gupta," Specifications of Test Automation and QTP, Pearson Publications, 2012.
2 Chandra Saurabh, “QC 10, QTP 10 and Automation Framework”, 2011.

18CS0XI CODE AUGMENTED REALITY 1 0 0 1

Course Objectives

- To understand the basic of Augmented Reality
- To learn the advanced Augmented Reality techniques
- To acquire the knowledge in Augmented Reality and applications

Course Outcomes (COs)

1. Identify the fundamental concepts of Augmented Reality application development
2. Illustrate the attractive user interface in Visualization and Design
3. Explicate the real-world application development

UNIT I **20 Hours**

Introduction to Virtual Reality - Output Devices - Input Devices - Virtual Realty APIs - 3D Interaction Techniques - Augmented Reality - Modeling and simulation - Experimental design and user studies - Effects of system fidelity - Real-world Applications of Virtual Reality and Augmented Reality in Visualization and Design - Mobile Augmented Reality.

Total: 20 Hours

Reference(s)

1 Greg Kipper, Joseph Rampolla, Augmented Reality: An Emerging Technologies Guide to AR, 2013.

18CS0XJ ANGULAR JAVA 1 0 0 1

Course Objectives

- To understand the design of single-page applications and AngularJS facilitates
- To acquiring knowledge in AngularJS expressions, filters, and scopes
- To build Angular forms and applications

Program Outcomes (POs)

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 (COs)

1. Identify the fundamental concepts of AngularJS
2. Illustrate the structure of AngularJS applications
3. Explicate the real-world application development in AngularJS

UNIT I **20 Hours**

JavaScript fundamentals: Scope & Function Context - Closures - Object-Oriented in JavaScript - Async and Parallel in JavaScript - JavaScript Design Pattern - Introduction to AngularJS - first AngularJS application - Single Page Applications – AngularJS Building Blocks for Building SPA - Model, View & Controller (MVC). Forms in AngularJS: ng-model directive - ng Model Controller and Form Controller - Custom Validation - Input directive. AngularJS Filters: Filter Syntax - AngularJS Filters - Custom filters - Communications - AngularJS Internal: AngularJS Start-up Process - AngularJS Runtime - Scope Communication - Template Services: Injector Service - Modules – Caching - $provide service – Routing - Ajax, Data, and Angular – AngularJS Testing - AngularJS Animation.

Total: 20 Hours

Reference(s)

1 AngularJS in Action, Brian Ford, Lukas Ruebbelke, 2014.

18CS0XK TENSORFLOW 1 0 0 1

Course Objectives

- Understand working in TensorFlow framework for implementing Machine Learning algorithms

Course Outcomes (COs)

1. Implement programs in Python and execute them in TensorFlow
2. Debug TensorFlow programs
3. Deploy the programs in GPU

UNIT I **20 Hours**

Tensor flow

Estimators- Pre-made estimators, Custom Estimators

Tensors- Rank, Shape, Data types, Evaluating tensors, Printing Tensors

Variables- Creating a variable, variable collections, Device placement, Initializing variables, using variables, Sharing variables.

Graphs and Sessions- Building a tf.graph, Naming operations, Tensor-like objects, tf.session, Visualizing a graph, Programming with Multiple graphs

Saving and Restoring- Saving variables, Restoring Variables, Building a SavedModel, Loading a SavedModel in Python, Standard constants, Using SavedModel with Estimators, CLI to inspect and execute SavedModel

Importing Data-Basic mechanics, Dataset structure, Creating an iterator, Consuming values from an iterator, Consuming NumPy arrays, Consuming TFRecord data, Consuming text data, Pre-processing data with Dataset.map(),Batching dataset elements, Training workflows.

Threading and Queues- Queue Usage Overview, Manual Thread Management-Coordinator, QueueRunner, Handling exceptions

Hours Embeddings-Introduction, Training an Embedding,V isualizing Embeddings-Setup, Metadata, Images, Interaction, Projections, Navigation, Collaborative Features

Debugging Tensorflow Programs-Wrapping TensorFlow Sessions with tfdbg, Debugging Model Training with tfdbg, Debugging tf-learn Estimators and Experiments.

