SETHU INSTITUTE OF TECHNOLOGY

(An Autonomous Institution | Accredited with 'A' Grade by NAAC)

Pulloor, Kariapatti – 626 115.

B.E. COMPUTER SCIENCE AND DESIGN

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABUS

(1st SEMESTER To 8th SEMESTER)

APPROVED IN THE ACADEMIC COUNCIL MEETING
HELD ON 14.05.2022

CHAIRPERSON

BOARD OF STUDIES

Chairperson
Board of Studies
Computer Science & Engineering
Sethu Institute of Technology
Kariapatti - 626 115

CHAIRMAN

ACADEMIC COUNCIL

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Sethu Institute of Technology
Pulloor, Kariapatti - 625 115

SETHU INSTITUTE OF TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN

Department Vision

To provide quality education in Computer Science and Design Engineering and research for the betterment of the society.

Department Mission

- Promoting students as computer and design experts to meet the expectations of the industry.
- Offering holistic learning environment.
- Inculcating the skills of the students to make successful engineers and entrepreneurs.
- Establishing relationship with the industries for mutual knowledge transfer.
- Promoting Research activities related to industry and society.
- Offering computing and design services to the society.

Core Values

- Quality   - Loyalty   - Originality   - Unity   - Civility

PROGRAM EDUCATIONAL OBJECTIVES	
PEO – I	Graduates will succeed as Computer and design Engineers through the state of the art infrastructure by adopting high quality academic practices to meet the demands of academia, industry, and nation.
PEO – II	Graduates will work as team leaders and members with professional behavior and ethics.
PEO – III	Graduates will enhance their professional skills through higher studies, employability, and research activities for the benefit of the society.

PROGRAM SPECIFIC OUTCOMES	
PSO – 1 (Programming)	Inculcate comprehensive knowledge in computing paradigm.
PSO – 2 (Design)	Develop applications for new media design in the areas like multimedia, animation, virtual reality, and gaming.

PROGRAM OUTCOMES	
1.	Apply the knowledge of mathematics, basic sciences, engineering fundamentals, and Computer Science and Design to the solution of complex engineering problems. **(Engineering Knowledge)**
2.	Identify, formulate, review research literature and analyze complex engineering problems requiring computing solutions to reach substantiated conclusions using first principles of mathematics, basic sciences, and Computer Science and Design. **(Problem analysis)**
3.	Design solutions for computer applied 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. **(Design/development of solutions)**
4.	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. **(Conduct investigations of complex problems)**
5.	Create, Select and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to computing related complex engineering activities with an understanding of the limitations. **(Modern tool usage)**
6.	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional computer science and engineering practice. **(The Engineer and society)**
7.	Understand the impact of the professional computer science and design solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. **(Environment and sustainability)**
8.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the computer science and design practice. **(Ethics)**
9.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. **(Individual and team work)**
10.	Communicate effectively on complex computer science and design 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. **(Communication)**
11.	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 cost effective projects in multidisciplinary environments.**(Project management and finance)**
12.	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. **(Life-long learning)**

SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti - 626 115

B.E. Degree Programme

CBCS CURRICULUM

Regulations 2021

Bachelor of Engineering in Computer Science & Design

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Humanities & Social Sciences	5	9	5.63
Basic Sciences	10	28	17.5
Engineering Sciences	8	20.5	12.81
Professional Core	23	59.5	37.19
Professional Elective	6	18	11.25
Open Electives	4	12	7.5
Project Work	3	13	8.13
Mandatory Course	9		
TOTAL	68	160	100

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
CSD	20	17	22	22	20	25	20	14	160

SEMESTER I

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UEN101	HS	English for Technical Communication (Common to ALL, except CSBS)	2	0	0	2
21UMA102	BS	Matrix and Calculus (Common to ALL, except CSBS)	3	1	0	4
21UPH103	BS	Engineering Physics (Common to ALL, except CSBS)	3	0	0	3
21UCY105	BS	Applied Chemistry (Common to CSE, ECE, EEE, IT, BME, BT, AI&DS, CSD, AI&ML)	3	0	0	3
21UCD107 / 21UME110	ES	Aesthetics Design / Engineering Drawing	3	0	0	3
21UCS108 / 21UCS107	ES	Problem Solving and PYTHON programming (Common to ALL, except CSBS) / Problem Solving and C programming (Common to ALL)	3	0	0	3
PRACTICAL COURSES						
21UCS110 / 21UCS111	ES	Problem Solving and PYTHON Programming Laboratory (Common to ALL, except CSBS) / Problem Solving and C Programming Laboratory (Common to ALL)	0	0	2	1
21UGS113	BS	Basic Sciences Laboratory - I (Common to ALL, except CSBS)	0	0	2	1
MANDATORY COURSE						
21UGM131	MC	Induction Programme	0	3	0	0
TOTAL			17	4	4	20
Total No. of Credits – 20						

SEMESTER II

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UEN201	HS	Communication Skills for Professionals (Common to ALL, except CSBS)	1	0	1	1.5
21UMA210	BS	Differential Equations, Fourier Series and Transforms (Common to AI & DS,CSD)	3	1	0	4
21UPH205	BS	Physics for Information Science (Common to CSE, EEE, IT, AI&DS, CSD)	3	0	0	3
21UCS204 / 21UCS203	ES	Programming Using C (Common to CSE, CSD) / Programming Using Python (Common to CSE, CSD)	3	0	0	3
21UCD205	ES	Digital and Computer Organization	3	0	0	3
PRACTICAL COURSES						
21UGS210	BS	Basic Sciences Laboratory - II (Common to CSE, CSD)	0	0	2	1
21UCS211 / 21UCS212	ES	C Programming Laboratory (Common to CSE, CSD) / Python Programming Laboratory (Common to CSE, CSD)	0	0	3	1.5
MANDATORY COURSE						
21UGM231	MC	Environmental Science	3	0	0	P/F
TOTAL			16	1	6	17
Total No. of Credits – 17						

SEMESTER III

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UMA328	BS	Discrete Mathematics (Common to AI& DS,CSD)	3	1	0	4
21UIT302	PC	Data Structures (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UCS303	PC	Object Oriented Programming using C++ (Common to CSE, IT, CSBS, CSD)	3	0	2	4
21UIT304	PC	Principles of Operating Systems (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UCD305	ES	Design Thinking	3	0	0	3
21UCD306	PC	Database System Design (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
PRACTICAL COURSES						
21UIT307	PC	Data Structures Laboratory (Common to CSE, IT, AI&DS, CSD)	0	0	2	1
21UCD308	PC	Database System Design Laboratory (Common to CSE, IT, AI&DS, CSD)	0	0	2	1
MANDATORY COURSE						
21UGM331	MC	Biology for Engineers	2	0	0	P/F
		TOTAL	20	1	6	22
Total No. of Credits – 22						

SEMESTER IV

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UMA426	BS	Probability and Statistical Techniques (Common to AI & DS,CSD)	3	1	0	4
21UCS402	PC	Computer Networks (Common to CSE, IT, CSD)	3	0	0	3
21UCS403	PC	Algorithm Analysis (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UIT404	PC	Java Programming (Common to CSE, IT, CSD)	3	0	2	4
21UCD405	PC	Computer Graphics	3	0	0	3
21UCD406	ES	Agile Methodologies	3	0	0	3
PRACTICAL COURSES						
21UCS407	PC	Computer Networks Laboratory (Common to CSE, IT, CSD)	0	0	2	1
21UCD408	PC	Computer Graphics Laboratory	0	0	2	1
MANDATORY COURSE						
21UGM431	MC	Gender Equality	1	0	0	P/F
			19	**1**	**6**	**22**
Total No. of Credits – 22						

SEMESTER V

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UIT501	PC	Internet and Web Technology (Common to CSE, IT, CSD)	3	0	2	4
21UCD502	PC	Mobile Interactive Design	2	0	2	3
21UCS503	PC	Theory of Computation (Common to CSE, CSD)	3	1	0	3
	PE	Professional Elective - I	3	0	0	3
	OE	Open Elective - I	3	0	0	3
21UGS531	BS	Reasoning and Aptitude (Common to CSE, ECE, IT, CSBS, AI&DS, CSD, AI&ML)	1	0	0	1
PRACTICAL COURSES						
21UCD507	PW	Creative Thinking and Innovation	0	0	2	1
21UGS532	HS	Soft Skills Laboratory (Common to CSE, EEE, IT, AGRI, CSBS, AI&DS, CSD)	0	0	2	1
MANDATORY COURSE						
21UGM531	MC	Tamil Literature, Culture, and Civilization through Archeology	1	0	0	P/F
		TOTAL	**16**	**1**	**8**	**20**
Total No. of Credits – 20						

SEMESTER VI

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UCD601	PC	Game Design and Development	3	0	0	3
21UCD602	PC	IoT Design (Common to CSE, CSD)	2	0	3	3.5
21UCD603	PC	Multimedia Technologies	3	0	0	3
	PE	Professional Elective - II	3	0	0	3
	PE	Professional Elective - III	3	0	0	3
	OE	Open Elective - II	3	0	0	3
PRACTICAL COURSES						
21UCD606	PC	Game programming Laboratory	0	0	2	1
21UCD607	PW	Product Development Project	0	0	8	4
21UGS633	HS	Interpersonal Skills Development Laboratory (Common to CSE, EEE, IT, AGRI, CSBS, AI&DS, CSD)	0	0	3	1.5
MANDATORY COURSE						
21UGM631	MC	Indian Constitution (Common to ALL)	1	0	0	P/F
		TOTAL	**18**	**0**	**16**	**25**
Total No. of Credits – 25						

SEMESTER VII

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UME701	HS	Project Management and Finance (Common to ALL except CSBS)	3	0	0	3
21UCD702	PC	Virtual Reality and Augmented Reality	3	0	0	3
21UCD703	PC	3D Modeling and Animation	3	0	0	3
	PE	Professional Elective – IV	3	0	0	3
	PE	Professional Elective – V	3	0	0	3
	OE	Open Elective – III	3	0	0	3
PRACTICAL COURSES						
21UCD707	PC	Virtual Reality and Augmented Reality Laboratory	0	0	2	1
21UCD708	PC	3D Modeling and Animation Laboratory	0	0	2	1
MANDATORY COURSES						
21UGM731	MC	Sports and Social Development	0	0	0	P/F
21UGM732	MC	Skill Development	0	0	0	P/F
		TOTAL	**18**	**0**	**4**	**20**
Total No. of Credits – 20						

SEMESTER VIII

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
	PE	Professional Elective – VI	3	0	0	3
	OE	Open Elective – IV	3	0	0	3
PRACTICAL COURSE						
21UCD801	PW	Project Work	0	0	16	8
MANDATORY COURSE						
21UGM831	MC	Professional Ethics and human values (Common to ALL)	2	0	0	0
		TOTAL	**8**	**0**	**16**	**14**
Total No. of Credits – 14						

TOTAL CREDITS – 160

LIST OF ELECTIVES

S.No.	Course Code	Course Name	L	T	P	C
1.	21UCD901	Digital Marketing Strategy	3	0	0	3
2.	21UCD902	Wearable Applications, Research, Design, and Interactions	3	0	0	3
3.	21UCD903	Non Linear Editing	3	0	0	3
4.	21UCD904	Robotic Process Automation	3	0	0	3
5.	21UCD905	GPU Computing	3	0	0	3
6.	21UCD906	Digital Audio Design and Synthesis	3	0	0	3
7.	21UCD907	Spatial Explorations in Interaction Design	3	0	0	3
8.	21UCD908	Image Processing Techniques for Computer vision	3	0	0	3
9.	21UCD909	Artificial intelligence for games	3	0	0	3
10.	21UCD910	Machine Learning Algorithms	3	0	0	3
11.	21UCD911	Robotics	3	0	0	3
12.	21UCD912	Cloud Computing Techniques	3	0	0	3
13.	21UCD913	Data Science and Analytics	3	0	0	3
14.	21UCD914	Compiler Design tools and techniques	3	0	0	3
15.	21UCD915	Crypto Currency	3	0	0	3
16.	21UCD916	Visualization Analysis Techniques	3	0	0	3
17.	21UCD917	Cryptography Algorithms for Network Security	3	0	0	3
18.	21UCD918	Information retrieval Mechanisms	3	0	0	3
19.	21UCD919	Mobile Computing	3	0	0	3
20.	21UCD920	C# and .NET Programming	2	0	2	3
21.	21UCD921	Usability Studies and Evaluation	3	0	0	3

Open Electives (OE)

S.No.	Course Code	Course Name	L	T	P	C
1.	21UCD971	Applied Design Thinking	3	0	0	3
2.	21UCD972	Digital Media and Society	3	0	0	3
3.	21UCD973	Mixed Reality	3	0	0	3
4.	21UCD974	Visual Design	3	0	0	3

Industry Designed Courses

S.No.	Course Code	Course Name	L	T	P	C
1.	21UCD861	NodeJS	1	0	0	1
2.	21UCD862	Design Tools	1	0	0	1
3.	21UCD863	OpenGL	1	0	0	1
4.	21UCD864	Hadoop	1	0	0	1

SEMESTER I

SEMESTER I

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UEN101	HS	English for Technical Communication (Common to ALL, except CSBS)	2	0	0	2
21UMA102	BS	Matrix and Calculus (Common to ALL, except CSBS)	3	1	0	4
21UPH103	BS	Engineering Physics (Common to ALL, except CSBS)	3	0	0	3
21UCY105	BS	Applied Chemistry (Common to CSE, ECE, EEE, IT, BME, BT, AI&DS, CSD, AI&ML)	3	0	0	3
21UCD107 / 21UME110	ES	Aesthetics Design / Engineering Drawing	3	0	0	3
21UCS108 / 21UCS107	ES	Problem Solving and PYTHON programming (Common to ALL, except CSBS) / Problem Solving and C programming (Common to ALL)	3	0	0	3
PRACTICAL COURSES						
21UCS110 / 21UCS111	ES	Problem Solving and PYTHON Programming Laboratory (Common to ALL, except CSBS) / Problem Solving and C Programming Laboratory (Common to ALL)	0	0	2	1
21UGS113	BS	Basic Sciences Laboratory - I (Common to ALL, except CSBS)	0	0	2	1
MANDATORY COURSE						
21UGM131	MC	Induction Programme	0	3	0	0
TOTAL			17	4	4	20
Total No. of Credits – 20						

21UGM131	INDUCTION PROGRAMME	L	T	P	C

PRE-REQUISITE:

COURSE OBJECTIVES :
- To rejuvenate the Body and Mind
- To strengthen Attitude and soft skills
- To practice Moral values of life.

UNIT I	PHYSICAL ACTIVITY	10 Hrs

Zumba - Bokwa Fitness – Yoga – Mediation – Fine Arts

UNIT II	CREATIVE ARTS	5 Hrs

Painting – Class Painting – Wall Painting – Art from waste

UNIT III	UNIVERSAL HUMAN VALUES & EMINENT SPEAKERS	5 Hrs

Ethical values – Ambition and Family Expectation, Gratitude, Competition and Excellence - Belief – Morality of life – Guest Lecture by Eminent personality

UNIT IV	LITERARY	

Elocution - Essay writing Competition - Impromptu Session - Dance and singing competition

UNIT V	PROFICIENCY MODULES	15 Hrs

Toastmaster club meet

UNIT VI	INDUSTRIAL & LOCAL VISIT	8 Hrs

Vaigai Dam – Theni - VOC- Port-Tuticorin - Madurai Radio City-Madurai - Aavin Milk -Madurai-NSS Activities.

UNIT VII	FAMILIARIZATION OF THE DEPT. AND INNOVATION	2 Hrs

Department Introduction and Purpose of Course - Eminent speakers – Scope and Feature of the Course - Latest Innovation

TOTAL : 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Practice physical activities regularly.
- Implement creativity in drawing and waste material.
- Communicate their ideas effectively.
- Identify inputs and outputs of different industry process.
- Describe the scope and features of their programme of study.

REFERENCE BOOK:

1. Student Induction Programme: A Detailed Guide by AICTE, New Delhi.

21UEN101	ENGLISH FOR TECHNICAL COMMUNICATION	L	T	P	C
		2	0	0	2

PRE-REQUISITE:

COURSE OBJECTIVES :

- To enhance the vocabulary of students
- To strengthen the application of functional grammar and basic skills
- To improve the language proficiency of students

UNIT I	PRESENTING ESSENTIALS OF CORRESPONDENCE	6

Listening - Formal and informal conversations and comprehension **Speaking -** introducing oneself - exchanging personal and social information- **Reading** – Skimming and Scanning.   **Writing –** Sentence Formation, Formal Letters (Permission/Requisition) - **Grammar** - Parts of Speech - Tense - **Vocabulary Development** - Technical Word Formation- Prefix- suffix - Synonyms and Antonyms- Phrases and Clauses

UNIT II	COMMUNICATION SKILLS	6

Listening – Telephonic Conversations**. Speaking** – Pronunciation rules with Stress pattern. **Reading** – comprehension-pre-reading, post-reading- comprehension questions **Writing** – Punctuation rules, paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions, Precise writing, Developing Hints - Report Writing (Industrial, Accident) - **Grammar** – Voice **Vocabulary Development**- Words from other languages in English.

UNIT III	CORRESPONDENCE AND VOCATION IMPROVEMENT	6

Listening - Motivational speech by Great Speakers **Speaking** - Narrating daily events -retelling short stories. **Reading** - Newspaper reading. **Writing** - Job application letter - Transformation of Information (Transcoding) - **Grammar** - Voice - **Vocabulary Development** - Same word in different parts of speech

UNIT IV	PORTRAYAL AND SUMMATION	6

Listening – Understating the instruction. **Speaking** - Intonation and preparing dialogue on various formal and informal situation Reading -Note Making from given text - **Writing** –Creating coherence, Essay writing with proper introduction and conclusion, Giving Instruction (Guidance/Procedure) - **Grammar** – Subject-Verb Agreement (Concord), **Vocabulary Development** – One word substitution.

UNIT V	CRITICAL THINKING	6

Listening – Listening important messages based on news report. **Speaking-** retelling short stories.

Reading - Organization Profile, news report. **Writing** – Precise writing, Developing Hints - Report Writing (Industrial, Accident). **Grammar** – Spot the Errors in English

TOTAL : 30 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply grammar effectively in writing meaningful sentences and paragraphs. (Respond – A2)
- Exhibit reading skills and comprehension to express the ideas in the given text. (Respond – A2)
- Develop writing skills to present the ideas in various formal situations. (Respond – A2)
- Develop oral fluency to express the ideas in various formal situations. (Respond – A2)
- Prepare reports for various purposes. (Respond – A2)

TEXT BOOK:

1. K N Shoba, Lourdes Joavani Rayen, ‚Communicative English', New Delhi, Cambridge University Press, 2017.

REFERENCE BOOKS:

1. Raman, Meenakshi, Sangeetha Sharma, ‚Business Communication', New Delhi, Oxford University Press, 2014.

2. Lakshminarayanan. K.R, ‚English for Technical Communication', Chennai, Scitech Publications (India) Pvt. Ltd, 2004.

3. Rizvi. Asraf M, ‚Effective Technical Communication', New Delhi, Tata McGraw-Hill Publishing Company Limited, 2007.

21UMA102	MATRIX AND CALCULUS (Common to ALL Branches – Except CSBS)	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :
- To make the students capable of identifying linear equations based problems (Eigen Value) from practical areas and obtain the Eigen value oriented solutions in certain cases.
- To widen the students' knowledge base on linear algebra, growth rate computation and application of integrals.
- Able to integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients of functions
- To apply these mathematical concepts (matrix theory, differentiation and integration) in engineering field.

UNIT I	MATRICES	8+3 Hrs

Eigen value and eigenvector of a real matrix – Characteristic equation – Properties – Cayley-Hamilton theorem (excluding Proof) - Orthogonal reduction -(transformation of a symmetric matrix to diagonal form) – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation

UNIT II	DIFFERENTIAL CALCULUS	9 +3 Hrs

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (n^{th} derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law - Simple electric circuit problems)

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	9 +3Hrs

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT IV	INTEGRAL CALCULUS	8+3 Hrs

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae - Beta and Gamma functions.

UNIT V	MULTIPLE INTEGRALS	8+3 Hrs

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double integral - Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Volume as triple integral.

SUPPLEMENT TOPIC (for internal evaluation only)	3 Hrs

Evocation / Application of Mathematics, Quick Mathematics – Speed Multiplication and Division Applications of Matrices.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the Characteristic Equation, Characteristic roots and use the applicability of Cayley – Hamilton theorem to find the Inverse of matrix. (Apply)

- Analyze functions using limits, continuity, derivatives and   to solve Physical application problems.(Analyze)
- Apply differentiation techniques and Lagrange multiplier method to predict the extreme values of the functions with constrain. (Apply)
- Apply the concept of some special function like Gamma, Beta function and their relation to evaluate some definite integral. (Apply)
- Apply integration to compute Multiple integrals, Area and Volume in addition to change of order and change of variables. (Apply)
- Understand the basic concept in Matrix, Differentiation and Integration. (Understand)

TEXT BOOKS:
1. BALI N. P and MANISH GOYAL, ¯A Text book of Engineering Mathematics‖, Laxmi Publications (P) Ltd, New Delhi, 8th Edition, (2011).
2. VEERARAJAN.T ¯Engineering Mathematics‖ Tata McGraw Hill Publishing Company, New Delhi, vol 15.
3. GREWAL. B.S, ¯Higher Engineering Mathematics‖, Khanna Publications, New Delhi, 42nd Edition, (2012).

REFERENCE BOOKS:
1. RAMANA B.V, ¯Higher Engineering Mathematics‖, Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, ¯Advanced Engineering Mathematics‖, Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K,‖ Advanced Engineering Mathematics‖, Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, ¯Vedic Mathematics - Mental Calculation‖, MotilalBanarsi
   Dass Publications, New Delhi, 1st Edition, (1965).

5. KREYSZIG. E, ¯Advanced Engineering Mathematics‖, John Wiley & Sons, New York, 10th Edition, (2011).
6. P.SIVARAMAKRISHNA DAS, E.RUKMANGADACHARI¯Engineering mathematics‖, volume1, Pearson Edison New Delhi, 2nd Edition, (2013).

21UPH103	ENGINEERING PHYSICS (Common To All Branches)	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :
- To develop the research interest in crystal physics.
- To use the principles of Lasers and its types.
- To apply principles of Quantum physics in engineering field.
- To develop knowledge about the properties of materials.

UNIT I	CRYSTAL STRUCTURE	9

Introduction - Classification of solids –Space lattice –Basis-Lattice parameter - Unit cell - Crystal system -Miller indices –d-spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius-Coordination number – Packing factor for SC, BCC, FCC and HCP structures - crystal imperfection – Point defects – Line defects – Surface defects – Volume defects - Burger vector.

UNIT II	SOLID DEFECTS AND HOLOGRAPHY	9

Introduction – Solid defects - Crystal imperfection –Point defects-Line defects-Surface defects - Volume defects Burger vector - Holography – Construction and Reconstruction of hologram - Industrial and Medical Applications

UNIT III	PHOTONICS	9

Introduction- Principles of Laser- Characteristics of laser -Spontaneous and stimulated emission - Population inversion – Einstein's A and B coefficients - Pumping methods – Basic components of Laser - Types of lasers – Nd-YAG laser - CO_2 laser – Holography – Construction and Reconstruction of hologram - Industrial and Medical Applications.

UNIT IV	QUANTUM MECHANICS	9

Introduction - Black body radiation – Planck's law of radiation - Wien's displacement law - Rayleigh Jeans law – Compton Effect – Theory and experimental verification – Matter waves - Schrodinger's wave equation – Time dependent – Time independent equation –Particle in 1-D dimensional box

UNIT V	PROPERTIES OF SOLIDS	9

Introduction – Elasticity - Stress and Strain - Hooke's law – Three moduli of elasticity – stress-strain curve – Poisson's ratio –Factors affecting elasticity – Bending moment – Depression of a cantilever -Young's modulus by uniform bending –I- shaped girders.

TOTAL: 45 PERIODS

<mark>COURSE OUTCOMES</mark>:
After the successful completion of this course, the student will be able to
- Classify the types of crystals, lasers, elasticity, and quantum behavior of solids. (Understand)
- Apply the basic knowledge of crystal, quantum mechanics, and mechanical behavior of solids to solve engineering problems. (Apply)
- Apply the principle of laser to estimate the wavelength of emitted photons. (Apply)
- Analyze the dual nature of matter using the concepts of quantum mechanics. (Analyze)
- Analyze the structural and optical properties of crystals in industrial and medical applications. (Analyze)
- Analyze the properties for specific Engineering Applications. (Analyze)

TEXT BOOKS:

1. Dr. Mani.P, ⁻Engineering Physics‖, Dhanam Publications, Edition ,2018, Chennai.

2. Rajendran.V, ⁻Engineering,Physics‖, Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition 2018.

3. Palanisami P.K., ⁻Physics For Engineers‖, Scitech Publications (India), Pvt Ltd., Chennai, 2018.

REFERENCE BOOKS:

1. Raghuvenshi G.S., ⁻Engineering Physics‖, PHI Learning Private Limited, New Delhi, Revised Edition 2018.

2. Arul doss .G., ⁻Engineering Physics‖, PHI Learning Limited, New Delhi, Revised Edition 2018.

3. Marikani .A., ⁻Engineering Physics‖, PHI Learning Private Limited, New Delhi, Revised Edition 2017.

4. Sankar B.N., and Pillai .S.O., ⁻A Text book of Engineering Physics‖, New Age International Publishers Private Limited, New Delhi, Revised Edition 2017.

5. Avadhanulu M.N. and Kshirsagar P.G., ⁻A Textbook: of Engineering Physics‖, S.Chand& Company Ltd., New Delhi, 2018.

21UCY105	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :
- To gain the knowledge on Chemical bonding and types.
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To know the importance of smart material and green chemistry.
- To acquire knowledge on energy storage devices

UNIT I	CHEMICAL BONDING	9

Chemical Bonding: Electronic Configuration- Ionic Bond - Covalent Bond – Metallic bond -Aufbau principle, Pauli Exclusion principle, Valence bond theory application and its limitations, Various types of hybridization (sp, sp^2, sp^3) (C_2H_2, C_2H_4, CH_4) -bond strength and bond energy - Hydrogen bonding, Vander Waalsforces*.*

UNIT II	WATER AND ITS TREATMENT TECHNOLOGIES	9

Hardness of water-types-expression of hardness(Problems)-units-estimation of hardness of water by EDTA - boiler troubles (scale and sludge) - Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) - External treatment Ion exchange process - Zeolite process - desalination of brackish water - Reverse Osmosis.

UNIT III	SMART MATERIALS	9

Introduction to smart materials and their structure - Organic Light Emitting Diodes – Principles and applications, Liquid crystals – definition and applications

UNIT IV	GREEN CHEMISTRY	9

Introduction to Green Chemistry, the 12 Principles of Green Chemistry, toxicology and Green Chemistry, Environmental Issues, Climate and Green Chemistry, Energy and Green Chemistry, e-waste disposal.

UNIT V	ENERGY STORAGE DEVICES	9

Batteries, fuel cells and super capacitors: Types of batteries - primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuelcells-H2-O2fuel cell and application.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- CO1: Describe the basic concept of chemistry involved in chemical bonding, water treatment methods, smart materials, e-waste management and energy storage devices. (Understand-K2)
- CO2: Explain the principles and application of organic light emitting diodes, liquid crystals and green chemistry (Understand- K2)
- CO3: Apply the knowledge of chemical bonding to identify the types of bonds in molecules. (Apply- K3)
- CO4: Apply the knowledge of the basic electrochemical cell terminology to select suitable type of energy storage devices for engineering application (Apply-K3)
- CO5: Analyze the impurities of water to find its hardness and remove the hardness causing substances. (Analyze-K4)

- CO6: Write a report on chemical application for Industries (Respond-A2)

TEXT BOOKS:

1. Jain P.C.and Monica Jain,¯Engineering Chemistry‖,Dhanpat Rai Publishing Company (P)Ltd., New Delhi, 2010
2. Dr.Sunita Rattan, ¯A Textbook of Engineering Chemistry‖ S.K.Kataria & Sons.,New Delhi,2013.
3. Pradeep. T ¯A textbook of Nanoscience and Nanotechnology‖, Tata McGraw - Hill education private ltd, 2012.

REFERENCE BOOKS:

1. Derek Pletcher and Frank C. Walsh, ¯Industrial Electrochemistry‖, Chapman and Hall, New York, 1993.
2. Peter Grundler, ¯ Chemical Sensors - An introduction for Scientists and Engineers‖, Springer, New York, 2007.

21UCD107	AESTHETIC DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- Develop the technical skills and the ability to organize the visual elements necessary to communicate concepts and experiences across various media
- Understand the aesthetic principles in software, Web and mobile application design.

UNIT I	Introduction to Aesthetic Principles	9

Aesthetic design introduction, Importance of aesthetic design, Design for aesthetic pleasure, Aesthetic organization of visual elements, - Line, Shape, Tone, Color, Pattern, Texture, Form, Balancing aesthetics and usability, 7 Principles of design.

UNIT II	Aesthetics in Software Engineering	9

Introduction to Software Engineering, Phases of Software Engineering, Importance of Aesthetics in Software Engineering - designer's perspective, user's perspective, Platonic Technology, A Platonic Aesthetics for Software Engineering, Applying Aesthetic Principles in Software Engineering.

UNIT III	Aesthetics in Web and Mobile applications design	9

Role & Importance of aesthetics in web design, 7 Elements of an Aesthetically Pleasing Website, Aesthetics Vs Usability in web design, Aesthetics Vs Functionality in Web design, Aesthetics in Modern web design, Aesthetics of Mobile app design, Mobile App Design Best Practices and Mistakes.

UNIT IV	Aesthetics in UI Design	9

UI Design Introduction-Types of User Interface-How GUI works-Reason for Aesthetics in UI-Limits of Aesthetic in UI design-Ideas to make UI design aesthetically-Rules for creating Aesthetic UI-design process of Aesthetic GUI.

UNIT V	Aesthetics in Color and Interactive Multimedia	9

Color Theory, Introduction to Color Wheel, Importance of Color Harmony, Color models – Additive & Subtractive, Introduction to Color Palettes, Types of Color Palettes, Introduction to Interactive Multimedia, Design Challenges of Interactive Multimedia, Interactive Vs Non-Interactive Media, 6 steps to establishing a design aesthetic for a brand.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
1. Explain the evolution of aesthetics throughout history   and contemporary Aesthetics **(Understand)**
2. Apply the various fundamental design elements to produce aesthetics design **(Apply)**
3. Use aesthetic criteria to evaluate creative process or product. **(Evaluate)**
4. Analyze how artists use specific design concepts to convey meaning. **(Analyze)**
5. Explore creative solutions to clearly define the real world problems from basic concepts and

methods from design Engineering**. (Create)**
6. Work individually or in teams and demonstrate the solutions to the given exercises through presentation. **(Affective Domain)**

Text Books

1. Mo Dodson, Jerry Palmer, ¯Design and Aesthetics‖,PHI, 2007
2. Mark Foster Gage, ¯Aesthetic Theory: Essential Texts for Architecture and Design, 2011.
3. Donald A. NormanThe Design of Everyday Things‖, 2002.
4. Michael J. Inwood, ¯Introductory Lectures on Aesthetics‖. Penguin Books Ltd, 2004.
5. Alina Wheeler, ¯Designing Brand Identity: An Essential Guide for the Entire Branding Team‖, John Wiley & Sons, First edition,2009.

Web references

1. https://ecomputernotes.com/software-engineering/software-engineering-phases
2. https://studylib.net/doc/11902307/aesthetics-in-software-engineering
3. https://99designs.com/blog/tips/brand-design-aesthetic/
4. https://careerfoundry.com/en/blog/ui-design/introduction-to-color-theory-and-color-palettes/
5. https://www.interaction-design.org/literature/topics/color-theory
6. https://digitalartarchive.siggraph.org/wp-content/uploads/2017/04/1994_wilson.pdf
7. https://www.investopedia.com/terms/i/interactive-media.asp
8. https://designcode.io/ui-design-handbook-ui-design-aesthetic
9. https://www.nngroup.com/articles/aesthetic-usability-effect/
10. https://xd.adobe.com/ideas/principles/human-computer-interaction/graphical-user-interface-gui-definition/
11. https://www.appliedi.net/blog/7-elements-of-an-aesthetically-pleasing-website/
12. https://www.digitalhill.com/blog/aesthetics-vs-usability-in-web-design/
13. https://marketingepic.com/the-importance-of-aesthetics-and-usability-in-web-design/
14. https://uxplanet.org/website-design-aesthetics-vs-functionality-8d429dd09f8a
15. https://www.crowdbotics.com/blog/aesthetics-in-modern-web-design
16. https://slidetodoc.com/the-aesthetics-of-mobile-app-design-or-the/

21UME113	ENGINEERING DRAWING AND DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES :

- To develop in students graphic skill for communication of concepts, ideas and design of
- engineering products and expose them to existing national standards related to technical drawings
- To impart knowledge in development of surfaces, isometric and perspective projections
- To demonstrate the capabilities of software for drafting and modeling.
- To train the students understand and draw simple solids, isometric projection of simple objects and residential building.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)	1

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventionsand Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning

UNIT I	PLANE CURVES AND 3D MODELING	7

Conics - Construction of ellipse, Parabola and hyperbola by eccentricity method - Construction of cycloid – construction of involutes of squad and circle.

Introduction to curves - Analytical curves: line, circle and conics - synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations, 3D modelling – types – solid, wireframe, and surface

UNIT II	PROJECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	7

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to Horizontal plane (HP) only. Development of lateral surfaces of simple and truncated solids inclined to Horizontal plane (HP) only – Prisms, pyramids, cylinders and cones.

UNIT III	ISOMETRIC AND PERSPECTIVE VIEWS	8

Isometric Projections
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones when cutting plane inclined to Horizontal plane (HP) only.
Perspective Projections
Perspective projection of prisms, pyramids and cylinders by visual ray method.

UNIT IV	ORTHOGRAPHIC PROJECTION	7

Representation of three dimensional objects - General principles of orthographic projection - Need for importance of multiple views and their placement - First angle projection - layout views - Developing visualization skills of multiple views from pictorial views of objects

LIST OF EXPERIMENTS:

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures.
2. Introduction to CAD Software Package Commands, creation of 2D Sketches by CAD Package.

3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.).
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
8. Drawing isometric projection of simple objects.
9. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students. **A minimum of eight experiments shall be offered**

TOTAL: 30 (L) + 30 (P) = 60 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
1. Construct the conic curves, involutes and cycloid and 3D modeling solids. (Apply)
2. Illustrate simple solids like prisms, pyramids, cylinder and cone and draw the development of simple solids. (Apply)
3. Draw the isometric and perspective projections of simple solids. (Apply)
4. Prepare orthographic views from isometric drawings. (Apply)
5. Construct the parabola and involutes using B spline or cubic spline. (Mechanism)
6. Sketches the 2D view of simple solids like prism, pyramid, cylinder and cone. (Mechanism)
7. Construct the 3D view of objects in Isometric projection using AutoCAD software. (Mechanism)
8. Sketch a plan of residential building using AutoCAD software. (Mechanism)

TEXT BOOKS:

1. Natrajan K.V., ¯A Text Book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2018.
2. Bhratt N.D. and Panchal V.M., ¯Engineering Drawing‖, Charotar Publishing House, 53rd Edition, 2019.
3. Parthasarathy, N. S. and Vela Murali, ¯Engineering Drawing‖, Oxford University Press, 2015

REFERENCE BOOKS:

1. Venugopal K., and Prabhu Raja V., ¯Engineering Graphics‖, New Age International (P) Limited, (2008).
2. Gopalakrishnan K.R., ¯Engineering Drawing‖ (Vol .I&II), Subhas Publications,(1998).
3. DhananjayA. Jolhe, ¯Engineering Drawing with an introduction to Auto CAD‖, Publishing Company Limited, (2008).
4. Basant Agarwal and Agarwal C.M., ¯Engineering Drawing‖, McGraw Hill, 2nd Edition, 2019.
5. Gopalakrishna K.R., ¯Engineering Drawing‖ (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition,2017.
6. Luzzader, Warren.J. and Duff, John M., ¯Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
7. Shah M.B., and Rana B.C., ¯Engineering Drawing‖, Pearson Education India,2nd Edition, 2009.

21UCS108	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To impart the concepts in problem solving for computing
- To familiarize the logical constructs of programming
- To illustrate programming in Python.

UNIT I	INTRODUCTION	9Hrs

Definition and basic organization of computers - classification of computers - Software - Types of software - types of programming paradigms - Translators: compiler and interpreter - Problem solving tools: Algorithms – Flowchart – Pseudo code.

UNIT II	INTRODUCTION TO PYTHON	9Hrs

Introduction to python - features of python - modes of working with python. Values and data types: numbers, Boolean, strings; variables, expressions, statements, tuple assignment, precedence of operators, comments – print function- conversion of algorithm in to program - Solving simple problems involving arithmetic computations and sequential logic to solve.

UNIT III	CONTROL CONSTRUCTS	9Hrs

Flow of execution - control structures: conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass – Solving problems involving decision making and iterations

UNIT IV	FUNCTIONS AND PACKAGES	9Hrs

Functions - function definition and use, flow of execution, parameters and arguments; parameters, local and global scope, function composition-Anonymous or Lambda Function, recursion -packages.

UNIT V	LISTS, TUPLES, DICTIONARIES AND STRINGS	9Hrs

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension - Strings: string slices; immutability, string functions and methods, string module

TOTAL: 45 Periods

After the successful completion of this course, the student will be able to
- Utilize problem solving tools in solving computing problems.(Apply)
- Solve mathematical expressions involving sequential logic in python.(Apply)
- Solve problems using python using decision structure and looping constructs.(Apply)
- Write modular programs using functions and packages .(Apply)
- Manipulate data using List, Tuples, Dictionaries and strings.(Apply)

TEXT BOOKS :

1. Ashok Namde v Kamthane & Amit Ashok Kamthane, ¯Problem solving and python programming‖, McGraw Hill Education, 2018 (copyright)
2. Anurag Gupta & G P Biswas, ¯Python Programming – Problem solving, packages and libraries‖, McGraw Hill Education, 2020 (copyright).

REFERENCE BOOKS:

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

21UCS107	PROBLEM SOLVING AND C PROGRAMMING (Common to ALL Branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C.

UNIT I	INTRODUCTION	8

Generation and Classification of Computers - Basic Organization of a Computer - Problem formulation - Problem Solving - Need for logical analysis and thinking – Algorithm - Pseudo code - Flow Chart.

UNIT II	C PROGRAMMING BASICS	9

Introduction to ‚C' programming – fundamentals – structure of a ‚C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‚C' – Managing Input and Output operations.

UNIT III	DECISION MAKING AND LOOPING STATEMENTS	10

if - if-else - nested if-else – else-if ladder statement – switch – goto - for- while – do-while – break – continue statements – Problem solving with decision making and looping statements.

UNIT IV	ARRAYS, STRINGS AND FUNCTIONS	9

Arrays - Initialization - Declaration - One dimensional and Two dimensional arrays - String - String operations - string arrays - Function - definition of function - Declaration of function - Parameter passing methods - Recursion - Storage classes - Problem solving with arrays, strings and functions.

UNIT V	POINTERS, STRUCTURES AND UNIONS	9

Pointers - Definition - Initialization - Pointers arithmetic - Pointers and arrays - Dynamic Memory allocation - Structure - need for structure data type - structure definition - Structure declaration - Structure within a structure - Union - Pre-processor directives.

TOTAL: 45Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the knowledge of arithmetic & sequential logic to solve problems related to mathematical expressions. (Apply)
- Analyze and identify suitable control constructs to provide solutions to computer applied complex engineering problems. (Evaluate)
- Apply the concept of pointers to solve complex engineering problems.(Apply)
- Formulate problems to provide solutions to computer applied complex engineering problems

using modularity.(Analyze)

- Apply the knowledge of permanent storage of data to solve computer applied complex engineering problems. (Apply)
- Design solutions for computer applied complex engineering problems that meet specified needs.(Create)

TEXT BOOKS :

1. Balagurusamy, E, ¯Programming in Ansi C‖,Eigthh Edition, Tats McGraw-Hill Publishing Company Limited, New Delhi, 2019.
2. Deitel and Deitel, ¯C How to Program‖, Pearson Education, New Delhi, 2011

REFERENCE BOOKS :

1. Yashavant P. Kanetkar. ¯ Let Us C‖, BPB Publications, 2011.
2. Kernighan.B.W ,Ritchie.D.M, ¯The C Programming language‖, Pearson Education,Second Edition, 2006.
3. Stephen G.Kochan, ¯Programming in C‖, Pearson Education India,Third Edition, 2005.
4. Anita Goel ,Ajay Mittal, ‖ Computer Fundamentals and Programming in C‖‖, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried, ‖ Programming with C ‖, Schaum's Outlines, Tata McGraw-Hill,Second Edition, 2006.
6. PradipDey, ManasGhosh, ¯Fundamentals of Computing and Programming in C‖, Oxford University Press, First Edition, 2009.

21UCS110	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :

- To familiarize with programming environment
- To familiarize the implementation of programs in Python

LIST OF EXPERIMENTS

Problems involve Sequential logic and Decision making

1. Write a Python program to process the mark processing system (Record has the following fields: Name, Reg_no, Mark1, Mark2, Mark3, Mark4, Total, average). Print the student details and find the total and average mark.

2. Write a Python program to compute the +2 Cutoff mark, given the Mathematics, physics and Chemistry marks. A college has decided to admit the students with a cut off marks of180. Decide whether the student is eligible to get an admission in that college or not.

3. A pizza in a circular shape with 8 inches and which is placed in a square box whose side length is 10 inches. Find how much of the box is ¯empty‖?

4. A person owns an air conditioned sleeper bus with 35 seating capacity that routes between Chennai to Bangalore. He wishes to calculate whether the bus is running in profit or loss state based on the following scenario:

   Amount he spent for a day for diesel filling is: Rs. 15,000

   Amount he spent for a day for Driver and cleaner beta is: Rs. 3,000Ticket

   amount for a Single person is Rs: 950

   If all the seats are filled, what would be the result?

   If only 15 seats are filled, what would be the result?

5. Consider the person ̱X' has some amount in his hand and the person ̱Y' has some amount in his hand. If they wish to exchange the amount among them, how they can exchange the amount by using the third party ̱Z'.