Total: 20 Hours

Reference(s)

1 Sam Abrahams, Danijar Hafner, Erik Erwitt, Ariel Scarpinelli “TensorFlow For Machine Intelligence: A hands-on introduction to learning algorithms”, 2016.

18CS0XL STATISTICAL ANALYSIS USING R 1 0 0 1

Course Objectives

- Demonstrate the basic the basics of R programming.
- Understand the data analysis and statistical models in R.
- Impart knowledge about using graphics in R.

Course Outcomes (COs)

1. Explain the basic concepts of R.
2. Illustrate exploratory data analysis with R.
3. Demonstrate the use of advanced concepts in R.

UNIT I **20 Hours**

R PROGRAMMING BASICS

Introduction to R - R Installation - Basic syntax- R as a calculator -R Libraries- Importing Data– loading packages - Data entry and exporting data - Creating and Manipulating objects in R - Vectors - Matrices - Data Frames – Lists - Basic plotting - 3D plotting- Histograms- Multi-panel plotting- Boxplots - Univariate Analysis - Multivariate Analysis - Linear & Nonlinear Models - Logistic Regression and Survival Analysis in R - Summary statistics - Validating & Exploring Data - Manipulating Data – Summarizing - Sorting – Subsetting – Merging - -Writing R functions - Introduction to Clustering and Classification

Total: 20 Hours

Reference(s)

1 Balas Kausik Natarajan, “Machine Learning: A Theoretical Approach”, Morgan Kaufmann, 2012.

18CS0XM MACHINE LEARNING FOR ENGINEERS 1 0 0 1

Course Objectives

- Demonstrate the basic and fundamental concepts of Machine Learning.
- Understand a wide variety of learning algorithms.
- Learn the basics of clustering with machine learning.

Course Outcomes (COs)

1. Explain the basic idea of the machine learning.
2. Explore the support vector machines in machine learning.
3. Design machine learning techniques to resolve the issue involved in learning from data.

UNIT I **15 Hours**

MACHINE LEARNING

Algorithmic models of learning - Learning classifiers – functions – relations – grammars - probabilistic models - value functions -Parameter estimation - sufficient statistics - decision trees - neural networks - support vector machines - Bayesian networks - bag of words classifiers - Markov and Hidden Markov models - association rules - nearest neighbor classifiers - ensemble classifiers - Computational learning theory - feature selection and visualization – Clustering - Reinforcement learning - Learning from heterogeneous – distributed - data and knowledge - Selected applications in data mining - automated knowledge acquisition - pattern recognition - program synthesis - text and language processing - internet-based information systems - human-computer interaction - semantic web and bioinformatics

Total: 15Hours

Reference(s)

1. Balas Kausik Natarajan, “Machine Learning: A Theoretical Approach”, Morgan Kaufmann, 2012.

18CS0XN BLOCK CHAIN TECHNOLOGIES 1 0 0 1

Course Objectives

- Understand how block chain systems (mainly Bit coin and Ethereum) work, to securely interact with them.
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

Programme Outcomes (POs)

1. Explain design principles of Bit coin and Ethereum.
2. Explain the Simplified Payment Verification protocol.
3. Interact with a block chain system by sending and reading transactions.

UNIT I **20 Hours**

BLOCK CHAIN AND CRYPTO CURRENCY

Block chain: Introduction, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

Crypto currency: History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin

Crypto currency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects - Crypto currency Exchange, Black Market and Global Economy.

Total: 20 Hours

Reference(s)

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

18CS0XO .NET PROGRAMMING 1 0 0 1

Course Objectives

- Understand the fundamental concepts of C# and .NET.
- Implement string manipulation, events and exception handling within .NET application environment

Course Outcomes (COs)

1. Understand the basics of .NET Framework Architecture.
2. Apply the concept of Objects, Inheritance and Generics in C#.
3. Analyze the concept of arrays, operators and type casting for accessing and storing the data.