Problems involve iterations

6. A man is blessed with a duck that can lay golden eggs. First day it lays one egg, in second day it lays two eggs, in third day it lays three eggs, and it continues to lay eggs in an incremental manner day by day. Now calculate how many golden eggs that duck lays till ̱n'th day.

7. Four People A,B,C,D are sitting in a Circular arrangement. In how many ways their seating can be arranged.

8. The Greek theater shown at the right has 30 seats in the first row of the center section. Each row behind the first row gains two additional seats. How many seats are in the 5th row in the center section?

Problem involve functions and recursive functions

9. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle. (Recall from the Pythagoras theorem that in a right triangle, the square of one side equals the sum of the squares of other two sides)

10. A game has to be made from marbles of five colors, yellow, blue, green, red and Violet where five marbles has to be kept one upon another. Write a python program using recursion, to find how many ways these marbles can be arranged.

11. Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

Here is a high-level outline of how to move a tower from the starting pole, to the goal pole, using an intermediate pole:

1. Move a tower of height-1 to an intermediate pole, using the final pole.
2. Move the remaining disk to the final pole.
3. Move the tower of height-1 from the intermediate pole to the final pole using original pole

Problems involve List and Nested List

12. In a class of 50 numbers of students, 6 students are selected for state cricket academy. Sports faculty of this school has to report to the state cricket academy about the selected students' physical fitness. Here is one of the physical measures of the selected students'; Height in cm is given for those 6 selected students [153,162,148,167,175,151]. By implementing functions, do the following operations.

   (i)   State academy selector has to check whether the given height is present in the selected students list or not.
   (ii)   State academy selector has to order the height of students in an incremental manner.
   (iii) State academy selector has to identify the maximum height from the list.

Problems involve Dictionary and Tuples

   Dictionary

13. A university wishes to create and maintain the details of the students such as Rollno, Regno, Name, Dept, Batch, Contact_no, Nativity(Indian/NRI) as key value pairs. Do the following operations:
   (i) Display the complete student details on giving Rollno as input.
   (ii) Display the complete student details whose nativity belongs to NRI.
   (iii) Display the complete student details whose department is CSE.

Tuples

14. A librarian wishes to maintain books details such as ISBN, Book Name, Author Name, Year published, Publisher Name. He wishes to retrieve the book details in the following scenario:
   (i)   Retrieve the complete details of the book on giving ISBN.
   (ii) Retrieve the details of the book which published after the year 2015.
   (iii) Retrieve the details of the book whose author name is 'Andrew'.
   (iv) Retrieve the details of the book that name of the book is 'Python'

Problems involve Strings

15. A musical album company has 'n' number of musical albums. The PRO of this company wishes to do following operations based on some scenarios:
   (i)   Name of the album starts with 's' or 'S'.
   (ii) (ii) Name of the album which contains 'jay' as substring.
   (iii) Check whether the album name presents in the repository or not.
   (iv)Count number of vowels and consonants in the given album name.

TOTAL: 45 Periods

After the successful completion of this course, the student will be able to
   • Formulate algorithms for simple problems and translate the algorithms to a working program

(Apply)
- Formulate algorithms and programs for arithmetic computations and sequential logic.(Apply)
- Write iterative programs using control constructs.(Apply)
- Develop programs using functions, packages and use recursion to reduce redundancy.(Apply)
- Represent data using lists, tuples, dictionaries and manipulate them through a program.(Apply)

HARDWARE AND SOFTWARE REQUIRMENTS

- **HARDWARE REQUIRMENTS**
  LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS

- **SOFTWARE REQUIRMENTS**
  OS – UNIX CLONE **(License free Linux)**
  EDITOR – IDLE

21UCS111	PROBLEM SOLVING AND C PROGRAMMING LABORATORY (COMMON TO ALL BRANCHES)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :

- Familiarize with programming environment
- Familiarize the implementation of programs in C

LIST OF EXPERIMENTS

- **Familiarization with Integrated Development Environment (IDE)**(Compile, Debug)
- **Problems involve arithmetic computations and sequential logic**
  1. Write a program to calculate the slope of a line.
  2. Write a program to convert polar coordinates to Cartesian coordinates
  3. A cylindrical can with radius of 10cm and height of 20cm is packed in a rectangular box with length, width, and height as 20cm. What is the volume of empty space between the can and the box? Write a simple C program to implement the above scenario.
  4. Write a C program to evaluate the net salary of an employee given the following Constraints:
     - DA : 12% of Basic salary
     - HRA : 20% of Basic salary
     - TA : 15% of Basic salary
     - Tax cuts - a) PF :14% of Basic salary and b) IT: 15% of Basic salaryNet
     - Salary = Basic Salary + DA + HRA + TA- (PF + IT)

Problems involve decision making
  5. Design a calculator to perform the arithmetic operations.
  6. Develop a program in C to calculate and print the Electricity bill of a given customer. The customer id., name and unit consumed by the user should be taken from the keyboard and display the total amount to be paid by the customer.

Unit	Charge/unit
upto 199	@1.20
200 and above but less than 400	@1.50
400 and above but less than 600	@1.80
600 and above	@2.00

   If bill exceeds Rs. 400 then a surcharge of 15% of bill amount will be charged and the minimum bill should be of Rs. 100/-

  7. A weather forecasting agency would like to intimate the people about the current temperature with the proper climatic message. Develop a C program to read temperature in centigrade and display a suitable message according to temperature state below :
     - Temp < 0 then Freezing weather
     - Temp 0-10 then Very Cold weather
     - Temp 10-20 then Cold weather
     - Temp 20-30 then Normal in Temp
     - Temp 30-40 then Its Hot
     - Temp >=40 then Its Very Hot

- **Problems involve iterations**
  8. A supermarket manager wishes to keep some toys and puzzle games to enable the customers to manage their kids during the purchase time. He kept a machine called ¯Fortune Teller machine‖, it replies the kid with some fortune message if he enters the palindrome number. It replies with ¯try

again later‖ if the kid failed to input a valid palindrome number.
Write a C program to help the manager to run the ‾Fortune Teller Machine‖ perfectly.

- **Problems involve 1D arrays**
  9. Given an array of integers, compute the maximum value for each integer in the index, by either summing all the digits or multiplying all the digits. (Choose which operation gives the maximum value)

    Input:5120 24 71 10 59Output:3 8 8 1 45

  10. Given below is the list of marks obtained by a class of 20 students in an annual examination.

    43 65 7 24 87 90 19 39 58 75 67 87 90 92 14 78 82 99 56 89

    Write a program to count the number of students belonging to each of following groups of marks: 0-9,10-19,20-29, ,100.

- **Problems involve 2D arrays**
  11. Write a C program to input a set of integer numbers, count and sum the positive numbers and the negative numbers then print the count and sum of all positive numbers and negative numbers.

- **Problems involve structures**
  12. A librarian wishes to maintain the details of the books such as bookid, bookname, authorname, yearofpublish, price. And he can do the following operations:
      a. He can retrieve the specific book details by giving bookid as an input.
      b. He can retrieve all the book details of specific author.
      c. He can retrieve all the book details by giving year of publish as an input.
      Develop a C program to accomplish the librarian tasks.

- **Problems involve functions**
  13. As a Developer, you are designated to develop a simple ATM application which does the following operations:
      a. Customer can deposit the amount.
      b. Customer can withdraw the amount after checking the minimum balance of Rs. 2,000.
      c. Customer can know the balance amount.
      Write a C program to implement the ATM application.

- **Problems involve recursive functions**
  14. Maisy is working the counter at Shmaskin Robbins. A hungry customer orders a triple scoop ice cream cone with strawberry, chocolate, and vanilla ice cream. How many different ways could she stack the ice cream flavors on top of each other? Write a   program to implement the above scenario using recursive functions.

TOTAL: 30 Periods

After the successful completion of this course, the student will be able to

- Write programs to solve problems involving computations. (Apply)

- Provide modular solution to complex problems to reduce redundancy and to improve code reuse.(apply)

- Access data stored in secondary storage in sequential and random manner.(apply)

Design solutions for computer applied complex engineering problems that meet specified needs. (create)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS

SOFTWARE

OS – UNIX CLONE (LICENSE FREE LINUX)

COMPILER – C

21UGS113	BASIC SCIENCES LABORATORY I	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:
- To create scientific Temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments
- To impart knowledge on basic concepts in applications of chemical analysis
- Train the students to handle various instruments.
- To acquire knowledge on the chemical analysis of various metalions.

PHYSICS LABORATORY

LIST OF EXPERIMENTS
1. Laser – Determination of particle size and wavelength of Laser source. using Diode Laser.
2. Ultrasonic Interferometer - Determination of velocity of sound in liquid and compressibility of liquid.
3. Poiseuille's method - Determination of Coefficient of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Air Wedge method - Determination of thickness of a thin wire.
6. Uniform bending method - Determination of Young's modulus of the given rectangular beam.

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS
1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid
2. Conductometric Titration of strong acid with strong base
3. Conductometric Titration of Mixture ofAcids
4. Estimation of Iron by Potentiometry
5. Determination of Strength of given acid using pH metry
6. Determination of molecular weight of polymer by Viscometry
7. Comparison of the electrical conductivity of two samples- Conductometric method
8. Estimation of copper in brass by EDTA method
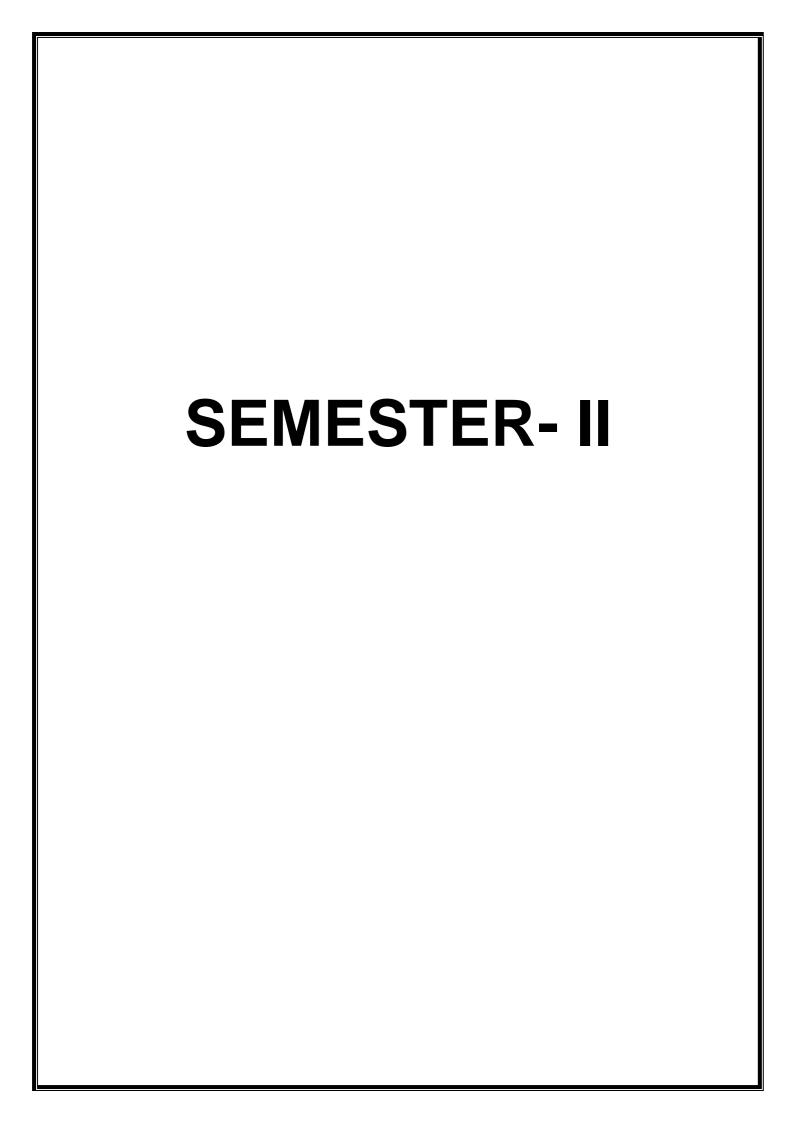
TOTAL : 30 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the principles of Optics, Laser physics and Mechanics to determine the Engineering properties of materials. (Apply)
- Analyze the given liquid sample to determine the viscosity and compressibility of the liquid. (Analyze)
- Apply the principles of spectroscopy to determine the properties of materials. (Apply)
- Apply the knowledge of Molarity and Normality to prepare standard solution for chemical analysis. (Apply)

- Apply the knowledge of electrochemical techniques to study various ions present in the industrial effluents. (Apply)
- Analyze the given solution quantitatively using titration.(Analyze)

A minimum of FIVE experiments shall be offered for every course
Laboratory classes on alternate weeks for Physics and Chemistry

SEMESTER- II

SEMESTER II

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UEN201	HS	Communication Skills for Professionals (Common to ALL, except CSBS)	1	0	1	1.5
21UMA210	BS	Differential Equations, Fourier Series and Transforms (Common to AI & DS,CSD)	3	1	0	4
21UPH205	BS	Physics for Information Science (Common to CSE, EEE, IT, AI&DS, CSD)	3	0	0	3
21UCS204 / 21UCS203	ES	Programming Using C (Common to CSE, CSD) / Programming Using Python (Common to CSE, CSD)	3	0	0	3
21UCD205	ES	Digital and Computer Organization	3	0	0	3
PRACTICAL COURSES						
21UGS210	BS	Basic Sciences Laboratory - II (Common to CSE, CSD)	0	0	2	1
21UCS211 / 21UCS212	ES	C Programming Laboratory (Common to CSE, CSD) / Python Programming Laboratory (Common to CSE, CSD)	0	0	3	1.5
MANDATORY COURSE						
21UGM231	MC	Environmental Science	3	0	0	P/F
TOTAL			16	1	6	17
Total No. of Credits – 17						

21UEN201	COMMUNICATION SKILLS FOR PROFESSIONALS	L	T	P	C
		1	0	1	1.5

PRE-REQUISITE:

COURSE OBJECTIVES :
- To improve the communication skills
- To develop the public speaking skills
- To develop their confidence and ability to speak in public
- To develop the leadership capacity

UNIT I	ERROR FREE LANGUAGE	3 Hrs

Parliamentary English words, Pronounce the words with stress, Words often confused. Finding Common Errors

UNIT II	LUCID WRITING	3 Hrs

Principles of Communicative English, Business Letters, Writing Technical Proposal

UNIT III	INDIVIDUAL AND TEAMWORK	3 Hrs

Creative Writing- Writing Paragraph, Dialogue Writing (Various situations), Rearrange the jumbled sentences

UNIT IV	LIFE SKILLS	3 Hrs

Professional Ethics, Code of Conduct, Relative Clauses

UNIT V	INTERPERSONAL SKILLS	3 Hrs

SWOT Analysis & Life Positions

TOTAL : 15 Periods

5 Oral Projects

Project 1: SELF INTRODUCTION&DELIVER A SPEECH BEFORE AUDIENCE (Time: 5 to 7 minutes)

- Speak in front of an audience with courage.
- Make your message clear, with supporting material.
- Create a strong opening and conclusion.

Project 2: SPEAK ON THE CHOSEN CONTENT (Time: 5 to 7 minutes)

- Select a general topic and bring out specific purposes.
- Avoid using notes.
- Use symbolic ideas to develop your ideas.

Project 3: USE EFFECTIVE BODY LANGUAGE& INTONATION(Time: 5 to 7 minutes)

- Use appropriate posture, gestures, facial expressions and eye contact to express your ideas.
- Use proper intonation and adequate speech module.

Project 4: PRESENT YOUR TOPIC WITH VISUAL AIDS (Time: 5 to 7 minutes)

- Persuade your points with suitable illustration, specific facts, examples
- Use suitable visual aids to present your topic with confidence.

Project 5: GRASP THE ATTENTION OF THE AUDIENCE (Time: 5 to 7 minutes)
- Influence your listeners by adopting holistic viewpoint.
- Use emotions, stories, and positive quotes in your speech.

Total Lecture Hours=15
Total Hours =15+15= 30 Hours

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Communicate orally with fluency and clarity in a given contextual situation. (Responding A2)
- Adapt them to work in a group as a member or leader for effectively executing the task. (Organizing A4)
- Write language appropriately without error in any given circumstances. (Responding A2)
- Communicate information ideas and opinions in any given situations. (Responding A2)
- Present the ideas creatively with coherence for given topic. (Organizing A4)

REFERENCE BOOKS:

1. Competent Communication- A Practical Guide to becoming a better speaker, Toastmasters International, USA.
2. Raman, Meenakshi, Sangeetha Sharma, Business Communication, New Delhi, Oxford University Press, 2014.
3. Norman Lewis - Word Power Made Easy, Pocket Book Publication, 2019.

21UMA203	DIFFERENTIAL EQUATIONS, FOURIER SERIES AND TRANSFORMS	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :

- To make the student knowledgeable in formulating certain practical problems in terms of ordinary and partial differential equations, solve them and physically interpret the results.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.
- To familiarize the students to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them numerically and interpret the results.

UNIT I	DIFFERENTIAL EQUATIONS	9+3 Hrs

Ordinary differential equations: Second order equation - Complementary solution - Particular integral: Operator Method – Homogenous equation of Euler's and Legendre's type; Partial differential equations: Formation – Solutions of first order equations – Standard types – Singular solutions – Lagrange's Linear equation – Classification of Partial Differential Equations – Solution of linear equations of higher order with constant coefficients

UNIT II	LAPLACE TRANSFORM	9+3 Hrs

Existence conditions – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function, impulse function and periodic function - Inverse Laplace transform - Convolution theorem (excluding Proof) - Application to Solution of linear ODE of second order with constant coefficients.

UNIT III	Z-TRANSFORM AND DIFFERENCE EQUATIONS	9 +3 Hrs

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations - Solution of difference equations.

UNIT IV	FOURIER SERIES	9 +3 Hrs

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic analysis - Application of Fourier series - Gibb's Phenomenon.

UNIT V	FOURIER TRANSFORM	9+3 Hrs

Fourier integral theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application of Fourier Transform

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to

- Apply the knowledge of higher order ordinary and partial differential equations in real life engineering problems. (CO1) AP – K3
- Apply the knowledge of Laplace transform and solve the problems with periodic function, inverse transform of convoluted function and Ordinary Differential Equation. (CO2) AP - K3
- Apply the acquired knowledge of Z transform and its properties inverse Z transform and difference equations. (CO3) AP – K3

- Apply the knowledge of Fourier series for the given function or discrete data and compute the Periodic function arising in the study of engineering problems. (CO4) AP – K3
- Apply the knowledge of Fourier transform and its properties which are used to transform signals between time and frequency domain. (CO5). AP – K3
- Understand the basic concept of periodic, non-periodic function and nature of partial differential equation. (CO6) U-K2

TEXT BOOKS:

1. GREWAL B.S, ¯Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 42nd Edition, (2012).

2. BALI N.P., MANISH GOYAL and WATAINS, ¯Advanced Engineering Mathematics‖, Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).

3. VEERAJAN.T, ¯Higher Engineering Mathematics‖, Yes Dee Publishing Pvt. Limited, 2015.

REFERENCE BOOKS:

1. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, S.Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

2. RAMANA.B.V, ¯Higher Engineering Mathematics‖ Tata McGraw Hill, New Delhi, 11th Reprint (2010).

3. GLYN JAMES, ¯Advanced Modern Engineering Mathematics‖, Pearson Education, New Delhi, 3rd Edition, (2007).

4. ERWIN KREYSZIG, ¯Advanced Engineering Mathematics‖, Wiley India, 10th Edition, (2011).

21UGM231	ENVIRONMENTAL SCIENCE	L	T	P	C
		3	0	0	0

PRE-REQUISITE:

COURSE OBJECTIVES :

- To explain the concepts of Environment ecosystem and Pollution.
- To impart the environmental issues in the society and the impact of environment related to human health.
- To describe the knowledge in alternative energies.

UNIT I	ENVIRONMENT AND ECOSYSTEMS	9

Definition, scope and importance of environment - Need for public awareness - Concept of ecosystem-Structure and function of ecosystem – Producers, consumers and decomposers-Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Aquatic ecosystems (c) Grassland ecosystem.

UNIT II	ENVIRONMENTAL POLLUTION	9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution- pollution case studies - Role of an individual in prevention of pollution -Disaster management: floods, earthquake, cyclone and landslides.

UNIT III	SOCIAL ISSUES AND THE ENVIRONMENT	9

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Environmental laws/Acts, (EPA).

UNIT IV	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth, variation among nations - Population explosion - Human rights - Family welfare programme – Environment and Human Health – Human Rights-Value education – HIV / AIDS – Women and child welfare - Role of information technology in environment and human health.

UNIT V	FUTURE POLICYAND ALTERNATIVES	9

Introduction to future policy and alternatives-fossil fuels-nuclear energy-solar energy-wind energy - hydroelectric energy-geothermal energy - tidal energy – sustainability - green power-nanotechnology.

Total: 45 Periods

==COURSE OUTCOMES==**:**
After the successful completion of this course, the student will be able to
- CO1: Explain the environmental issues, consequences and suitable solution. (Understand-K2)
- CO2: Explain the various types of renewable energy sources for sustainable development of natural resources (Understand-K2)
- CO3: Apply the principles of value education with respect to human population to preserve environment (Apply-K3)
- CO4: Apply the knowledge of various pollution types to prevent the ecosystem and Environment (Apply-K3)
- CO5: Analyze the environmental problem to report the social issues and provide sustainable solution. (Analyze-K4)

- CO6: write a report on environmental issues and provide solution for sustainable development (Respond-A2)

TEXT BOOKS:

1. Anubha Kaushik, kaushik C.P., ‾Environmental Science and Engineering‖, Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph ‾Environmental Science and Engineering‖, Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, ‗Introduction to Environmental Engineering and Science', Pearson Education, Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science‖, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., ‾Environmental Chemistry‖, Wiley Eastern Ltd., New Delhi,2001. Trivedi R.K., Goel P.K., ‾Introduction to Air Pollution‖, Techno-Science Publication, Jaipur,2005.

21UPH205	PHYSICS FOR INFORMATION SCIENCE (COMMON TO EEE, AI&DS, CSD, CSE & IT BRANCHES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To introduce the essential principles of physics for information science and related Engineering applications.
- To demonstrate the concepts of conduction in conductors.
- To enable the students to understand the dielectric and magnetic materials.
- To apply fundamental knowledge in the area of fiber optics.

UNIT I	CONDUCTING MATERIALS	9

Introduction - Conduction in metals-mobility and conductivity – classical free electron theory of metals – merits and demerits- Electrical and thermal conductivity (derivation)– Wiedemann – Franz law – Lorentz number – Fermi distribution function - Effect of temperature on Fermi function - Density of energy states - carrier concentration in metals.

UNIT II	TRANSPORT PROPERTIES OF SEMICONDUCTORS	9

Introduction - Properties -Types of semiconductor -Electron and hole concentration -Intrinsic Carrier Concentration-Expression for electrical conductivity of a semiconductor - Band gap determination-Hall effect and its applications.

UNIT III	MAGNETIC AND DIELECTRICS MATERIALS	9

Introduction – Classification of magnetic materials - Domain theory - Hysteresis - soft and hard magnetic material - Ferrites - Magnetic storage devices - hard disc - compact disc - RAM – ROM - Applications - Introduction - Types of polarization - Dielectric loss - Dielectric breakdown - Capacitor and its types – Applications

UNIT IV	OPTICAL PROPERTIES	9

Introduction - Optical properties of metal , insulator and semiconductor - Liquid crystal - LCD and its phases - Light Emitting Diode - Diode Laser – Solar cell – Detector.

UNIT V	FIBRE OPTIC COMMUNICATION	9

Introduction- Principle and propagation of light in optical fibres – Numerical aperture and acceptance angle - Types of optical fibre – Attenuation - Fibre optic communication systems (Block diagram) - Fibre optic sensors -Temperature and pressure sensor - Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to

- Summarize the importance of free electrons in determining the properties of metals, semiconductors and dielectric materials (Understand)
- Interpret the characteristics of conducting materials and semiconducting materials in terms of band gap and charge carriers (Analyze)
- Apply the concept of spin and orbital motion of electrons in determining magnetic properties of materials and concept of polarization in dielectric materials having specific engineering applications. (Apply)

- Apply the principle of Laser in optical fiber communication (Apply)
- Analyze the structural behaviour and properties of conducting, semiconducting and magnetic Materials to select suitable material for industrial application. (Analyze)
- Illustrate the strategies of magnetism and fiber optics to facilitate and to solve the engineering problems (Apply)

TEXT BOOKS:

1. William D. Callister, Jr. ⁻Material Science and Engineering‖, Seventh Edition, John Wiley & Sons Inc. New Delhi, 2015
2. Dr. Mani.P, ⁻Engineering Physics II ‖, Dhanam Publications, Edition ,2018, Chennai
3. Rajendran.V, ⁻Engineering Physics‖, Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition 2016.

REFERENCE BOOKS:

1. Raghuvenshi G.S., ⁻Engineering Physics‖, PHI Learning Private Limited, New Delhi, Revised Edition 2014.
2. Arul doss .G., ⁻Engineering Physics‖, PHI Learning Limited, New Delhi, Revised Edition 2013.
3. Marikani .A., ⁻Engineering Physics‖, PHI Learning Private Limited, New Delhi, Revised Edition 2012.
4. Sankar B.N., and Pillai .S.O., ⁻Engineering Physics – I‖, New Age International Publishers Private Limited, New Delhi, Revised Edition 2015.

21UCS204	PROGRAMMING USING C (COMMON TO CSE & CSD)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To familiarize the programming constructs of C
- To explain the concepts of arrays, functions, pointers, structures in C
- To explain the concepts of file

UNIT I	INTRODUCTION TO C	9Hrs

Introduction to C language - Structure of C program - Character set - token - identifiers – reserved words – Comments - data types – constants – printf() function - variables – scanf() function - operators - expression - declaration statement - assignment statement - conversion of algorithm in to program – Solving simple problems involving arithmetic computations and sequential logic to solve.

UNIT II	C PROGRAMMING CONSTRUCTS	9Hrs

Flow of execution – branching constructs: if, if – else, else if ladder, switch, break – looping constructs: while, do. While, for, break and continue - Solving problems involving decision making and iterations

UNIT III	ARRAYS AND POINTERS	9Hrs

Array definition - one dimensional array declaration - initialization - accessing elements - Solving problems using 1D array manipulation - two dimensional array declaration - initialization - accessing elements - Solving problems for matrix manipulation, and string manipulation Pointers: Declaration - Referencing and Dereferencing - Solving problems of string handling.

UNIT IV	STRUCTURES,UNION AND FUNCTIONS	9Hrs

Structures and Union: Definition - variable declaration - initialization - accessing members - Solving problems using structures and union - pointer to structures - self-referential structures - notion of linked list (without implementation) - Functions: definition - prototype - function call - functions with arguments and without arguments - Parameter passing methods - recursive functions - Solving problems using non-recursive and recursive functions.

UNIT V	FILE PROCESSING	9Hrs

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files - Command line arguments

TOTAL: 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Explain the basic C programming constructs. (Understand)
- Apply the concepts of programming constructs to solve problems related to mathematical expressions. (Apply)
- Apply the advanced concepts o C language to solve complex engineering problems.(Apply)

- Identify the suitable control constructs to provide solutions to computer applied complex engineering problems. (Analyze)
- Develop solutions for computer applied complex engineering problems that meet specified needs.(Create)
- Work individually or in teams and communicate effectively to justify the solution for real world scenario based on C programming principles. (Affective domain)

TEXT BOOKS :

1. Balagurusamy, E, ̄Programming in Ansi C‖, Eighth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2019.
2. Deitel and Deitel, ̄C How to Program‖, Pearson Education, New Delhi, 2011

REFERENCE BOOKS :

1. Yashavant P. Kanetkar. ̄Let Us C‖, BPB Publications, 2011.
2. Kernighan.B.W, Ritchie.D.M, ̄The C Programming language‖, Pearson Education, Second Edition, 2006.
3. Stephen G.Kochan, ̄Programming in C‖, Pearson Education India, Third Edition, 2005.
4. Anita Goel , Ajay Mittal, ̄Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried,‖ Programming with C‖, Schaum's Outlines, Tata McGraw-Hill, Second Edition, 2006.
6. Pradip Dey, Manas Ghosh, ̄Fundamentals of Computing and Programming in C‖, Oxford University Press, First Edition, 2009.

21UCD205	DIGITAL AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational and sequential digital circuits using logic gates.
- To familiarize the components of computer system and instructions
- To discuss in detail the operation of the arithmetic unit.
- To give knowledge on memory and I/O systems.

UNIT I	DIGITAL FUNDAMENTALS	9

Number Systems – Decimal, binary, Octal, Hexadecimal, 1's and 2's complements, Codes- Binary, BCD, Excess3, Gray, Alphanumeric codes, Boolean theorms, Logic gates, Universal gates, Sum of products and Product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine McCluskey method of minimization.

UNIT II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9

Design of Half and Full Adders, Half and Full Subtractors--Multiplexer, Demultiplexer,-Decoder, Encoder- Flip flops- SR,JK,T,D, Master/Slave FF- Registers - Shift Registers - Binary Counters

UNIT III	OVERVIEW AND INSTRUCTIONS	9

Components of a computer system - Basic Operational Concepts - operations and operands - representing instructions- Logical operations - control operations – Instruction and instruction sequencing - Addressing and addressing modes

UNIT IV	ARITHMETIC OPERATIONS AND PIPELINING	9

ALU - Addition and subtraction of signed numbers - Multiplication of unsigned and signed numbers - Fast Multiplication - Integer division - Floating point numbers and operations. Pipelining – Data hazards – Instruction Hazards – Superscalar Operation

UNIT V	MEMORY AND I/O SYSTEMS	9

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs- Memory Management Requirements - Input/output system, DMA and interrupts, Buses.

TOTAL: 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Design circuits to provide solutions for engineering problems. **(Apply)**
- Develop a digital system for the given application to meet the functional requirements. **(Create).**

- Apply the knowledge of instructions and addressing modes to solve the real world problem.**(Apply)**
- Solve the arithmetic operations in arithmetic logic unit for signed and unsigned numbers. **(Apply).**
- Apply the knowledge of hazards to improve the pipelining performance. **(Apply)**
- Describe the different types of memory and I/O systems. **(Understand)**

TEXT BOOKS:

1. M. Morris Mano, ‾Digital Logic and Computer Design‖, Pearson Education, 4th Edition, 2016.

2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ‾Computer Organization‖, Fifth Edition, Tata McGraw Hill, 2002.

REFERENCE BOOKS:

1. A. Kumar, ‾Fundamentals of Digital Circuits‖, Prentice Hall India, 2016.
2. R.P. Jain, ‾Modern Digital Electronics‖, McGraw Hill Education, 2009.
3. David A. Patterson and John L. Hennessey, ‾Computer organization and design the hardware / software interface', Morgan Kauffman / Elsevier, Fifth edition, 2014.
4. William Stallings ‾Computer Organization and Architecture‖, Seventh Edition, Pearson Education, 2006.
5. Govindarajalu, ‾Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.

21UGS210	BASIC SCIENCES LABORATORY II	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:
- To analyze the Band gap, moment of inertia, thermal conductivity and rigidity modulus of the materials.
- To gain knowledge in PHOTONICS.
- Apply the theoretical concepts to perform lab experiments.
- To assess the water quality parameters.
- To acquire knowledge on water quality parameters for the analysis of industrial effluents.

PHYSICS LABORATORY

LIST OF EXPERIMENTS

1. Determination of Energy band gap of a semiconductor.
2. Torsion pendulum – Determination of Moment of inertia of a metallic disc and rigidity modulus of a given metallic wire.
3. Spectrometer - Determination of wavelength of mercury spectrum using grating.
4. Laser – Determination of numerical aperture and acceptance angle of an optical fiber
5. Newton's rings – Determination of radius of curvature of a convex lens
6. Lee's Disc - Determination of thermal conductivity of a bad conductor.
7. Determination of Solar cell Characteristics using optical transducers kit.
8. Digital Logic gates (Virtual Lab)

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of Chloride in water sample (Argentometric method)
4. Determination of DO in water
5. Estimation of chromium in tannery wastes
6. Estimation of available chlorine in bleaching powder
7. Estimation of iron by Spectrophotometry.
8. Determination of acidity of industrial effluents.

TOTAL : 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the principles of Optics, Light, and Elasticity to determine the Engineering properties of materials.(Apply)
- Analyze the thermal conductivities of different bad conductors. (Analyze)
- Analyze the characteristics of a Semiconductor. (Analze)
- Determine the energy gap and specific resistance of the given material.(Understand)
- Test and analyze the water quality parameters for the given sample. (Analyze)

A minimum of FIVE experiments shall be offered

21UCS211	C PROGRAMMING LABORATORY (COMMON TO CSE & CSD)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :
- Familiarize with programming environment
- Familiarize the implementation of programs in C

LIST OF EXPERIMENTS

- **Familiarization with Integrated Development Environment (IDE)**(Compile, Debug)
- **Problems involve arithmetic computations and sequential logic**
  1. Write a program to calculate the slope of a line, given the data for coordinates of the end points of the line.
  2. Write a program to convert polar coordinates to Cartesian coordinates
  3. Write a program to compute the volume of a cylinder with diameter d and height h and print diameter, height and the volume.
- **Problems involve decision making**
  1. Design a calculator to perform the following operations addition, subtraction, multiplication, division
  2. Write program to find the given year is leap year or not
- **Problems involve iterations**
  1. printing simple series,
  2. Fibonacci sequence
- **Problems involve 1D arrays**
  1. Design an one dimensional array with height of the person and find how many persons are above the average height
  2. Write a program to input a set of integer numbers, count and sum the positive numbers and also count and sum the negative numbers then print the count and sum of all positive numbers and negative numbers.
- **Problems involve 2D arrays**
  1. Design a two dimensional array with height and weight of the persons and compute the body mass index of individuals.
  2. Write a program to multiply two matrices
- **Problems involve structures**
  1. Generate salary slip of an employee and print the salary details of an employee whose first name is ¯aaa‖.
  2. Compute internal marks of students for five different subjects
- **Problems involve functions**
  1. Write a program to check the given number is prime or not using function
  2. From a given paragraph perform the following using inbuilt in functions
     a. Find the total number of words
     b. Capitalize the first word of each sentence
     c. Replace a given word with another word
- **Problems involve recursive functions**
  1. Find the GCD of the given number
- **Problems with File concepts**

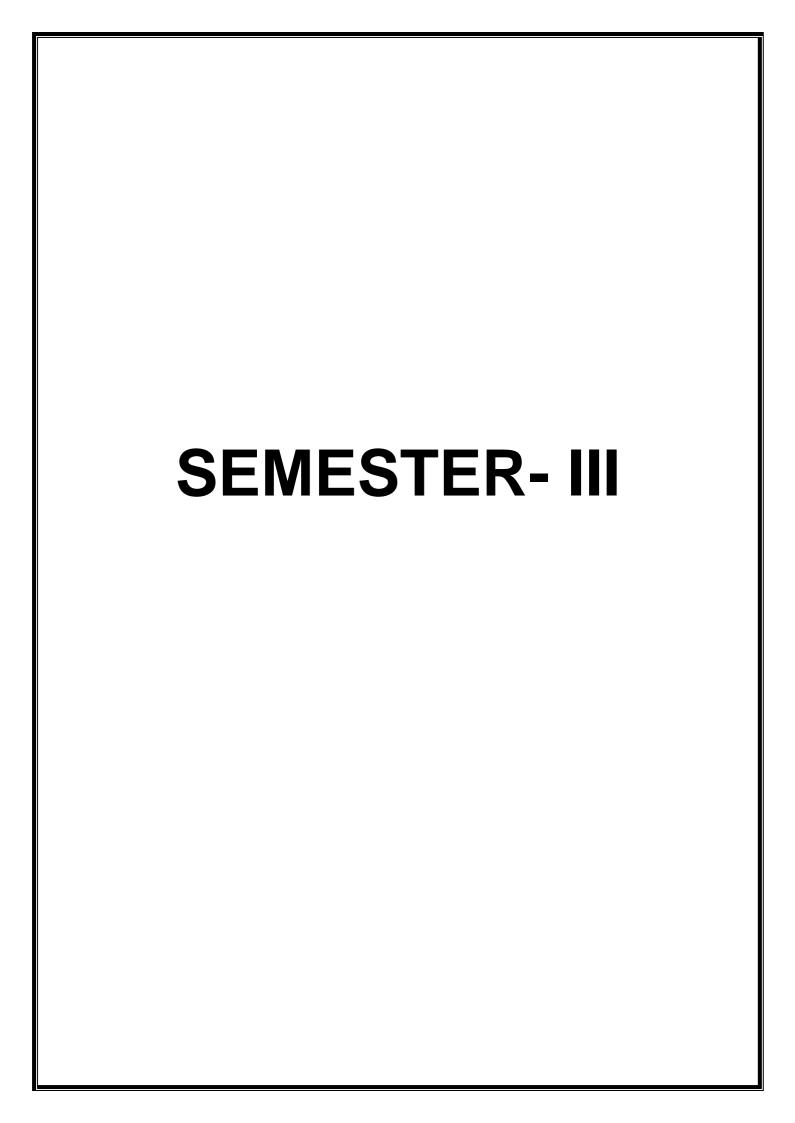1. Insert, update, delete and append telephone details of an individual's using file

TOTAL: 45 Periods

After the successful completion of this course, the student will be able to
- Write programs to solve problems involving computations. (Apply)
- Provide modular solution to complex problems to reduce redundancy and to improve code reuse.(Apply)
- Access data stored in secondary storage in sequential and random manner. (Apply)
- Design solutions for computer applied complex Engineering Problems that meet specified needs. (Create)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS
- HARDWARE
- LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS
- SOFTWARE
- OS – UNIX CLONE (LICENSE FREE LINUX)
- COMPILER – C

SEMESTER- III

SEMESTER III

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UMA328	BS	Discrete Mathematics (Common to AI& DS,CSD)	3	1	0	4
21UIT302	PC	Data Structures (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UCS303	PC	Object Oriented Programming using C++ (Common to CSE, IT, CSBS, CSD)	3	0	2	4
21UIT304	PC	Principles of Operating Systems (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UCD305	ES	Design Thinking	3	0	0	3
21UCD306	PC	Database System Design (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
PRACTICAL COURSES						
21UIT307	PC	Data Structures Laboratory (Common to CSE, IT, AI&DS, CSD)	0	0	2	1
21UCD308	PC	Database System Design Laboratory (Common to CSE, IT, AI&DS, CSD)	0	0	2	1
MANDATORY COURSE						
21UGM331	MC	Biology for Engineers	2	0	0	P/F
TOTAL			20	1	6	22
Total No. of Credits – 22						

21UMA328	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :
- To make the student acquire sound knowledge to test the logic of program.
- To familiarize the student to be aware of generating functions.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I	LOGIC AND PROOF METHODS	9+3 Hrs

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested Quantifiers - Rules of inference - Introduction to Proofs - Proof Methods and Strategy.

UNIT II	COMBINATORICS	9+3 Hrs

Permutations and Combinations - Mathematical inductions - Strong induction and well ordering - The basics of counting – The pigeonhole Principle – Recurrence relations – Solving Linear recurrence relations - Generating functions - Inclusion and exclusion and applications.

UNIT III	ALGEBRAIC STRUCTURES	9+3 Hrs

Algebraic systems - Semi groups and Monoids - Groups - Subgroups and Homomorphisms - Cosets and Lagrange's theorem - Ring & Fields - Vector Spaces (Definitions and examples).

UNIT IV	GRAPHS	9+3 Hrs

Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths

UNIT V	LATTICES AND BOOLEAN ALGEBRA	9+3 Hrs

Partial Ordering – Posets – Lattices as Posets – Properties of Lattices – Lattices as Algebraic Systems - Sub Lattices - Direct Product And Homomorphism - Some Special Lattices - Boolean Algebra.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Apply logical structure of proofs and work symbolically with connections and quantifiers to produce logical value, correct and clear argument. (CO1) AP – K3
- Apply the knowledge of induction hypotheses and the principle of basic counting, pigeonhole principle and solving, linear Recurrence relations, generating functions.(CO2) AP - K3
- Apply the knowledge of set with the operations for groups, rings and fields using elementary properties if necessary. (CO3) AP – K3
- Apply the acquired knowledge of graph models and their connectivity, traversability in solving real world problems. (CO4) AP – K3
- Apply the significance of algebraic structural ideas used in coding theory and cryptography. (CO5) AP – K3
- Understand the knowledge of validity of the logical arguments, mathematical proofs and correctness of the algorithm. (CO6) U – K2

TEXT BOOKS:

1. KENNETH H.ROSEN, ¯Discrete Mathematics and its Applications‖, Special Indian Edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 5th Edition, (2008).
2. TREMBLY J.P and MANOHAR R, ¯Discrete Mathematical Structures with Applications to Computer Science‖, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 35th Re-print, (2008).
3. Thomas Koshy,‖ Discrete Mathematics with Applications‖, Elsevier Publications, Boston, 2004

REFERENCE BOOKS:

1. RALPH. P. GRIMALDI, ¯Discrete and Combinatorial Mathematics: An Applied Introduction‖, Pearson Education, New Delhi, 4th Edition, (2002).
2. TAMILARASI.A, and NATARAJAN.A.M, ¯Discrete Mathematics and its Applications‖, Khanna Publishers, New Delhi, 3rd Edition, (2008).
3. SEYMOUR LIPSCHUTZ and MARK LIPSON, ¯Discrete Mathematics‖, Schaum's Outlines, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).
4. VEERARAJAN, T. ¯Discrete Mathematics with Graph Theory and Combinatorics‖, Tata McGraw-Hill, New Delhi, 7th Edition, (2008).

21UIT302	DATA STRUCTURES	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Programming using C

COURSE OBJECTIVES :

- To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.
- To impart a thorough understanding of linear non-linear data structures such as list, stacks, queues, trees, graphs and their applications.
- To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.

UNIT I	LINEAR DATA STRUCTURE – LIST	9

Basic Terminologies: Elementary Data Organizations, Abstract Data Types (ADTs) - List ADT-linked list implementation -singly linked lists- circularly linked lists- doubly-linked lists – applications of lists -Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II	LINEAR DATA STRUCTURE – STACK, QUEUE	9

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	NON-LINEAR DATA STRUCTURE – TREE, HEAP	9

Introduction - Basic Terminology - Traversal - Operations: Binary trees - Binary Search trees. Heap: Binary Heaps – Binomial Heaps– Comparison – Applications

UNIT IV	NON-LINEAR DATA STRUCTURE – GRAPH	9

Introduction - Graph Terminology - Representation of Graphs - Graph Traversal - Topological sort - Minimum Spanning Trees - Prim's and Kruskal's Algorithm - Shortest path algorithm - Dijkstra's algorithm - Applications of graphs.