UNIT I

Need for programming - Introduction to .NET and .NET Core - Introduction to C# - Features of C# - Namespace - access modifiers - Data Types – Keywords - Variables and Operators - Flow control- Enumeration- Namespaces - Class- Structs - Static Classes- The object class- Extension Methods- Inheritance- Types of Inheritance- Implementation Inheritance- Modifiers- Interfaces-Generics overview- creating generic classes- Generics Features- Generic Interfaces- Generic Structs- Generic Methods - Simple arrays- Multidimensional arrays- Jagged arrays-operators and cast- operators - Operator Overloading-User Defined casts- Referencing methods- Delegates- Lambda Expressions- Events - Collection Interface and Types - Lists- Queues- Stacks- Dictionaries- Sets- Observable Collections- BIT Arrays- Immutable Collections- Concurrent Collections-LINQ overview- Standard Query Operators- Reflection- Manipulating and Inspecting code at runtime- Custom Attributes- Using Reflection

20 Hours

Reference(s)

1. Christian Nagel, Jay Glynn, Morgan Skinner, Professional C# 5.0 and .NET 4.5.1 , John Wiley & Sons, 2014
2. http://www.tutorialspoint.com/csharp/
3. http://www.csharp-station.com/Tutorial.aspx

18CS0XP GO PROGRAMMING 1 0 0 1

Course Objectives

- Understand the fundamental concepts of Go language
- Implement functions and operators using Go programming

Course Outcomes (COs)

1. Understand the basics of Go programming.
2. Apply the concept of branching and looping in Go programming
3. Analyze the concept of composite datatypes, functions and methods.

UNIT I **20 Hours**

INTRODUCTION

Golang Introduction – brief history, strength and weakness – statically typed, garbage collected, concurrency, keywords. Packages – introduction, standard packages.

Variables & Constants: Variable Declaration – naming constraints, different styles of declaration, data types, memory s size allocations, scope of variables, Constants – different styles of declaration and scope. Iota – declaration and usage.

Operators & Pointers: Operator types – arithmetic, relational, logical, bitwise, shift, unary and binary. Operator precedence. Pointers – different styles of declarations and usage.

Branching & Looping Structures: If Statement – condition evaluation, nested if else. Switch Statement - different types of condition evaluation and case matching, fall through and break. Loops – for and for range, break and continue statements. Go to statements.

Composite Data Types Arrays – declaration, initialization, accessing and modifying elements, Slice – slicing arrays, length and capacity, add, modify and remove elements from slices. Maps – declaration, add, modify and remove elements in maps. Structs – declaration and initialization, accessing struct fields, type embedding,

Functions & Methods: Functions - function signature and multiple return variables. Methods – method receivers, difference between function and methods. Defer keyword & order of defer execution.

Interfaces: Interface declaration, implementation, interface embedding, benefits.

REFERENCES

1. Alan A. A. Donovan, Brian W. Kernighan, “The Go Programming Language” Addison-Wesley Professional, 2015
2. https://www.tutorialspoint.com/go/index.htm
3. http://www.https://go.dev/

18CS0XQ REACT JS 1 0 0 1

Course Objectives

- To understand the design of applications and React JS facilitates.
- To acquiring knowledge in React JS expressions, List, and keys.
- To build React forms and applications

Course Outcomes (COs)

1. Explore the basic concepts of React JS facilitates.
2. Illustrate the components, event used in React JS for web application
3. Development of forms and web applications.

UNIT I **20 Hours**

REACT JavaScript

Introduction: React Getting Started, React Directly in HTML, setting up a React Environment, Run the React Application–Rendering Elements: Rendering an Element into the DOM, Updating the Rendered Element.

5 Hours

Components and Props: Function and Class Components, rendering a Component, Composing Components, Extracting Components - State and Lifecycle: Converting a Function to a Class, Adding Local State to a Class, Adding Lifecycle Methods to a Class, The Data Flows Down.

5 Hours

Handling Events: Passing Arguments to Event Handlers –Conditional Rendering: Element Variables, Inline If with Logical && Operator, Inline If-Else with Conditional Operator, Preventing Component from Rendering –Lists and Keys: Rendering Multiple Components, Keys, Extracting Components with Keys, Embedding map () in JSX.

5 Hours

Forms: Controlled Components, the textarea Tag, the select Tag, the file input Tag, Handling Multiple Inputs, Controlled Input Null Value, Alternatives to Controlled Components, Fully-Fledged Solutions - Lifting State Up: Adding a Second Input, Writing Conversion Functions- Composition vs Inheritance, Containment, Specialization.

Total: 20 Hours

REFERENCES

1. Robin Wieruch. “The Road to React: Your journey to master React.js in JavaScript”, 2022.
2. Eve Porcello, Alex Banks, “Learning React, 2e: Modern Patterns for Developing React Apps”, O’Reilly, 2022.

18CS0XR NODE JS 1 0 0 1

Course Objectives

- To understand the design of applications and Node JS facilitates.
- To acquiring knowledge in Node File system, Web server, and Event handling.
- To build database connectivity and web applications.

Course Outcomes (COs)

1. Explore the basic concepts of Node JS facilitates.
2. Illustrate the file and I/O operations in Node JS for web application
3. Deploy the application projects.

UNIT I **5 Hours**

Node JS

Node JS Modules: Functions, Buffer, Module, Modules Types, Modules Exports - Node Package Manager: What is NPM, Installing Packages Locally & globally, Adding dependency in package Json, Updating packages.

5 Hours

Creating Web Server: Creating Web Server, Sending Requests, Handling HTTP requests - File System, Read File, Writing a File, Opening a File, Deleting a File, Writing a file asynchronously, Other I/O Operations - Debugging Node JS Application: Core Node JS Debugger.

5 Hours

Events: Event Emitter class, Inheriting Events, Returning event emitter - Express JS: Configuring Routes, Working with Express - Serving Static Resources: Serving Static Files, Working with Middle Ware.

5 Hours

Database Connectivity: Connecting String, Configuring, Updating Records, Working with Select Command, Deleting Records - Project Development: Project Development using Node JS.

Reference(s)

1. Ray Yao, “Node.Js: Node.Js Programming, In 8 Hours, For Beginners, Quick Start Guide: Node.Js Cookbook Crash Course Tutorial & Exercises”, 2022.
2. Patrick Mulder, Kelsey Breseman, “Node.Js for Embedded Systems”, O’Reilly, 2017.

18CS0XS POSTGRESQL 1 0 0 1

Course Objectives

- To understand the design of database for web applications.
- To acquiring knowledge in querying statements.
- To build database connectivity for web applications.

Course Outcomes (COs)

1. Explore the basic concepts of PostgreSQL.
2. Illustrate the filtering and functions in PostgreSQL for web application.
3. Deploy the application projects using PostgreSQL.

UNIT I **5 Hours**

PostgreSQL

Foundations Basic Concepts: Relational database, SQL vs Postgres, Database tables, Rows and columns, Data types -Graphical User Interface: Object Explorer, Query Window, Results Grid Setting Options.

5 Hours

Querying Select Statements: Syntax of a SELECT statement, Selecting specific columns, Using a LIMIT clause, Distinct records, Using a WHERE clause, Field and Table Aliases - Filtering and Aggregating: Filtering with Text Criteria, Wildcard Filters, Filtering with Numeric Criteria, Using SUM, COUNT and AVG, Using MAX and MIN, Group-by Statements.

5 Hours

Adding – Data Creating tables: Primary keys Foreign keys Data normalization Create statement Constraints Inserting data Insert statement Nulls, empty strings and zeros Update Statement Setting Conflict Actions - Combining tables: Joins Inner Joins Full Outer Joins Left/Right Joins Views Creating a view Performance issues.