UNIT V	SEARCHING, SORTING AND HASHING	9

Searching: Linear Search - Binary Search, Sorting: Selection Sort - Bubble Sort - Insertion Sort - Merge sort – Quick sort – Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the basic concepts of linear and nonlinear data structures. (Understand)
- Apply appropriate data structures to solve a complex engineering problem. (Apply)
- Analyze the suitability of a data structure to solve a complex engineering problem. (Analyze)
- Evaluate the problems and find solutions using linear, non-linear applications, searching, sorting and hashing algorithms. (Evaluate)
- Design and develop efficient linear, non-linear, sorting, searching and hashing data structures to solve problems. (Create)

- Work individually or in teams and demonstrate the solutions to the given exercises through presentation. (Affective Domain)

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2011
2. Seymour Lipschutz, ⁻Data Structures with C‖, McGraw Hill Education, Special Indian Edition, 2014.

REFERENCE BOOKS:

1. ISRD Group, ⁻Data Structures using C‖, 2nd Edition, McGrraw-Hill Education (India) Private Limited, 2013.
2. Reema Thareja, ⁻Data Structures Using C‖, Oxford University Press, 2011.
3. A.V.Aho, J.E Hopcroft and J.D.Ullman, ⁻Data structures and Algorithms‖, Pearson Education, First Edition Reprint 2003.

21UCS303	OBJECT ORIENTED PROGRAMMING USING C++ (INTEGRATED COURSE)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES :
- To explain OOP principles in C++.
- To introduce generic programming and exception handling mechanism.
- To enable the students to work with files

UNIT I	INTRODUCTION	9 + 9

Object-Oriented Paradigm - Elements of Object Oriented Programming – Directives - Operators – Control Statement – Arrays – Structures – Enumerations - Functions-Inline functions – default arguments.

List of Exercises

1. Write C++ programs that produce following outputs.
   A B C D E
   A B C D
   A B C
   A B
   A
2. An electricity board charges the following rates to domestic users to discourage large conceptions of energy.
   First 100 units   Rs 1.50 p/unit
   From 100 to 200 units   Rs 1.80 p/unit
   Beyond 200   Rs 2.50 p/unit
   All users are charged a minimum of Rs 50/-. If the total amount is more than 300 then an additional surcharge of 15% of the calculated amount is added. Write a C++ program to read the name of an user, number of units consumed and print out the Electricity bill in a neat format.
3. Write a C++ program using functions to perform matrix addition & subtraction.
4. Write a C++ program to find and print the volume of a cube using inline functions.

UNIT II	CLASSES AND OBJECTS	9 + 6

Classes and Objects - Passing objects as arguments - returning objects - Friend functions- Constructors -Parameterized constructor- Copy constructor - Destructor - Array of Objects - pointer to object members – Static member.

List of Exercises

1. Define a class to represent a bank account. Include the following members. Data Members: Name of depositor, Account number, Type of Account, Balance amount in the account Member functions : To assign initial values, To deposit an amount, To withdraw an amount after checking the balance, To display name and balance.
2. Create a class complex with real and imaginary as data members. Also include member functions to get the values for a complex number, to add two complex number, to multiply

two complex numbers, to print the complex number in a+ib format.
3. Create a class complex with real and imaginary as data members. Also include member functions to get the values for a complex number and to print the complex number in a+ib format. Also include friend functions to add two complex numbers and multiply two complex numbers.
4. Write a C++ program to count the number of objects created and destroyed for a class using stating data members and static member functions.

UNIT III	POLYMORPHISM	9 + 6

Polymorphism – Function overloading – Unary operator overloading – binary operator overloading – Data Conversion – Overloading with Friend Functions

List of Exercises

1. Write a C++ program to find the area of a square and rectangle using function overloading.
2. Write a C++ program to swap two integers, floats, characters and two strings using function overloading concept.
3. Write a C++ program to perform complex number addition, subtraction, multiplication using operator overloading with friend functions.
4. Write a C++ program to perform complex number addition, subtraction, multiplication using operator overloading with member functions.
5. Write a C++ program to perform matrix addition, subtraction, multiplication using operator overloading with friend functions.
6. Write a C++ program to perform matrix addition, subtraction, multiplication using operator overloading with member functions.
7. Write a C++ program to overload all arithmetic assignment operator (+=, -=, *=, /=) for the complex number class using friend functions and member functions.

UNIT IV	INHERITANCE AND VIRTUAL FUNCTIONS	9 + 6

Inheritance –Derived class – Abstract Classes – Types of Inheritance - Virtual functions – Need – Definition – Pure Virtual Functions – Virtual Destructors

List of Exercises

1. Imagine a publishing company that markets both book and audio-cassette versions of its work. Create a class publication that stores the title and price. From this class derive two classes book and tape; book includes one more property: page numbers and tape contains its length in minutes (float). Each of these classes must have getdata ( ) functions and putdata ( ) functions to input/output its data. Write a main function to test the book and tape classes.
2. Create three classes Student, Test and Result classes. The student class contains student relevant information. Test class contains marks for five subjects. The result class contains Total and average of the marks obtained in five subjects. Inherit the properties of Student and Test class details in Result class through multilevel inheritance.
3. Create three classes Student, Test and Result classes. The student class contains student relevant information. Test class contains marks for five subjects. The result class contains Total and average of the marks obtained in five subjects. Inherit the properties of Student and Test class details in Result class through multiple inheritance.
4. Create a base class Shape with relevant data members and member functions to get data and print the area. Create two more classes Rectangle and Triangle which inherit Shape class. Make the print data function as virtual function in base class. Write a C++ main ( ) function to check this.

UNIT V	TEMPLATES, EXCEPTION HANDLING AND FILES	9 + 3

Template – Class template – Function Template - Exception handling – catching multiple exceptions – - Streams and formatted I/O – I/O manipulators - File modes – File I/O

List of Exercises
1. Write a C++ program to represent a stack data structure using class template.
2. Write a function template for finding the minimum value contained in an array.
3. Write C++ programs handle multiple catch block, default catch block and re-throwing exceptions for your own problem situation.
4. Create a user defined manipulator for displaying the details of employees in a neat table format. (Hint: Employee details can be maintained as array of structures).
5. Write a C++ program to perform Sorting of File contents.

TOTAL: 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

CO1. Explain about the various programming constructs in C++ to solve real world problems. [Understand]

CO2: Apply the concepts of object oriented programming in integrated environment to develop interactive applications. [Apply]

CO3: Analyze problems and implement simple C++ applications using an object Oriented software engineering approach. [Analyze]

CO4: Assess the different object programming concepts and adopt the suitable technique to build mobile and enterprise applications. [Evaluate]

CO5: Develop a software application using various object oriented paradigms [Create]

CO6: Communicate effectively to explain the computing solutions based on legal and ethical principles. (Affective domain)

TEXT BOOKS :

1. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, ‖Mastering C++‖, Tata McGraw Hill, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Robert Lafore, Object Oriented Programming in C++, Pearson, 4th Edition, 2002.

2. Ira Pohl, ‾Object Oriented Programming using C++‖, Pearson Education, Second Edition, Reprint, 2004.

3. Lippman.S.B, JoseeLajoie, Barbara E. MooC++ Primer‖, Pearson Education, fourth Edition, 2005.

4. E.Balagurusamy, Object-Oriented Programming with C++, 7th Edition,2017.

21UIT304	PRINCIPLES OF OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :
- To impart major Operating System components and its principles
- To provide an in-depth exposure to process, memory, device and file management techniques
- To initiate knowledge on various security challenges related to Operating Systems

UNIT I	FUNDAMENTALS AND PROCESS CONCEPTS	9

Introduction: Introduction: Mainframe systems - Desktop Systems - Multiprocessor Systems - Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection Operating System operations, Kernel data structures, computing environments.

Operating System structure: Operating System Services, User- Operating System interface, System Calls, Types of system calls, system programs, Operating System design and implementation.

Processes: Inter process communication, cooperating Process

UNIT II	PROCESS SYNCHRONIZATION AND SCHEDULING	9

Process Synchronization: The critical section problem, Peterson's solution, Mutex locks, Semaphores, Classical problems of synchronization.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms

UNIT III	DEADLOCK AND MAIN MEMORY MANAGEMENT	9

Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.

UNIT IV	VIRTUAL MEMORY MANAGEMENT AND VIRUTALIZATION	9

Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing

Virtualization : Virtual Machines Virtualization (Hardware/Software, Server, Service, Network) Hypervisors -OS - Container Virtualization - Cost of virtualization

UNIT V	STORAGE MANAGEMENT AND SAFETY METHODS	9

File Concepts: File System Structure - File System Implementation - Directory Implementation - Allocation Methods - Free-space Management- IO Systems- Kernel I/O Subsystems - Mass Storage Structure: Disk Structure – Disk Scheduling

Disk Management - Swap-Space Management

Protection And Security : Goals, Principles, Domain, Access Matrix, Access Control, Revocation of access rights and Capability Based Systems Security Problems, Program Threats, System and

Network Threats, Cryptography as a security tool.

Total: 45 periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Explain the concepts of operating system structures, services and functionalities. (Understand)
- Apply various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms. Deadlock detection and avoidance techniques for providing Operating System functionalities. (Apply)
- Analyze various process management concepts (including scheduling, synchronization and deadlocks), Memory Management strategies and Design considerations of file system. (Analyze)
- Design solutions for complex engineering processes that meet specified needs with Scheduling, Synchronization, Page replacement and Disk Scheduling algorithms using Programming Language and present the same along with the report. (Create)
- Evaluate the Multiprogramming, Synchronization and Virtual Memory Concepts (Evaluate)
- Make an effective communication and presentation in a team to demonstrate the concepts of OS (Affective Domain)

TEXT BOOKS:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating Systems Concepts,9 th Edition, John Wiley Edition.

REFERENCE BOOKS:

1. William Stallings, Operating Systems -Internals and Design Principles, 7th Edition, Prentice Hall, 2012.

2. Andrew S.Tanenbaum, Modern Operating System, 2014, 4th Edition Pearson Education.

21UCD305	DESIGN THINKING	L	T	P	C
		3	0	0	3

OBJECTIVES :
- To introduce the fundamental concepts of Design Thinking.
- To illustrate the design aspects, innovation and its applications in different spheres of development and growth.

UNIT I	INTRODUCTION TO DESIGN THINKING	9

Maslow's hierarchy of needs - Introduction to design thinking process – wicked vs. tame problems – Goal and value of the design thinking process - history of Design Thinking, Stages in design thinking - Four Questions, Ten Tools.

UNIT II	EMPATHISE, DEFINE, IDEATE	9

Importance of Empathise stage - Empathy in design thinking process - key empathy building methods – Define Stage – Defining a good problem statement -write a meaningful problem statement – The four Ws – The five Whys - Ideation stage - key ideation building methods

UNIT III	PROTYPE, TEST	9

Introduction to Prototype – Different kinds of prototypes – Best practices to create prototypes – Test stage - User testing methods – Usability requirements and measures – Universal usability – Goals – Guidelines – Golden rules of interface design – Principles – Theories.

UNIT IV	MANAGING DESIGN PROCESS	9

Organizational support for design – The design process – Frameworks – Methods -Tools, Practices, and Patterns - Expert reviews and heuristics - Usability testing - acceptance tests - Evaluation during active use and beyond.

UNIT V	INTERACTION STYLES	9

Direct Manipulation – Examples – 2D and 3D Interfaces – Teleoperation and presence – Augmented and Virtual Reality – Navigation by selection – Audio menus – Speech recognition and speech production – Human language technology

TOTAL: 45 Periods

==COURSE OUTCOMES==:
After the successful completion of this course, the student will be able to
- Explain the concepts of Design Thinking. **[Understand]**
- Use appropriate tools of design thinking to provide solutions for problems. **[Apply]**
- Compare the performance of various innovation techniques for solving design oriented problems. **[Analyze].**
- Choose the best suitable design thinking technique for Product development in a constraint environment. **[Evaluate]**
- Develop design thinking for various real world applications. **[Create]**
- Recognize the quantum of work in the scenario and bring the solutions. **[Receiving/Affective Domain]**

TEXT BOOKS:

1 Andrew Pressman, ¯Design Thinking - A guide to creative problem solving for everyone‖, Routledge, Taylor & Francis Group, 2019.
2 Tim Brown and Harper Bollins, ¯Change by Design‖, 2009.
3 Jeanne Liedtka, Tim Ogilvie, ¯Designing for Growth: a designing toolkit for managers‖, Columbia Business School Publishing, 2011.
4 Ben Shneiderman, Catherine Plaisant, Maxine S. Cohen & Steven M. Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition, Addison Wesley, 2018.

REFERENCE BOOKS:

5 Shrrutin N Shetty, ¯Design the Future‖, Norton Press.
6 Wilbert O. Galitz, ¯The Essential Guide to User Interface Design - An Introduction to GUI Design Principles and techniques‖, 2007, Wiley

21UCD306	DATABASE SYSTEM DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Introduction Computer Science and Engineering

COURSE OBJECTIVES :
- To impart the knowledge in Relational Database Management Systems.
- To inculcate knowledge Normalization techniques.
- To familiarize in transaction management.
- To understand the storage and retrieval mechanisms in Databases.
- To learn query optimization techniques.
- To gain knowledge in advanced databases.

UNIT I	RELATIONAL DATABSES	9

Purpose of Database System - Views of data - Database System Architecture - Introduction to relational databases - Relational Model - Keys - Relational Algebra - Entity-Relationship model - ER Diagrams – Enhanced ER Model – ER to Relational Mapping

UNIT II	SQL AND NORMALIZATION	9

SQL fundamentals - Advanced SQL - Embedded SQL - Functional Dependencies - Non-loss Decomposition - First, Second, Third Normal Forms, Dependency Preservation - Boyce-Codd Normal Form

UNIT III	TRANSACTION PROCESSING AND CONCURRENCY CONTROL	9

Transaction Concepts - ACID Properties - Schedules - Serializability - Concurrency Control - Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points - Isolation Levels - SQL Facilities for Concurrency and Recovery

UNIT IV	IMPLEMENTATION TECHNIQUES	9

File Organization – Organization of Records in Files - Indexing and Hashing -Ordered Indices - B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing – Algorithms for SELECT and JOIN operations - Query optimization using Heuristics and Cost Estimation

UNIT V	NoSQL	9

Overview of NoSQL Databases - Definition of the Four Types of NoSQL Database - Comparison of relational databases to new NoSQL stores - NoSQL Key/Value databases using MongoDB - CRUD operation in MongoDB - Column oriented NoSQL databases using Apache Cassandra, Create, Alter & Drop Key space in Cassandra - Cassandra Query Language (CQL): Insert Into, Update, Delete.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Explain the basic as well as advanced concepts of Database Management Systems. (Understand)
- Apply the database design techniques to find solutions to complex engineering problems in

real world applications. (Apply)
- Analyze various database design techniques to develop a database application for a given scenario. (Analyze)
- Evaluate various storage and query evaluation plans to optimize query cost (Evaluate)
- Design Database for a given real life scenario using the concepts of Relational model and ER diagrams (Create)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, ¯Database System Concepts‖, McGraw Hill Education (India) Private Limited, Sixth Edition, 2013.

2. C.J.Date, A.Kannan, S.Swamynathan, ¯An Introduction to Database Systems‖, Pearson Education, Eighth Edition, 2006

3. Pramod J.Sadalage, Martin Fowler ¯NoSQL A Brief Guide to the emerging World of Polyglot Persistence Distilled‖, Pearson Education Inc, 2013

REFERENCE BOOKS:

1. Ramez Elmasri and Shamkant B.Navathe, ¯Fundamentals of Database Systems‖, Fifth Edition, Pearson Education, 2008.

2. Raghu Ramakrishnan, ¯Database Management Systems‖, Fourth Edition, Tata McGraw Hill, 2010.

3. Atul Kahate, ¯Introduction to Database Management Systems‖, Pearson Education, New Delhi, 2006.

4. Alexis Leon and Mathews Leon, ¯Database Management Systems‖, Vikas Publishing House Private Limited, New Delhi, 2003.

21UIT307	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:
- To demonstrate the systematic way of solving problems using linear and non – linear data structures
- To demonstrate the hashing techniques
- To demonstrate the sorting, searching algorithms.

LIST OF EXPERIMENTS
1. Implement of Linked list.
2. Implement Polynomial Arithmetic using Linked List.
3. Implementation of Stack ADT.
4. Implementation of Stack and use it to convert infix to postfix expression.
5. Implementation of stack and use it to Evaluate postfix expression
6. Implementation of Queue ADT.
7. Implementation of Binary search tree.
8. Implementation of hashing technique.
9. Implementation of Searching technique.
10. Implementation of Sorting Techniques

TOTAL : 30 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the linear and non-linear data structures and sorting searching and hashing algorithms appropriately to develop solutions. (Apply)
- Analyze the different Program to implement various data structure algorithms. (Analyze)
- Develop efficient linear, non-linear, sorting, searching and hashing data structure algorithms to solve problems for real world complex engineering problems. (Create)
- Work as an individual and as a member or leader in diverse teams for solving data structure problems.
- Communicate and present various algorithm design techniques for developing algorithms and collaborate with others. (Affective domain)
- Identify the requirement and take further preparation in order to adopt Technological change. (Affective domain)

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements:
Computer required: 30 No's
Minimum Requirement: Processor: Processor: Pentium IV, Ram: 1GB, Hard Disk: 80GB
Software requirements:
Operating System: Linux(Ubuntu / Fedora / Debian / Mint OS) / Windows
Turbo C Version 3 or GCC Version 4 / Built in Linux / DEVC++

21UCD308	DATABASE SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate the creation and usage of database

LIST OF EXPERIMENTS

1. A TV Company wishes to develop a database to store data about the TV series that the company produces. The data includes information about actors who play in the series, and directors who direct the episodes of the series. Actors and directors are employed by the company. A TV series are divided into episodes. Each episode may be transmitted at several occasions. An actor is hired to participate in a series, but may participate in many series. Each episode of a series is directed by one of the directors, but different episodes may be directed by different directors.
   Create tables with necessary integrity constraints. Insert minimum of 10 records in each table.

2. A departmental store has many sections such as Toys, Cosmetics, Clothing, Household Items, and Electronics etc. Each section has many employees. Employees can belong to only one section. In addition, each section also has a head that is responsible for the section s performance.
   The department store also has many customers who purchase goods from various sections. Customers can be of two types Regular and Ad-hoc. Regular customers get credit at the department store. Maximum credit limit allowed is Rs.10000.
   The store procures goods from various suppliers. The goods are stored in a warehouse and transferred to the store as and when requirement comes up. Quantity of goods supplied cannot be less than 0 and cannot be greater than 10000 for a particular supply. The store has a computerized system for all its operations.
   Create the tables with all appropriate constraints. Use the constraints UNIQUE, NOT NULL, CHECK, PRIMARY KEY, FOREIGN KEY etc. wherever necessary.

3. Solve the following queries using the database created in Ex.1:
    i. Which actors play in the series ‗The Devil'?
   ii. In which series does the actor ‗Rayan' participate?
   iii. Which actors participate in more than one series?
   iv. How many times has the first episode of the series ‗The Devil' been transmitted? At what times?
    v. How many directors are employed by the company?
   vi. Which director has directed the greatest number of episodes?

4. Solve the following queries using the database created in Ex.2:
    i. Find all employees whose names begin with A and end with A.
   ii. Find all products whose descriptions have the characters me.
   iii. Find the total salary paid by each section to employees.
   iv. Display the section names and the names of the employees who belongto that section.

v. Display the section name and the name of the person who heads the section.

vi. Display supplier names and cities. If the city is null, display LOCAL.

vii. Display the customer names and the customer type. If the customer type is R, display as ‗Regular'. If the customer type is A, display ‗Ad-hoc'.

5. A municipality needs a database containing information concerning the inhabitants of the municipality. The database will be used for the planning of schools, health care and child care. From the database, you should be able to receive answers to queries of the following types: (Use library functions and aggregate functions)
    i. How many boys and girls will start school during year x?
    ii. How many people will become old-age pensioners during year x?
    iii. How many households have more than x people?
    iv. How many people are single parents?
    v. In how many households is at least one member unemployed?
    vi. How many households have a total income that is less than the norm for receiving social benefits?

6. A medical health research project has a database containing data about all patients at a hospital. For each patient, data about the symptoms that the patient shows is registered: fever, headache, cough, chest pains. Symptoms can have different severity: low, middle, or high. A patient may show several symptoms, e.g., high fever, medium headache and some cough. The database also contains data about diseases. Each disease is characterized by different symptoms: a patient with a cold should have fever and a cough, a malaria patient should have fever and fits of shivering, etc.
   Write SQL statements that answer the following questions (define and use views). Find the names of all patients that:
    i. don't have any symptom of high severity,
    ii. have at least two different symptoms,
    iii. have at least one of the symptoms of malaria
    iv. have all the symptoms of malaria.