5 Hours

Advanced Topics: Advanced querying Subqueries Querying JSON data - Stored Procedures: Creating a stored procedure Transactions Temp Tables –Functions: String Functions Cast Function Convert Function Rounding Functions - Dealing with CSVs: Loading data from a CSV, Exporting a table to CSV.

Total: 20 Hours

Reference(s)

1. Joshua D. Drake, John C. Worsley, “Practical PostgreSQL: A Hardened, Robust, Open Source Database”, O’Reilly, 2022.
2. Hans-Jurgen Schonig, “Mastering PostgreSQL 13”, Packt, 2020.

18CS0XT EMBEDDED IOT 1 0 0 1

Course Objectives

- To understand the basic and fundamental concepts in Arduino IDE.
- To Gain knowledge about ESP32, WDM and Communication protocol administration commands.
- To demonstrate and implements of Network server and Application Server integration in Embedded IOT.

Course Outcomes (COs)

1. Explore the basic concepts of Arduino IDE for Embedded IoT.
2. Illustrate the use of ESP32, WDM and Communication protocol for IoT application
3. Development of Embedded IoT Application for real time problems.

UNIT I **5 Hours**

Embedded IOT

Introduction: IoT and its Application, Arduino IDE and its software installation, Arduino IDE programming, Introduction to ESP32 & WDM -ESP32: Use of IR Sensor, Soil Moisture Sensor / Potentiometer and Ultrasonic sensor HCSR04.

5 Hours

Communication Protocol: I2C, SPI, UART. I2C Sensor datasheet and its Library Installation, I2C Sensor (BH1750) integration with WDM, UART integration with Arduino, Bluetooth and its types: Device control using Classic Bluetooth, Data writing to Serial monitor from BT Serial Monitor

5 Hours

BLE: Introduction to BLE, BLE scan, Characteristics Read and Write using BLE in WDM, Thing speak: Introduction and its account creation, Device Control using Wi-Fi Thing speak.

5 Hours

LoRa & LoRaWAN: Introduction, Specifications and Parameters of LoRaWAN, Activation Methods, Classes of LoRaWAN, Network server: Introduction, Gateway registration procedure, Device Registration in Network Server, Application Server integration: Introduction and usage.

Total: 20 Hours

Reference(s)

1. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed” Wiley – IEEE, 2018.

18CS0XU TABLEAU 1 0 0 1

Course Objectives

- Learn how to build visualizations, organize data and design dashboards to empower more meaningful business decisions.

Programme Outcomes (POs)

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

e. Create, select, and apply appropriate techniques, resources, and modern engineering and ITtools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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.

Course Outcomes (COs)

1. Examine, navigate and learn to use the various features of Tableau.
2. Create and design data visualizations and dashboards using Tableau.

UNIT I **20 Hours**

Introduction to Tableau - Different Products by Tableau - Advantages of Tableau- Introduction toData Visualization- Applications of Tableau- Companies using Tableau- Features of Tableau- Tableau Terminologies- Tableau Navigations- Tableau Design Flow- How to Connect to a File Source- Understanding of Different Data Sources- Data Source Filters- Data Types - Tableau Operators- String Functions in Tableau- Date Functions - Logical Statements - Aggregate Functions- Joins- Data Blending- Field Operator-Filter- Changing Data Type of a Field from Data Pane-Formatting- Worksheet- Line Chart-Bar Chart- Histogram- Scatter Plot- Pie Chart- Bubble chart- Tableau Forecasting- Tableau Dashboard.

Total: 20 Hours

Reference(s)

1. Ben Jones, Communicating Data with Tableau - Designing, Developing, and Delivering Data Visualizations, O'Reilly, 2014
2. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

18CS0XV TYPE SCRIPT WITH JEST TESTING FRAMEWORK 1 0 0 1

Course Objectives

- Gain Knowledge about the TypeScript with a Testing Framework called Jest which will give you an idea of how the coding standard will look in Production of Top Firms.
- Create and write programs in TypeScript.
- Create the test cases for the program written in Jest Framework.