7. A company has several employees, all with different names, who perform interviews with job applicants (one applicant is interviewed by one employee). The job applicants also have different names. The interviewer makes appointments for interviews with the applicants. Each applicant may be interviewed at several occasions, possibly by different interviewers, but in that case the interviews take place during different days.
   The company has special interview rooms. Each interviewer uses the same room for all interviews during a day. A room may, however, be used by different interviewers during a day, as long as the interviews don't collide in time.
   The reservation of interview appointments is to be computerized. The database developer has decided to use a single relation for all data, with the following schema:
       Interviews(interviewer, applicant, day, time, room)
    i. From the text, find functional dependencies in the relation.
    ii. Find the keys of the relation.
    iii. Show that the relation is in 3NF but not in BCNF.
    iv. Decompose the relation in relations that are in BCNF.

8. Shops sell items at varying prices. Customers buy items from shops. This is described

by the following relations:

    Shops(shopId, name, address)
    Items(itemId, name, description)
    Sells(shopId, itemId, price)
    Customers(customerId, name, address)
    Sales(saleId, customerId, itemId, shopId, date)

    i. Write a procedure to print the name and address of all customers who haven't bought any item.

    ii. Write a procedure for all customers that have bought at least one item: print the customer id and the total sum of all purchases.

    iii. Write a function to print the number of shops that sell items with id's starting with 'EF'.

    iv. Write a function to print the name and address of the shop(s) that sell the item with id = 'EF123-A' at the lowest price.

9. A company organizes its activities in projects. Products that are used in the projects are bought from suppliers. This is described in a database with the following schema:

    Projects(<u>projNbr</u>, name, city)
    Products(<u>prodNbr</u>, name, color)
    Suppliers(<u>supplNbr</u>, name, city)
    Deliveries(*<u>supplNbr, prodNbr, projNbr</u>*, number)

    i. Write a trigger which displays a message whenever an entry is made in the table ˎDeliveries'.

    ii. Write a trigger which is invoked automatically whenever a product is supplied to the city ˎLondon'.

    iii. Execute an exception if the ˎnumber' field in ˎDeliveries' table is zero.

10. Design a logical data model for Hotel App using a cassandra physical Model. A hotel that wants to allow guests to book a reservation. Our conceptual domain includes hotels, guests that stay in the hotels, a collection of rooms for each hotel, and a record of the reservation, which is a certain guest in a certain room for a certain period of time (called the ˉstay‖). Hotels typically also maintain a collection of ˉpoints of interest,‖ which are parks, museums, shopping galleries, monuments, or other places near the hotel that guests might want to visit during their stay. Both hotels and points of interest need to maintain geo location data so that they can be found on maps for mash ups, and to calculate distances.

TOTAL : 30 Periods

<mark>COURSE OUTCOMES</mark>**:**

After the successful completion of this course, the student will be able to

- Apply the concepts of database systems to design a good database schema for a given application. (Apply)
- Construct queries using SQL and NoSQL to extract information from a database. (Apply)
- Analyze various database design techniques to develop a database application for a given scenario. (Analyze)
- Design Database application for a given real life scenario using the concepts of SQL, PL/SQL, and NoSQL. (Create)

- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Affective domain)
- Function effectively as an individual or in teams to develop database application for a given scenario. (Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

- HARDWARE REQUIREMENTS:

    Personal Computers – 30 Numbers

- SOFTWARE REQUIREMENTS:

    Front end: Any front end tool

    Back end: Oracle / SQL / MySQL / NoSQL / PostGress / DB2 or Equivalent

21UGM331	BIOLOGY FOR ENGINEERS	L	T	P	C
		2	0	0	0

PRE-REQUISITE:

COURSE OBJECTIVES :
- To provide a basic understanding of biological mechanisms of living organisms and the human biology from the perspective of engineers.
- To encourage engineering students to think about solving biological problems with engineering principles and tools.

UNIT I	INTRODUCTION AND CLASSIFICATION	5

Introduction to Biology – Comparison of Biology and Engineering – Eye and Camera – Bird flying and Aircraft – Brownian motion and Thermodynamics – Classification – Unicellular or multicellular – Unicellular: Bacteria, Protozoa, Yeast – Multi Cellular: Animals, Humans, Plants, fungi etc. – Ultra structure: prokaryotes or eukaryotes – Habitat: aquatic or terrestrial.

UNIT II	DIGESTIVE & RESPIRATORY SYSTEMS – ENZYME	6

Study of digestive – Respiratory systems and their functions –.Enzyme – Classification of Enzyme – Mechanism of Enzyme activity – Enzymes for Industrial Applications: Waste management – Food processing industry – Beverages – Pharmaceutical – Paper Industry etc.

UNIT III	GENETICS AND BIO MOLECULES (Basics only)	7

Basics of Genes – DNA structure – Genes and hereditary – Genetic Code – Coding and decoding Genetic information – Gene Mapping – Gene Interactions – Mutations – Genetic disorders – Gene therapy – Biomolecules: Carbohydrates, lipids, nucleic acids, proteins. Biological Applications in Engineering: Genetic Algorithm – Computer Application in Genetic Engineering – Genetic Programming – Genetic Computers.

UNIT IV	NERVOUS SYSTEM AND CELL SIGNALING	7

Central Nervous System: Brain and Spinal Cord – Peripheral Nervous System – Sensory Division – Motor Division – Neurons – sensory, motor, and interneurons – Signals –Transfer of Information – Bio Signals – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electrooculography (EOG) – X-ray – CT Scan – MRI scan – Biological Applications in Engineering -Neurons and Neural Network.

UNIT V	BIOLOGY AND ITS INDUSTRIAL AND CLINICAL APPLICATIONS	5

Bioreactors – Biopharming – Recombinant vaccines – Cloning – Drug discovery –Bioremediation – Biofertilizer – Biocontrol – Biofilters – Biosensors – Biopolymers – Bioenergy – Biomaterials – Biochips.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
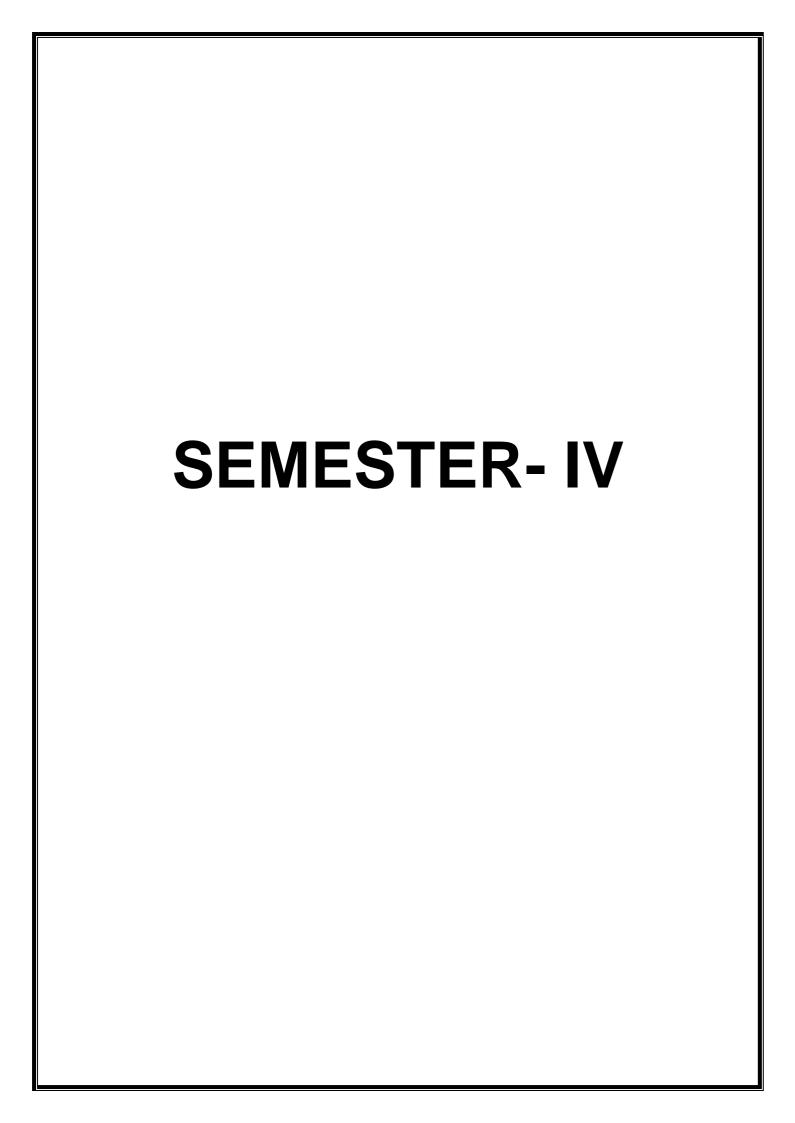- Explain the fundamentals of living things, their classification, cell structure and biochemical constituents.(Understand)
- Apply the concept of plant, animal and microbial systems and growth in real life situations. (Apply)
- Analyze biological engineering principles, procedures needed to solve societal issues. (Analyze)

TEXT BOOKS:

1. R.C.Dubey, ¯A Text book of Biotechnology‖, S. Chand Higher Academic Publications, 2013.
2. R. Khandpur, ¯Biomedical instrumentation - Technology and applications‖, McGraw Hill Professional, 2004.

REFERENCES:

1. Arthur T. Johnson, ¯Biology for Engineers‖, CRC Press, Taylor and Francis, 2nd Edition, 2019.
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, ¯Cell Biology and Genetics (Biology: The unity and diversity of life Volume I)‖, Cengage Learning, 12th Edition, 2008.
3. Gerard J. Tortora and Bryan H.Derrickson, ¯Principles of Anatomy and Physiology‖,15th Edition, Wiley publications, 2016.

SEMESTER- IV

SEMESTER IV

COURSE CODE	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UMA426	BS	Probability and Statistical Techniques (Common to AI & DS,CSD)	3	1	0	4
21UCS402	PC	Computer Networks (Common to CSE, IT, CSD)	3	0	0	3
21UCS403	PC	Algorithm Analysis (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UIT404	PC	Java Programming (Common to CSE, IT, CSD)	3	0	2	4
21UCD405	PC	Computer Graphics	3	0	0	3
21UCD406	ES	Agile Methodologies	3	0	0	3
PRACTICAL COURSES						
21UCS407	PC	Computer Networks Laboratory (Common to CSE, IT, CSD)	0	0	2	1
21UCD408	PC	Computer Graphics Laboratory	0	0	2	1
MANDATORY COURSE						
21UGM431	MC	Gender Equality	1	0	0	P/F
			19	**1**	**6**	**22**
Total No. of Credits – 22						

21UMA426	PROBABILITY AND STATISTICAL TECHNIQUES	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :
- To make the student acquire sound knowledge of random variables emerge in real life problems and its standard distributions that can describe real life phenomena.
- Analyze the various data by different statistical sampling techniques.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- To make the student to understand the fundamentals relation between probability and statistics which will greatly help at data analysis and interpretation.

UNIT I	PROBABILITY & RANDOM VARIABLES	9 +3 Hrs

Probability: Concepts of experiments, Sample space, event - Combinatorial probability - Conditional probability – Baye's theorem. Random variable: Probability mass function - Probability density function - Properties - Multivariate Distributions - Marginal Distributions - Conditional Distributions - Expected Value of a Random Variable - Moments - Moment Generating Functions - Conditional Expectation..

UNIT II	SPECIAL DISTRIBUTIONS	9+3 Hrs

Discrete Probability distributions: Binomial distribution -Poisson distribution - Geometric distribution. Continuous Probability distributions: Uniform distribution - Exponential distribution - Gamma distribution - Normal distribution.

UNIT III	REGRESSION AND CORRELATION	9+3 Hrs

Linear Regression - Method of Least Squares - Normal Regression Analysis - Normal correlation Analysis - Multiple Linear Regressions

UNIT IV	ESTIMATION THEORY	9 +3 Hrs

Unbiased Estimators – Efficiency – Consistency – Sufficiency – Robustness – Method of Moments - Method of Maximum Likelihood – Interval Estimation of Means, Differences Between Means, Variances and Ratio of Two variances

UNIT V	TESTING OF HYPOTHESIS	9+3 Hrs

Sampling – Large sample test: Tests for Single mean – Test for difference between two means. Small sample test: Tests for mean (t test), F – test – Chi – square test for Goodness of fit and Independence of attributes

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply the knowledge of probability in Bayes theorem and Mathematical expectation for one dimensional random variables.(CO1) AP-K3

- Apply the acquired knowledge of standard Distribution in real life phenomena.(CO2) AP - K3
- Analyze the various collection of data by methods of Correlation and regression.(CO3) A - K4
- Apply the knowledge of Statistical Inference and Estimation methods. (CO4) AP - K3
- Analyze the various collections of data in science / engineering problems using statistical inference techniques.(CO5) A - K4
- Understand the basic concept of probability , Random Variable and statistics .(CO6) U - K2

TEXT BOOKS:

1. S. M. Ross, ⁻Introduction of Probability Models‖, Academic Press, Springer Publication, 2000.
2. GREWAL B.S, ⁻Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 42nd Edition, (2012).
3. GUPTA S.C, KAPOOR V.K. ⁻Fundamental of Mathematical Statistics‖ 10th Edition, Sultan Chand and Sons, New Delhi 2002.

REFERENCE BOOKS:

1. SHARMA J.N , GOEL J.K ⁻ Mathematical statistics⁻, 7th Edition, Krishna Prakasham Mandis, Mearut, (1998).
2. WALPOLE. R.E., MYERS .R.H., MYERS S.L., and YE. K, ⁻Probability and Statistics for Engineers and Scientists‖, Pearson Education, New Delhi, 8th edition, (2007).
3. SPIEGEL M.R., SCHILLER J. and SRINIVASAN R.A., ⁻Schaum's Outlines Probability and Statistics‖, Tata McGraw Hill, New Delhi, (2004).
4. JOHNSON R.A, and GUPTA C.B., ⁻Miller and Freund's Probability and Statistics for Engineers‖, Pearson Education, New Delhi, 8th Edition, (2011).
5. A.M. Mood, F.A. Graybill and D.C. Boes, ⁻‖Introduction to the Theory of Statistics – II‖, 3rd edition, McGraw Hill Education, (2010).

21UCS402	COMPUTER NETWORKS (Common for CSE,IT and CSD)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To describe the general principles of data communication components
- To describe the various functionalities of the different layers of the network
- To learn the logical addressing and different routing protocols
- To familiarize the transmission of data and the quality of service in the network
- To acquire the knowledge on the applications of the different protocols

UNIT I	INTRODUCTION AND PHYSICAL LAYERS	9

Data Communication - Networks – Network Types - Protocol Layering – OSI Model - TCP/IP Protocol suite – Physical Layer: Performance – multiplexing -Transmission media – Switching.

UNIT II	DATA LINK LAYER AND MEDIA ACCESS CONTROL	9

Error Detection and Error Correction – DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control- Wired LANs- Ethernet -Wireless LAN- IEEE 802.11 –Bluetooth – Connecting Devices-FDDI

UNIT III	NETWORK LAYER	9

Network Layer Services - Logical Addressing- Internet Protocols (IPV4 and IPv6)– Address Mapping – Network Layer Protocols: ICMP – IGMP – ICMP v6 – Delivery- Forwarding – Routing Protocol (Unicast – Multicast)

UNIT IV	TRANSPORT LAYER	9

Transport Services – Elements of Transport Protocols -Process to Process Communication-UDP, TCP and SCTP- Congestion Control- QoS improving techniques- RPC

UNIT IV	APPLICATION LAYER	9

WWW and HTTP- FTP –Email-Telnet-DNS-SNMP, Basic concepts of Cryptography and digital

signature – Firewalls.

		TOTAL:45 Periods

<mark>COURSE OUTCOMES</mark>**:**

After the successful completion of this course, the student will be able to

- Explain the data communication components and the various functionalities of different network layers (Understand)
- Apply the knowledge of layer functionalities to provide error free and congestion free data flow. (Apply)
- Analyze the working principles of various protocols for effective data communication. (Analyze)
- Estimate the performance of various network parameters to improve QoS. (Evaluate)
- Design a LAN network with the principles of protocol stack for a given real world scenario.

(Create)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)

TEXT BOOKS:

1. Behrouz A. Forouzan, ‾Data Communications and Networking‖, Fifth Edition TMH, 2013.
2. William Stallings , ‾Data and Computer Communications‖, Tenth Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. James F. Kuross, Keith W. Ross, ‾Computer Networking, A Top-Down Approach Featuring the Internet‖, Addison Wesley, Third Edition, 2004.
2. Larry L. Peterson, Bruce S. Davie, ‾Computer Networks: A Systems Approach‖, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
3. Andrew S Tanenbaum, ‾Computer Networks‖, PHI, 2010.
4. Nader F. Mir, ‾Computer and Communication Networks‖, Pearson Education, 2007.
5. Comer, ‾Computer Networks and Internets with Internet Applications‖, Pearson Education, Fourth Edition, 2007.
6. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011

21UCS403	ALGORITHM ANALYSIS (Common to CSE ,IT,CSD,AI&DS, CSE(AI&ML))	L	T	P	C
		3	0	0	3

PRE-REQUISITE: DATA STRUCTURES

COURSE OBJECTIVES :
- To analyze a problem and identify the computing requirements appropriate for its solutions
- To summarize sorting , searching algorithms and report algorithm design methods
- To become familiar with the different algorithm design techniques

UNIT I	INTRODUCTION	9

Introduction - Notion of an Algorithm-Fundamentals of Algorithmic Problem Solving-Fundamentals of the Analysis of Algorithm Efficiency- Analysis Framework- Asymptotic Notations and its properties- Mathematical analysis for Recursive and Non-recursive algorithm.

UNIT II	SEARCHING AND TRAVERSAL TECHNIQUES	9

Brute Force - Selection Sort and Bubble Sort - Sequential Search and Brute-force string matching - Divide and conquer methodology – Merge sort – Quick sort – Binary search – Binary tree traversal algorithm, Graph traversals - Breadth first search and Depth first search.

UNIT III	ALGORITHMIC TECHNIQUES	9

Dynamic Programming – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Greedy Technique – Prim's algorithm- Kruskal's Algorithm - Dijkstra's Algorithm-Huffman Trees.

UNIT IV	BACKTRACKING, BRANCH AND BOUND	9

Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem- Branch and Bound - Assignment problem - Knapsack Problem- Traveling Salesman Problem-Iterative Improvement-Maximum Flow Problem-Maximum Matching in Bipartite Graphs

UNIT V	COMPUTATIONAL COMPLEXITY AND PARALLEL ALGORITHMS	9

Non Deterministic algorithms, The classes P, NP, NP Complete, NP hard Proofs for NP Complete Problems: Clique, Vertex Cover Parallel Algorithms.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- CO1- Understand the concept of Notation of Algorithm that apply in various methodologies like brute force divide and Conquer, Greedy Techniques **[Understand]**

- CO2- Apply various Methodology based algorithm and different types of searching sorting techniques for providing Betterment solution for the problems. **[Apply]**
- CO3-Analyze various methodology based algorithm for enhancing the efficiency of the problem **[Analyze]**
- CO4-Analyze different set of problem and to Design a solution using algorithm design methodology **[Design]**
- CO5-Evaluate running time, efficiency of the problem using different set of algorithm **[Evaluate]**
- CO6- Demonstrate the algorithms with analyzed solution based on time complexity , efficiency and also shows the concepts of difference between different methodology using Virtualization tools **[Modern Tool Usage]**

TEXT BOOKS

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithm", Pearson Education Asia,Third Edition, 2012.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Computer Algorithms / C++", Universities Press, Second Edition, 2007.

REFERENCE BOOKS:

1. Thomas H Cormen, Charles E.L Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithm", PHI Pvt. Ltd, Third Edition, 2012.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Fundamentals of Computer Algorithms,Second Edition, Universities Press, Hyderabad, 2008.
3. Fayez Gebali," Algorithms and Parallel Computing", Willy (Indian Paperback Edition), 2011.
4. Aho.A.V, Hopcroft.J.E, Ullman.J.D, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, Third Edition, 2008.
5. Lee. R.C.T, Tseng.S.S, Chang.R.C, Tsai Y.T, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", McGraw-Hill Education, First Edition, 2005.

21UIT404	JAVA PROGRAMMING (INTEGRATED COURSE) (Common to CSE, IT & CSD)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES :

The student should be made to:
- To implement object-oriented designs with Java.
- To extend Java classes with inheritance and dynamic binding.
- To work with Java Collections API and Packages.
- To handle Exceptions with Exceptions classes.
- To make use of String Classes in Java.

UNIT I	Java Fundamentals	9+6

Introduction to Java - Java Architecture –keywords –Identifiers –Variables – Data types–Operators–Type conversion–Selection control Structure –Iteration Control Structure

Case Study:

a) Implement a program to calculate the product of three positive integer values. However, if one of the integers is 7, consider only the values to the right of 7 for calculation. If 7 is the last integer, then display -1

b) Quadratic equation is an equation with degree 2 in the form of $ax^2 + bx + c = 0$ where a, b and c are the coefficients.
Implement a program to solve a quadratic equation.

Find the discriminant value using the formula given below.

discriminant = $b^2 - 4ac$

If the discriminant is 0, the values of both the roots will be same. Display the value of the root.

If the discriminant is greater than 0, the roots will be unequal real roots. Display the values of both the roots.