Programme Outcomes (POs)

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

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Illustrate how the production code looks like irrespective to languages.
2. Implement TypeScript Language with Jest Testing Framework.
3. Examine the code written with test cases using Jest Testing Framework.

UNIT I **20 Hours**

TypeScript **10 Hours**

Introduction to JavaScript – Difference between JavaScript and TypeScript – Why do we need to prefer TypeScript over JavaScript – Introduction to TypeScript – Features of TypeScript – Access Modifiers – Data Types – Keywords – Flow Control – Interface, Class, Objects – Practical Session on writing TypeScript Code.

Jest Testing Framework **10 Hours**

What is Testing – What is meant by testcase – Introduction to Unit Testing - Difference between Unit Testing, Integration Testing, Regression Testing – Introduction to Jest Testing – Features of Jest – Writing unit tests – Testing the code written in Typescript – Practical Session on Jest Testing Frame work.

Total: 20 Hours

Reference(s)

1. Nathan Rozentals, Jest Mastering Typescript, Fourth Edition, Packt.

21CS0XW INDUSTRIAL METAVERSE **1 0 0 1**

Course Objectives

- Create a Digital twin
- Create the network and messaging infrastructure for digital twins.
- Build a metaverse for hosting digital twin components.
- Digital component Presentation using Virtual reality.

Programme Outcomes (POs)

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.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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.

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 global requirements.

Course Outcomes (s)

1. Create physical hardware on a simulator that reads and controls real-world data.
2. Digitize and build a cloud framework to build a digital twin.
3. Design a virtual world with multiple asset files
4. Build the Phygital Model using Virtual reality and control simulated actions in real time

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	
3			2							2			2	

UNIT I **15 Hours**

Introduction to Metaverse and Physical environments - Introduction to microcontroller and sensors - What is analogue and digital data - Getting started with programming for microcontroller - How to Interface Sensors with a microcontroller. Introduction to IoT and Cloud - Features of cloud and its initialization - How to read and write data to cloud - Integration of microcontroller and sensors from simulator with cloud. Introduction to Unity packages - Optimization of 3D model - Introduction to REST API - Interfacing cloud data with unity - Testing Hardware and cloud with unity- integrate oculus quest2 with unity -Deploying project to oculus quest2

Total: 15 Hours

FOR FURTHER READING

Digital twins – Visualisation and simulation using VR – Omniverse Digital twin platform – Industrial metaverse – Digital native

Reference(s)

1. SketchUp for Site Design: A Guide to Modelling Site Plans, Terrain, and Architecture 2nd Edition by Daniel Tal.
2. SketchUp for Builders: A Comprehensive Guide for Creating 3D Building Models Using SketchUp by John Brock.
3. SketchUp for Interior Design: 3D Visualizing, Designing, and Space Planning.
4. The SketchUp Workflow for Architecture: Modelling Buildings, Visualizing Design, and Creating Construction Documents with SketchUp Pro and Layout.
5. Digital Twin: A Complete Guide For The Complete Beginner, a book by Vijay Raghunathan & Santanu Deb Barma
6. Digital Twin – Fundamental Concepts to Applications in Advanced Manufactur- ing, a book by Surjya Kanta Pal, Debasish Mishra, Arpan Pal, Samik Dutta, De- bashish Chakravarty, & Srikanta Pal
7. Learning in Metaverses: Co-Existing in Real Virtuality, a book by Eliane Schlemmer
8. https://docs.arduino.cc/software/ide-v1/tutorials/Windows
9. https://www.circuitstoday.com/nodemcu
10. https://nodemcu.readthedocs.io/en/release/

Resource Person:

Pradeep Sathya Kumar,
Regional Head,
Scopik Edutech Private Limited, Chennai.
Mail ID: regionalhead@scopik.in

21CS0XX WEB SERVICES SOLUTION ARCHITECT 1 0 0 1

Course Objectives

- Design and deploy scalable, secure, and cost-effective cloud solutions using AWS services.

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.
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.
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 global requirements.