If the discriminant is less than 0, there will be no real roots. Display the message "The equation has no real root"

Use the formula given below to find the roots of a quadratic equation.

x = (-b ± discriminant)/2a

UNIT II	Introduction to Object Oriented Programming	9+6

Introduction to Object Oriented Programming-Methods - Constructors - This keyword – Memory management- Encapsulation - Abstraction - Access Modifiers – Arrays

Case Study:

a) Implement a class Calculator with the method mentioned below.

Method Description

findAverage()

Calculate the average of three numbers

Return the average rounded off to two decimal digits

Test the functionalities using the provided Tester class.

b) Modify the Restaurant class created before and add the below mentioned constructor.

Method Description

Restaurant(String name, long restaurantContact, String restaurantAddress, float rating)

Initialize the instance variables appropriately with the values passed to the constructor.

Create an object of the Restaurant class and invoke the **displayRestaurantDetails()** method in the main() method of the Tester class.

UNIT III	Advanced Java Concepts	9+6

Inheritance- Introduction to inheritance- Single Inheritance – Multilevel Inheritance - Polymorphism -Method overloading -Method Overriding -Constructor overloading -Super keyword -Final Keyword- Static modifier -Abstract class – Interfaces

Case Study:

a) The Point class is used for representing a point with two coordinates.

Implement the class Point based on the class diagram and description given below.

Method Description

Point(double xCoordinate , double yCoordinate)

Initialize the instance variables xCoordinate and yCoordinate appropriately with the values passed to the constructor.

calculateDistance()

Calculate and return the distance of the point from the origin (0,0). The distance can be calculated using the formula given below. The distance should be rounded off to 2 decimal digits.

distance=√((x2-x1)2+(y2-y1)2), where x1 and x2 are values of x-coordinates of two points and y1 and y2 are values of y-coordinates of two points

calculateDistance(Point point)

Calculate and return the distance of the point from the 'point' passed to the method. The distance should be rounded off to 2 decimal digits.

Hints:

Use Math.sqrt(double d) method to calculate the square root

Use Math.round(double d) method to round off the values

Implement the getter and setter methods appropriately.

Test the functionalities using the provided Tester class.

UNIT IV	Collections , Packages and Exception Handling	9+6

Collection Interface – Collection Class – Array List –Linked List –Introduction to Package –Import – Exception – Try – Throw – Catch –Finally – User defined Exception – throws

Case study:

a)A bank wants to conduct examinations for recruitment. You need to develop an application for the applicants to submit their details by implementing the classes based on the description given below.

Method Description

validateName(String name)

Validate that the name is not null or empty. If the name is null or empty, return false, else return true.

validateJobProfile(String jobProfile)

Validate that the jobProfile is either 'Associate' or 'Clerk' or 'Executive' or 'Officer'. If the jobProfile is valid, return true, else return false. Perform case-insensitive comparison.

validateAge(int age)

Validate that the age is between 18 and 30 (both inclusive). If the age is valid, return true, else return false

validate(Applicant applicant)

Validate the details of the applicant by calling the appropriate methods. If any validation fails, throw user defined exceptions based on the below description.

Field violated	User defined exception	Exception message
name	InvalidNameException	Invalid name
jobProfile	InvalidJobProfileException	Invalid job profile
age	InvalidAgeException	Invalid age

Implement the required user defined exception classes.

Test the functionalities using the main method of the provided Tester class based on the below description.

Create an object of Applicant class and set the values of all the instance variables

Validate the details of the applicant by invoking the validate() method of the Validator class

If all the details are valid, display 'Application submitted successfully!', else, display appropriate error message

UNIT V	String Handling	9+6

String Constructors – Character extraction – String Comparison – Searching strings – String Buffer

Case Study:

a)Complete the removeWhiteSpaces() method given in the Tester class.

Method Description

removeWhiteSpaces(String str)

Remove all the white spaces from the string passed to the method and return the modified string.

Test the functionalities using the main() method of the Tester class.

TOTAL: 45 Periods

After the successful completion of this course, the student will be able to

- Explain the Object oriented features of Java. (Understand)

- Write Java code for various applications. (Apply)

- Analyze the suitable object oriented methodology for solving a complex engineering problem. (Analyze)

- Design various real time java applications (Create)

- Compare the given code with original for logical and syntactical errors (Evaluate)

- Work individually or in teams and communicate effectively to justify the various operating system concepts. (Affective domain)

Text Books:

1.Cay S. Horstmann "Core Java Volume I–Fundamentals", Pearson Publishers, Eleventh Edition, 2018

References:

1. Infosys Offered Course (https://infyspringboard.onwingspan.com/)

2. Herbert Schildt ̄ The Complete Reference Java ̄, McGraw Hill , Eleventh Edition , 2018

21UCD405	COMPUTER GRAPHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To impart computer graphics skills to students
- To demonstrate 2D and 3D concepts to develop programs.

UNIT I	GRAPHICS PRIMITIVES	9

Display devices-Raster and Random Scan Systems-Computer Graphics API-Coordinate Reference Frames-Input Devices-2D output Primitives-3D Primitives-OpenGL Point Functions-OpenGL Line Functions-OpenGL Curve Functions-Fill Area Primitives- Pixel Array Primitives

UNIT II	2D GRAPHICS & TRANSFORMATIONS	9

Basic 2D Geometric Transformations – Inverse Transformations – 2D Composite Transformations-OpenGL Functions for 2D Geometric Transformations-2D Viewing-OpenGL 2D Viewing Functions-2D Clipping Algorithms-Point-Line-Curve-Text

UNIT III	3D GRAPHICS & TRANSFORMATIONS	9

3D Transformations –Composite 3D Transformations - 3D Object Coordinate Systems- OpenGL 3D Geometric Transformation Functions-3D Viewing pipeline-OpenGL 3D Viewing Functions-3D Clipping Algorithms

UNIT IV	RENDERING & ILLUMINATION	9

Design of Animation Sequences and Techniques - Computer Animation Languages- Key Frame Systems- Motion Specifications-Visible Surface Detection Algorithms-OpenGL Illumination and Surface Rendering Functions-OpenGL Texture Functions

UNIT V	VULKAN GRAPHICS API	9

Drawing Primitives - validation layers- resource management- Physical devices and queue families-logical devices and queues- Graphics pipeline- Input assembler, vertex shader- Tesselation- Geometry shader- Rasterization- Fragment shader- color blending- Vertex buffers- uniform buffers- Texture mapping- Depth buffering- Command buffer.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the concepts of computer graphics used to develop real-world applications. **(Understand)**
- Apply the concepts of computer graphics for solving real world problems **(Apply)**
- Analyze the suitable techniques used for developing solution for a given real world scenario. **(Analyze)**
- Evaluate various parameters used to execute the algorithms successfully to implement graphics applications. **(Evaluate)**
- Design an interactive graphics application using 2D and 3D algorithms for real world problems. **(Create)**
- Work individually or in teams and communicate effectively to justify the solution for real world scenario. **(Affective domain)**

TEXT BOOK:

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, ¯Computer Graphics with OpenGL‖, Pearson Education, Fourth Edition, 2011.

2. Steve Marschner, Peter Shirley, ¯Fundamentals of Computer Graphics‖, 5th Edition, CRC Press/ Taylor and Francis Group, 2021.

REFERENCES:

1. Edward Angel, Dave Shreiner,‖ Interactive Computer Graphics. A Top-Down Approach with WebGL‖, 7th Edition, 2015.

2. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V, 9th Edition, Addison Wesley, 2016.

3. Graham Sellers, John Kessenich, ¯Vulkan Programming Guide‖, 1st Edition, Addison Wesley, 2016.

4. Francis S Hill Jr., Stephen M Kelley,‖Computer Graphics Using OpenGL‖, PHI Learning, Third Edition, 2009.

5. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley, ¯ Computer Graphics Principles and Practice‖, Third Edition, Addison Wesley, 2013.

6. Samanta Guha, ¯Computer Graphics Through OpenGL: From Theory to Experiments‖, Third Edition, Chapman and Hall / CRC Press, 2021.

7. Jung Hyun Han, ¯3D Graphics for Game Programming‖, Delmar Cengage Learning, 2011.

21UCD406	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To provide the basic Knowledge in Software Engineering and its applications.
- To understand software Engineering layered architecture and the process frame work and models.
- To design software requirements and specifications of documents.
- To know about the quality checking mechanism for software process and product.

UNIT I	SOFTWARE PROCESS AND MODELS	9

Software process structure – Process models: Waterfall model – Incremental process models – Evolutionary process models – Requirements engineering – Requirements analysis – Scenario Based Modeling – Class-Based Modeling – Flow Oriented Models – Behavioral Models- Design Concepts.

UNIT II	AGILE PRINCIPLES AND SCRUM	9

Understanding the Agile Values – Agile Principles – Agile Project - Scrum and Self-Organizing Teams - Basic pattern for a Scrum Project – Rules of Scrum – Self-Organizing Teams - Scrum Values – Daily Scrum – Sprints, Planning and Retrospectives - Scrum Planning and Collective Commitment - User stories – Conditions of Satisfaction – Story Points and Velocity – Burn down Charts – Planning and Running a Sprint – Generally Accepted Scrum Practices

UNIT III	XP AND INCREMENTAL DESIGN, LEAN, AND KANBAN	9

Primary Practices of XP – The XP values help the team change their mindset – An effective mindset starts with the XP values – Understanding the XP principles – Feedback Loops- Lean Thinking – Commitment, Options Thinking and Set Based Development – Create Heroes and Magical Thinking – Eliminate Waste – Value Stream Map – Deliver As Fast As Possible – WIP Area Chart – Pull Systems – The Principles of Kanban – Improving Your Process with Kanban – Measure and Manage Flow – Little's Law – Emergent Behavior with Kanban

UNIT IV	SOFTWARE TESTING	9

Software testing strategies: Strategic approach – Issues - Test strategies for conventional and Object Oriented software – Validation and System testing – Debugging – Testing conventional applications: White box testing – Basis path testing – Control structure testing – Black box testing – Software configuration management - SCM repository - SCM process.

UNIT V	MANAGING SOFTWARE PROJECTS	9

Software Project Management Concepts - Process and Project Metrics - Estimation for Software Projects – Project Scheduling – Risk Management – Software Configuration Management – Software Process Improvements (SPI) – The SPI Process – Capability Maturity Model Integration (CMMI) – Other SPI Frameworks.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the nature of software development practices or methodologies of traditional and agile software development for a developing a software project **(Understand)**
- Apply relevant standards and perform testing methods in one or more application domains **(Apply)**
- Analyze the principles, practices and modern engineering tools necessary for software project management and software reuse, and an ability to engage in life-long learning. **(Analyze)**

- Estimate the resources required in Software Project Development **(Evaluate)**
- Design software requirements and specifications of documents requirements through a productive working relationship with various stakeholders of the project using engineering principles and use cases. **(Create)**
- Prepare a report on the software requirements design and development and give a detailed presentation **(Affective Domain)**

TEXT BOOKS:

1. Roger S. Pressman, ¯Software Engineering – A Practitioner's Approach‖, Eighth Edition, McGraw-Hill International Edition, 2014.
2. Andrew Stellman and Jennifer Greene, ¯Learning Agile: Understanding Scrum, XP, Lean and Kanban‖, First Edition, O'Reilly Media Inc, 2015

REFERENCE BOOKS:

1. Rajib Mall, ¯Fundamentals of Software Engineering‖, Third Edition, PHI Learning Private Limited, 2009.
2. Ken Schawber, Mike Beedle,‖ Agile Software Development with Scrum‖, Pearson, 2002.
3. Ian Sommerville, ¯Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

21UCS407	COMPUTER NETWORKS LABORATORY (Common for CSE,IT and CSD)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:
- To learn and use network commands
- To learn socket programming
- To implement and analyze various network protocols & RPC.
- To learn and use simulation tools
- To use simulation tools to analyze the performance of network routing Protocol

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine and Implementation of Data Encryption and Decryption

2. Simulation of error correction code (like CRC and Hamming Code generation).

3. Implementation of Stop and Wait Protocol and Sliding Window Protocol

4. Simulation of Distance Vector / Link State Vector Routing Protocol algorithm

5. Applications using TCP sockets like:

    (i) Data and Time Server & Client & Chat

    (ii) Echo Server & Client

    (iii) File Transfer

    (iv) Web page Upload and Download

6. Simulation of DNS using UDP socket

7. Write a code simulating ARP/RARP Protocols & RPC

8. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.

9. Study of TCP/UDP performance using Simulation tool.

10. Performance evaluation of Routing protocols using Simulation tool.

TOTAL : 30 Periods

After the successful completion of this course, the student will be able to

- Apply various error detection and correction algorithms to implement secure data transfer. (Apply)

- Analyze various interfaces to implement application layer protocols. (Analyze)

- Apply the concept of encryption and decryption for secure message transfer. (Apply)

- Simulate various routing protocols to find an optimal solution for the effective data communication. (Create)

- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Affective domain)

- Work effectively as an individual or in teams to simulate routing protocols for a given scenario. (Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Desktops – 30Nos

SOFTWARE REQUIREWMENTS:

1. C/C++ Compiler,J2SDK(Freeware),
2. Network Simulators like NS2 / Glomosim / OPNET / Packet Tracer / Equivalent (Freeware).

21UGM431	GENDER EQUALITY	L	T	P	C
		1	0	0	0

PRE-REQUISITE:

COURSE OBJECTIVES :
- To introduce basic concepts relating to gender and to provide logical understanding of gender roles.

UNIT I	GENDER SENSITIZATION	5

Definition of gender, Perspectives-Gender sensitive approach- Gender and sex- Social construction of gender and gender roles- Socialization- institutions of socialization- changing content and context of gender-need for re-socialization. Gender Stereotyping and Gender Discrimination.

UNIT II	GENDER EQUALITY AND CONSTITUTION	5

Indian constitution related to equality - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation - cultural and educational rights - the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers- Internal Complaints Committee - Legal AID cells, Help line, State and National level Commission.

UNIT III	GENDER ROLES & EQUALITY	5

Gender & Morality – Structural and functionalist views of Gender- Gender in the Classroom-Beyond

access for girls and boys-Gender equality in schools-Gender equality and adult basic education-Developing capacity to achieve gender equality in education-Individuality and removal of gender stereotypes- Respect for each other's-Promote equal opportunity.
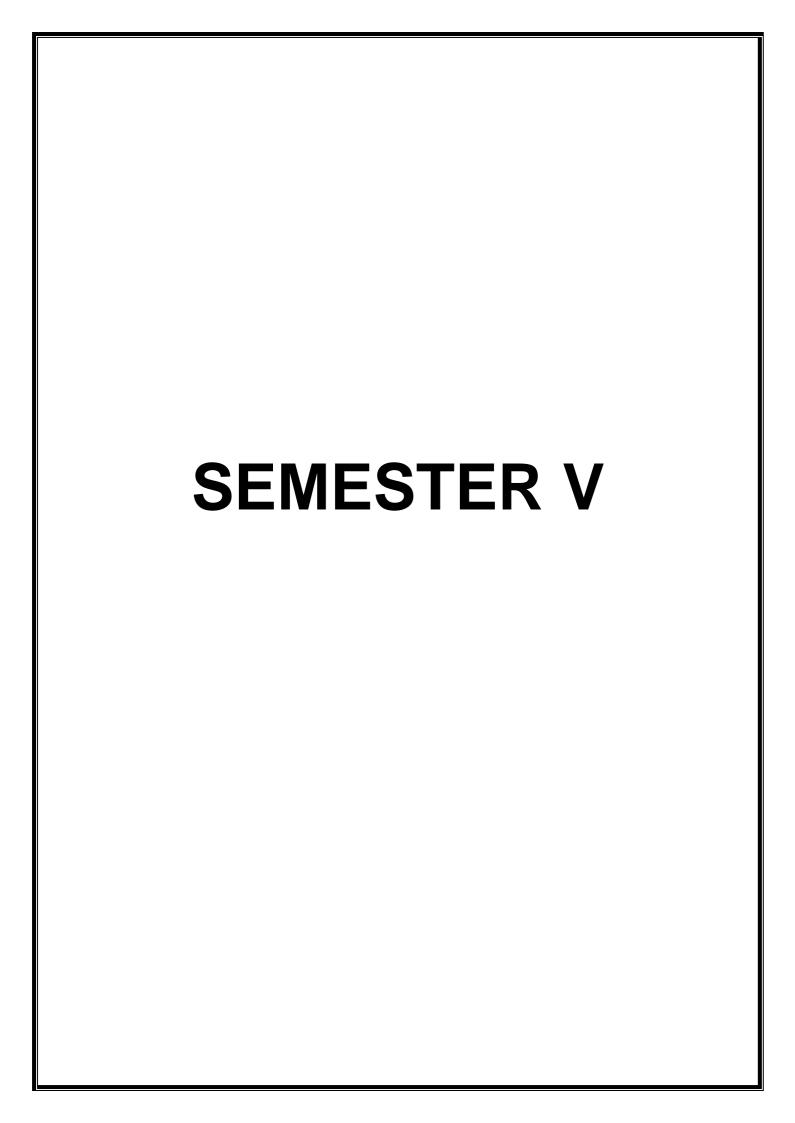
TOTAL:15 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Describe the social construction of gender and sexuality and their influence in social context. (Understand)
- Analyze how the concepts of gender equality are created, maintained, and/or challenged. (Analyze)
- Apply concepts of gender roles and equality in classroom, school, disciplinary or interdisciplinary creative, scholarly, and/or activist project. (Apply)

REFERENCES:
1. Sheila Aikman and Elaine Unterhalter, ‾Practising Gender Equality in Education‖, Oxfam GB, 2007.
2. Pasadena and Hackensack, ‾Gender roles and Equality‖, Salem Press,2011.

SEMESTER V

SEMESTER V

COURSE CODE		COURSE TITLE	L	T	P	C
THEORY						
21UCD501	PC	Internet and Web Technology (Common to CSE, IT, CSD)	3	0	2	4
21UCD502	PC	Mobile Interactive Design	2	0	2	3
21UCS503	PC	Theory of Computation (Common to CSE, CSD)	3	1	0	3
	PE	Professional Elective - I	3	0	0	3
	OE	Open Elective - I	3	0	0	3
21UGS531	BS	Reasoning and Aptitude	1	0	0	1
PRACTICAL						
21UCD507	PW	Creative Thinking and Innovation	0	0	2	1
21UGS532	HS	Soft Skills Laboratory	0	0	2	1
MANDATORY COURSES						
21UGM531	MC	Tamil Literature, Culture, and Civilization through Archeology	1	0	0	0
TOTAL			16	0	8	20
Total No. of Credits – 20						

1UCD503	IOT TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES:
- To summarize the basic issues, policy and challenges in the Internet.
- To explain the components and the protocols in Internet.
- To demonstrate the various modes of communications with internet.

UNIT I	INTRODUCTION	9

Definition - phases - Foundations - Policy- Challenges and Issues - identification - security - privacy. Components in internet of things**:** Control Units - Sensors - Communication modules - Power Sources - Communication Technologies – RFID – Bluetooth – Zigbee -Wifi – Rflinks – Mobile Internet – Wired
Communication.

UNIT II	PROGRAMMING THE MICROCONTROLLER FOR IOT	9

Basics of Sensors and actuators - examples and working principles of sensors and actuators - Cloud computing and IOT - Arduino/Equivalent Microcontroller platform -Setting up the board - Programming for IOT – Reading from Sensors.
Communication: Connecting microcontroller with mobile devices - communication through bluetooth and
USB - connection with the internet using wifi / Ethernet.

UNIT III	RESOURCE MANAGEMENT IN THE INTERNET OF THINGS	9

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object -Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFIDbased EPC Network to an Agent based Internet of Things- Agents for the
Behaviour of Objects.

UNIT IV	BUSINESS MODELS FOR THE INTERNET OF THINGS	9

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration – Middleware Technologies Needed for a DiY Internet of Things Semantic Interoperability as a Requirement for DiY Creation -Ontology- Value Creation in the Internet of Things-Application of Ontology Engineering in the Internet of Things-Semantic Web-
Ontology - The Internet of Things in Context of EURIDICE - Business Impact.

UNIT V	FROM THE INTERNET OF THINGS TO THE WEB OF THINGS	9

Resource-oriented Architecture and Best Practices- Designing REST ful Smart Things -Web-enabling Constrained Devices - The Future Web of Things - Set up cloud environment- send data from microcontroller to cloud – Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects.

TOTAL:45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Describe the components needed to develop IOT environment. **(Understand)**
- Design IoT prototype for automating the process. (**Create)**
- Analyze the resource management techniques for an IOT Applications. **(Analyze)**
- Apply the DiY principles to develop of IoT products Framework. **(Apply)**

- Develop an IoT application with web of things.**(Create)**
- Describe the need of web of things. **(Understand)**

TEXT BOOKS:
1. CharalamposDoukas, Building Internet of Things with the Arduino, Create space, April 2002.
2. Dieter Uckelmann et.al, ¯Architecting the Internet of Things‖, Springer, 2011.

REFERENCE BOOKS:
1. Luigi Atzor et.al, ¯The Internet of Things: A survey, ¯, Journal on Networks, Elsevier Publications, October, 2010.
2. http://postscapes.com/.
   http://www.theinternetofthings.eu/what-is-the-internet-of-things.

21UCD507	CREATIVE THINKING AND INNOVATION	L	T	P	C
		0	0	2	1

PREAMBLE:

Creativity is vital in nearly every industry and occupation. Creativity and innovation are key to generation of new ideas and methods of improving goods and services for customer satisfaction. This course enhances the creative thinking and innovation skills of the students. Being creative helps one to be a better problem solver in all areas of life and work.