Course Outcomes (COs)

1. Design and deploy resilient, scalable, and highly available architectures using AWS services.
2. Implement security best practices to ensure the confidentiality, integrity, and availability of data in the cloud.
3. Optimize cost and performance by effectively utilizing AWS services and resources.

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		2	2										2	
2		2	2			2								
3	2	2	2											2

UNIT I **20 Hours**

AWS Platform - Introduction to AWS Elastic computing - Introduction to the AWS products - EC2 Instance - Understanding AMI - Launching your first AWS instance - Load Balancing - Introduction to Scaling - ELB(Elastic Load Balancer) - Components and types of load balancing - Auto-scaling - Dynamic Scaling - The lifecycle of autoscaling - Policies of autoscaling - EBS (Elastic Block Storage) - Storage in Cloud - Identity Access Management (IAM) - AWS Security Management - Relational Database Service.

Total: 20 Hours

Reference(s)

1. "AWS Certified Solutions Architect Official Study Guide" by Joe Baron, Hisham Baz, Tim Bixler, Biff Gaut, Kevin E. Kelly, and Sean Senior.
2. https://aws.amazon.com/certification/certified-solutions-architect-associate/.

Resource Person:

Dr. Prakash K P
Innovano Technology Solutions Pvt.Ltd,
22, 23, 2nd Main Rd, VGP Selva Nagar,
Velachery, Chennai, Tamil Nadu 600042
Phone No : +91-9551250299
Email Id : prakash@graderesults.com
prakash@innovano.com

21CS0XY FLUTTER APPLICATION DEVELOPMENT 1 0 0 1

Course Objectives

- Understand the basic concepts of flutter and cross-platform.

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.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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.
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 global requirements.

Course Outcomes (COs)

1. Identify basic concepts, installation, and architecture of flutter
2. Design mobile apps for Flutter widgets and layouts.
3. Explore the Database connections, accessing API using Flutter

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								
3	2	2	2											2

UNIT I **15 Hours**

Foundation of Flutter Programming- Introduction -Flutter SDK Installation. Dart Basics - Asynchronous programming - Widget Tree, Common Widgets. Animations-Container, CrossFade, Opacity, Controller -App's Navigation-Bottom Navigation Bar, Bottom AppBar, TabBar, Drawer, ListView-Scrolling Lists and Effects - Database Connections-Accessing API.

Total: 15 Hours

Reference(s)

1. Beginning Flutter: A Hands On Guide to App Development, MarcoL. Napoli; ISBN-13: 978-1119550822
2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps -Rap Payne-2019.

Resource Person:

Mr.V.Praveen Kumar
Software Engineer,AGS Health,Chennai

21CS0XZ GUI DEVELOPMENT WITH PYTHON 1 0 0 1

Course Objectives

- To understand and develop Graphical User Interface using Python and Tkinter.

Programme Outcomes (POs)

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.
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.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Understand the basics of Python and Tkinter.
2. Create GUI using themes and styles.
3. Create Tinker Object-oriented 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				2
3		2			2									2

UNIT I **15 Hours**

Overview of Python- Basics, Data Types, Control flow, Functions, Map and Filters, File handling. - classes and modules - Introduction to Tkinter - Tkinter basics: Windows and widgets, Tkinter variables, Buttons with arguments, Events, Menus, Canvas, Frames, Tables. Layouts : Pack, Grid, place, Combining layouts, Creating custom widgets, Creating Scrollable frame, Working with multiple windows. Object oriented Programming with Tkinter: Creating Windows and frames, Switching between frames using tkraise() method. Styling : Introduction, Themes and colors, styling with customtkinter, Converting a tkinter app to customtkinter, styling with ttkBootstrap editor, Widgets in ttkBootstrap, Animated widgets, creating animated images.

Total: 15 Hours

Reference(s)

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- https://www.pythontutorial.net/tkinter/tkinter-object-oriented-window/
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Resource Person:

Mr.PremKumar M,
SDE, Amazon,
Hyderabad
Phone No :9629348059