COURSE OBJECTIVES:

- To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.

- To transform innovative ideas into successful businesses

- To use a range of creative thinking tools to develop Out of the Box Ideas

Course Content

Introduction to Creativity and Innovation- Creative Techniques - Problem Identification through Brain Storming - Solution Identification through Creative Techniques - Presentation on the Innovative Idea - Market Analysis - Revenue and Business Model - Preparation of promotional aids - Customer Feedback Analysis.

List of Activities:

Duration	What does the Faculty do?	What do the students do?
Week 1	Explains creativity and innovation	Team Formation (Team Size: 3)
Week 2	Explains the Creative Techniques (Through Video / Presentation)	Discovering Consumer Need through Need Analysis (Customer Segment)
Week 3	Facilitates the brain storming	Problem Identification through brain storming
Week 4	Facilitates problem solving	Identify the solution for the chosen problem through creative techniques
Week 5	Evaluates the presentation	Presentation on the Innovative Idea and Value Proposition

	Week 6	Evaluates the presentation	Presentation on the Innovative Idea and Value Proposition
	Week 7	Explains about the Market Research / Competitor Analysis, Revenue Model and Business Model	Market Analysis after the explanation
	Week 8	Facilitates the students work	Preparation of Innovation Development Plan, Business Development Plan and Financial Plan
	Week 9	Facilitates the students work	Preparing product promotional material
	Week 10	Facilitates the students work	Improvement through Feedback

Total Hours: 30 Periods

Assessment Pattern

1. Internal Assessment: Presentation on the Innovative Idea

2. End Semester Assessment:

   o Submission of Business Plan

   o Presentation on My Startup Idea (Evaluator : From Industry)

<mark>**Course outcomes**</mark>:

After successful completion of the course students will be able to:

1. Demonstrate the ability to assess societal, health and safety issues and the consequent responsibilities relevant to the professional engineering practice (Valuing – Affective Domain)
2. Examine impact on environment and society in the proposed innovative idea and provide solutions for sustainable development (Organization – Affective Domain)
3. Adapt themselves to work in a group as a member or a leader for efficiently executing the given task (Organization – Affective Domain)

21UGS532	SOFT SKILLS LABORATORY	L	T	P	C
		0	0	2	1

PRE-REQUISITE:

COURSE OBJECTIVES :

• To develop a requisite knowledge in Communication skills and Soft skills.

• To enhance the students' acumen in honing the skills to meet the Global changes and Industrial needs.

UNIT I	SPEAKING SKILLS	9

Conversational Skills - Self Introduction - Group Discussion - Public Speaking - Presentation Skills

UNIT II	WRITING SKILLS	9

Letter Writing – Report Writing – Email Writing – Job Application – Resume Preparation

UNIT III	READING AND LISTENING	9

Reading Comprehension – Enriching Vocabulary – Error Spotting – Listening and Note Taking

UNIT IV	SOFTSKILLS	9

Professional Ethics – Interpersonal Skills – Stress Management – Leadership Qualities – Time

Management - Conflict Resolution

UNIT V	INTERVIEW SKILLS	9

Types of Interview – Body Language – Professional Grooming – Basic Etiquette

TOTAL:30 Periods

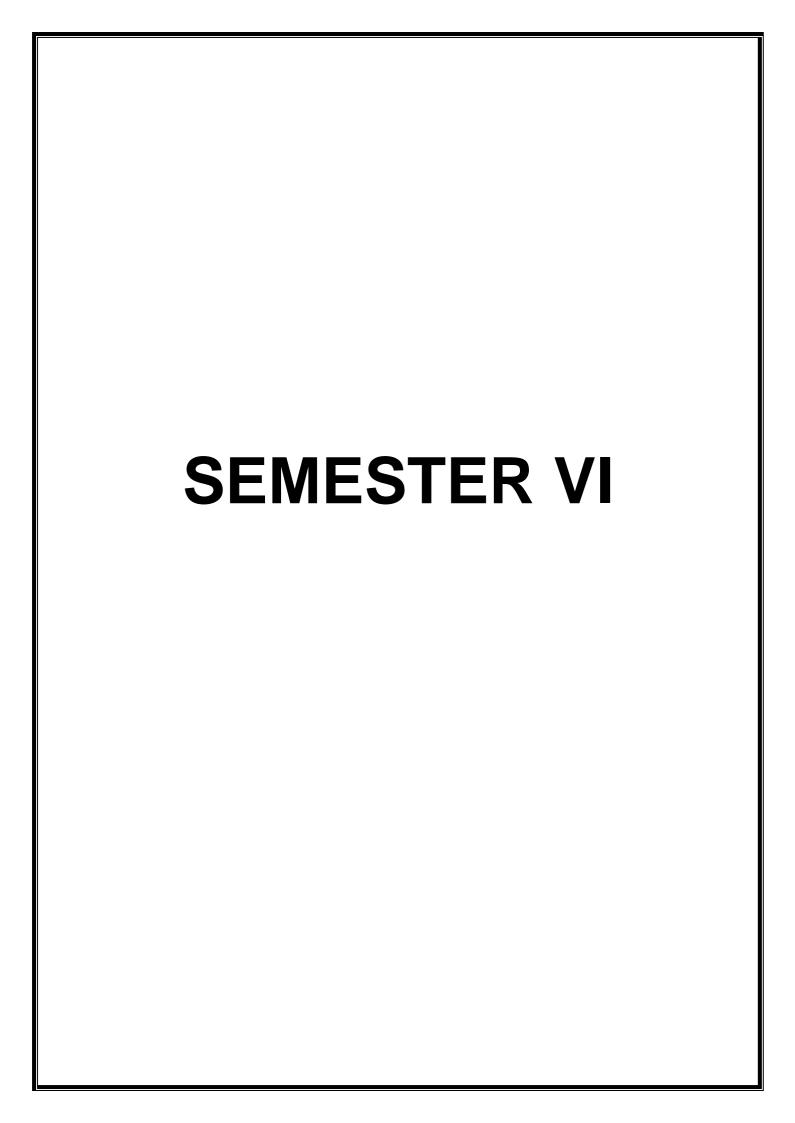**COURSE OUTCOMES:**

After the successful completion of this course, the student will be able to

• Answer the queries precisely after carefully listening to the conversation or speech. (Affective domain - Responding)

• Communicate orally with fluency and clarity in a given contextual situation (Affective domain - Responding)

• Debate with clarity of thought and expression to convey their ideas politely to others (Affective domain - Valuing)

• Apply correct usage of English grammar in writing, fluent speaking and comprehending. (Cognitive Domain - Apply)

REFERENCE BOOKS:

1. Skills for Success, Listening and Speaking - Level 4 by Brooks and Margret - Oxford University Press, Oxford 2011 Edition.
2. Professional Communication by Raman, Meenakshi and Sangeetha Sharma - Oxford University Press, 2014 Edition.
3. Developing Soft Skills by Sherfield, Robert M, R J Montgomery and Patricia G Moody– Pearson Education Publishers

SEMESTER VI

SEMESTER VI

COURSE CODE		COURSE TITLE	L	T	P	C
THEORY						
21UCD601	PC	Game Design and Development	3	0	0	3
21UCD602	PC	IoT Design (Common to CSE, CSD)	2	0	3	3.5
21UCD603	PC	Multimedia Technologies	3	0	0	3
	PE	Professional Elective – II	3	0	0	3
	PE	Professional Elective – III	3	0	0	3
	OE	Open Elective – II	3	0	0	3
PRACTICAL						
21UCD606	PC	Game programming Laboratory	0	0	2	1
21UCD607	PW	Product Development Project	0	0	8	4
21UGS633	HS	Interpersonal Skills Development Laboratory	0	0	3	1.5
MANDATORY COURSES						
21UGM632	MC	Indian Constitution	1	0	0	P/F
		TOTAL	**16**	**0**	**14**	**25**
Total No. of Credits – 25						

21UCD601	GAME DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To learn the various gaming mechanism
- To use the various gaming framework
- To learn the various mechanism to input values
- To familiarize in game development

UNIT I	Introduction to game design and development	9

Introduction to gaming, game Architecture, Applying the game architecture, Application layer, Game logic, Game view for the human player, Game views for AI agents, Networked game architecture

UNIT II	Coding Tidbits and style	9

General coding style, Smart code design practice, smart pointers and naked pointers, using memory correctly, Grab bag of useful stuff, Developing the style that's right

UNIT III	Game actors and component architecture	9

Building game actors, Component architecture, Creating actors and components, Defining actors and components, Storing and accessing Actors, Putting it all together, Data sharing

UNIT IV	Controlling main loop	9

Organizing the main loop, Playing nicely with the OS, Using direct 11 framework, game resource, resource file, resource cache

UNIT V	Programming Input Devices	9

Getting the device state, Using Xinput or direct input, few safety tips, working with two-axis control, working with a game controller, working with a key board

TOTAL:45 Periods

After the successful completion of this course, the student will be able to
- Demonstrate the various mechanisms used in game development **(Understand)**
- Demonstrate the various frameworks used in game development **(Understand)**
- Apply the various gamming styles in the game development **(Apply)**
- Apply various controller mechanisms used to program input devices **(Apply)**
- Analyze various designing methodologies and frameworks used in game designing **(Analyze)**

Design an effective game using two axis controller **(Create)**

TEXT BOOKS:
1. Mike McSaffry and David, ‾Game Coding complete‖, Fourth Edition, Paraglyph Press
2. Robert Nystrom, ‾Game Programming Patterns‖, Genever Benning,2014.

REFERENCE BOOKS:
1. Michael E.Moore, ‾Basics of Game Design‖, CRC Press, 2016.
2. Robert Zubek, ‾Elements of Game Design‖, MIT Press, 2020.
3. Jesse Schell, ‾The art of game design‖, Taylor and Francis, 2014.

21UCD602	AUTOMATA THEORY	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Transforms and Discrete Mathematics, Design and Analysis of Algorithms

COURSE OBJECTIVES :
- To understand various formal languages like Regular Language, Context Free Language, Context Sensitive Language and Recursively Enumerable language.
- To understand various Computing models like Finite State Machine, Pushdown Automata, Linear Bounded Automata and Turing Machine.
- To understand Decidability and Undecidability of various problems.

UNIT I	**FINITE AUTOMATA**	9

Introduction –Concepts of Automata theory- Chomsky Hierarchy of formal languages-Finite Automata (FA) – Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) - Finite Automata with Epsilon Transitions - Equivalence of NFA and DFA– Equivalence of € NFA and DFA –Equivalence of NFA and € NFA.

UNIT II	**REGULAR LANGUAGE AND GRAMMAR**	9

Regular Expression, Regular Language and Regular Grammar – Equivalence of FA and Regular Expressions- Equivalence of FA and Regular Grammar-Properties - Pumping Lemma for Regular Languages –Equivalence and Minimization of Automata.

UNIT III	**CONTEXT FREE AND CONTEXT SENSITIVE LANGUAGE**	9

Context-free grammars (CFG) and languages (CFL)-Derivation and Parse trees-Equivalence of Derivations and Parse Trees-Ambiguity in CFG- Normal forms of CFG – Chomsky and Greibach normal forms-Context Sensitive Grammars-Context Sensitive Languages.

UNIT IV	**PUSH DOWN AUTOMATA AND LINEAR BOUNDED AUTOMATA**	9

Introduction- Pushdown automata- Languages of PDA-Equivalence of PDA and CFG-Deterministic pushdown automata-Properties - Pumping lemma for context-free languages- Closure properties of CFLs- Linear Bounded Automata – Equivalence of LBA‗s and CSG‗s

UNIT V	**TURING MACHINE AND UNDECIDABILITY**	9

Turing Machines – Language of a Turing Machine – Turing Machine as a Computing Device – Programming Techniques for TM – Multi Tape Turing Machines, Equivalence of One Way and Multi- Tape Turing Machines.
A Language that is not Recursively Enumerable (RE) – An Undecidable Problem that is RE – Undecidable Problems about Turing Machine – Properties of Recursive and Recursively Enumerable Languages - Post‗s Correspondence Problem (PCP) - Modified Post Correspondence Problem- Time and tape Complexity measure of TM – the classes of P and NP – NP –completeness.

TOTAL:45 Periods

After the successful completion of this course, the student will be able to

- Explain the concepts of formal languages and automata theory for solving various engineering problems. (Understand)

- Apply the knowledge of formal languages and automata theory to solve complex engineering problems. (Apply)

- Identify the suitable automata model for complex engineering problems for reaching sustained conclusions. (Analyze)

- Evaluate the design of a model using the concepts of the automata theory, formal languages or grammars.(Evaluate)

- Design computational models for a given real world problem using any modern tools.(Create)
- Summarize the conclusions for the different problems through presentation with teams or individually. (Affective Domain)

TEXT BOOK:
3. J.E.Hopcroft, R.Motwani and J.D Ullman, ⎯Introduction to Automata Theory, Languages and Computations‖, Pearson Education, Third Edition, 2008.

REFERENCES:
1. Mishra K L P and Chandrasekaran N, ⎯Theory of Computer Science-Automata, Languages and Computation‖, Prentice Hall of India, Third Edition, 2007.
2. Harry R. Lewis and Christos H. Papadimitriou, ⎯Elements of the theory of Computation‖, Prentice-Hall of India Pvt. Ltd, Second Edition, 2009.
3. Kamala Krithivasan and R. Rama, ⎯Introduction to Formal Languages, Automata Theory and Computation‖, Pearson Education, Delhi, 2009.
4. J. Martin, ⎯Introduction to Languages and the Theory of Computation‖, Tata McGraw Hill, New Delhi, Third Edition, 2007.
5. MichealSipser, ⎯Introduction to the Theory and Computation‖, Cengage Learning India, 2012.

21UCD603	MULTIMEDIA TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn the basics of multimedia, graphics and image data, video data, and audio data
- To Know the file formats and Interfaces of Multimedia
- To Study about the Storage and 3D Modeling
- To use the Multimedia Technology to get the visual effects

UNIT I	INTRODUCTION	10

Multimedia – Definitions, components - History of Multimedia - Applications and Challenges - Multimedia and learning - Communication Network and Multimedia: Bandwidth, Session Management, Security, Support for Mobility and Traffic -Basics of digital audio – Digitization of sound – MIDI – Quantization and Transmission of Audio - Basic audio compression techniques: ADPCM in speech coding - Data compression - MPEG audio compression - Image Compression - Video Compression - Multimedia software tools

UNIT II	FORMATS AND INTERFACES	10

Raster Graphics – Vector Graphics – Image File Formats: Windows Formats, Macintosh Formats, Cross Platform Formats – Audio & Video File formats – Audio & Video Streaming Formats – Graphics and Animation for Web - Web File Formats - CODEC: Lossy Vs Lossless, Compression Techniques - Multimedia Search: Text, Speech, Audio, Image and Video Based Indexing – API: Open GL, Direct X, Direct3D – Interfaces: Parallel, Serial, IDE/ATA, SATA, SCSI, USB, Firewire, PCI, AGP, PCI Express – Graphics Cards – TV Tuners

UNIT III	MULTIMEDIA STORAGE AND 3D MODELLING	9

Multimedia Servers – Removal Storage: Floppy, ZIP, Jazz, Flash Drive, iPod, Removal HDD – Optical Storage: Characteristics of CDs & DVDs – CD Formats – DVD Formats – Replication and Duplication Process – Blu-ray Discs - Definition of Modelling - Surface Modelling- Object cloning-Object Editing-3D Procedural Modelling- Modelling with Polygons-Building Simple scenes-Building complex scenes- Modelling with NURBS

UNIT IV	MULTIMEDIA APPLICATION DESIGN	8

Types of Multimedia systems - Virtual Reality Design - Components of Multimedia system - Distributed Application Design Issues - Multimedia Authoring and User Interface – Hypermedia Messaging - Distributed Multimedia Systems

UNIT V	MULTIMEDIA USING BLENDER	8

3D House Modeling - 3D Furniture and Auditorium Modeling - 3D Cartoon Modeling - 3D Automobile Modeling - 3D Cup Modeling - 3D Text Animation - Fire and Smoke Effects Generation

	TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Familiarize with the concept of Multimedia **(Understand)**

2. Identify suitable file formats and Interfaces for use in appropriate Multimedia Applications **(Apply)**
3. Select appropriate storage systems for Multimedia **(Apply)**
4. Design Multimedia Applications to create 3D Modeling **(Apply)**
5. Create realistic environment with the help of Multimedia concepts **(Create)**
6. Employ Multimedia Authoring Tools to develop Modeling **(Apply)**

TEXT BOOKS:

1. Donald Hearn, M. Pauline Baker, ¯Computer Graphics(C version)‖ Second edition , Prentice Hall ,2002
2. Tay Vaughan, ¯Multimedia: Making It Work‖, McGraw-Hill Education, ninth edition, 2014
3. Banerji Ashok &GhoshAnanda Mohan, ¯Multimedia Technologies‖, Tata McGraw Hill, New Delhi 2010.

REFERENCE BOOKS:

1. Strategies of Multimedia Communication, Girish Saxena, Vista International Publishing
House, 2005
2. Multimedia: Making it Work, Seventh Edition, Tay Vaughan, McGraw Hill Osborne Media, 2006.

3. Virtual Reality Systems, John Vince, Addison Wesley Longman, 2000

21UCD606	GAME PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

PRE-REQUISITE :

COURSE OBJECTIVES:
- Understand the concepts of Game design and development.
- Know about Game programming platforms, frame works and engines.
- Learn to develop games.

1. Plan development based on GDD written using Mind Mapping Tools (Mind Manager)
2. Basics of Unity Game Engine (Set up 3D Scene)
3. Creating Game Objects and Components
4. Move, Scale and Rotate 3D object
5. Learning to get Input from Canvas
6. Learning to use Raycast
7. Core Loop based on Game Design Document
8. Create HUD and Scoring
9. Create End Report for the Game
10. Run Profiler and list the Top 4 Computation Hungry Scripts

- Students may use platforms such as Windows platform, DirectX SDK for rendering, APIs such as Lua scripting language, Box2D Physics Engine, tools such as Visual Studio IDE for software development, Tiled for map editing, RUBE for Box2D level editing, Gimp for sprite sheet creation, Audacity for sound recording and editing.

TOTAL : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Design simple games using game engine. (Apply)
- Apply the concept of Graphics for transformation of objects. (Apply)
- Apply the concept of collision detection, Physics simulation and UI design in construction of games. (Apply)
- Create Interactive Games. (Create)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal Computers - 30 Numbers

SOFTWARE REQUIREMENTS:

- C++, Java, Python.
- Unity 3D
- Unreal Engine 4
- GameMaker Studio 2
- Construct 3
- Godot Engine

21UGS633	INTERPERSONAL SKILLS DEVELOPMENT LABORATORY	L	T	P	C
		0	0	3	1.5

Part - A : Communication and Leadership Projects

I) Speech Projects

1. The Open up Speech (Prepared Speech)
2. Speech Organizing to the Point (Prepared Speech)
3. Table Topics Speech

II) Evaluation Projects

4. Speech Evaluation
5. TAG (Timer, Ah Counter and Grammarian) Evaluation

III) Leadership Roles

6. Speech Master of the Day
7. General Evaluator
8. Table Topics Master

Part - B : Problem-Solving and Decision- Making Project

IV) Quality Circle Project

TOTAL : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Communicate orally with fluency and clarity in a given contextual situation (Responding - Affective Domain)

- Evaluate a speech and offer constructive evaluation of the speech (Evaluating - Cognitive Domain)

- Adapt themselves to work in a group as a member or a leader for efficiently executing the given task (Organization – Affective Domain)

- Analyze a problem and find appropriate solution (Analyze - Cognitive Domain)

- Take decision by organizing relevant information and defining alternatives (Create - Cognitive Domain)

19UGM632	INDIAN CONSTITUTION	L	T	P	C
		1	0	0	P/F

PRE-REQUISITE:

COURSE OBJECTIVES :

- The students will be exposed to fundamental rights & duties in Indian Constitution.
- The students will be given knowledge on the components of the parliamentary system to prepare for the process of their career development.
- The student will have knowledge on powers and functions of Local bodies and Indian polity to appear for various competitive exams such as UPSC, TNPSC and RRB…
- The student will know about the functions of judiciary and electoral process followed in the country.

UNIT I	INTRODUCTION ON INDIAN CONSTITUTION	

Preamble - Salient features of the Constitution of India. Fundamental Rights - its restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) - Fundamental Duties: its Scope and significance in Nation building - Constitution components: schedule, parts and articles of constitution- important Amendments of constitution.

UNIT II	PARLIAMENTARY SYSTEM	

Parliamentary System – parliamentary system of other countries - Indian parliamentary system- Federal System – LS and RS, Centre-State Relations-Election of member of parliaments- Union Executive - President, Prime Minister, Union Cabinet. State Legislature -State Executives -election of MLA- Governor, Chief Minister, State Cabinet.

UNIT III	JUDICIARY AND ELECTION COMMISSION	

Supreme Court of India: Structure, Power and Functions of Supreme Court-- Judicial Reviews - Judicial Activism. High Court and Subordinate Courts: Structure, Power and Functions. – Lok adhalats. Elections- Electoral Process - Election Commission of India - Election Laws - Emergency Provisions - types of Emergencies and its consequences.

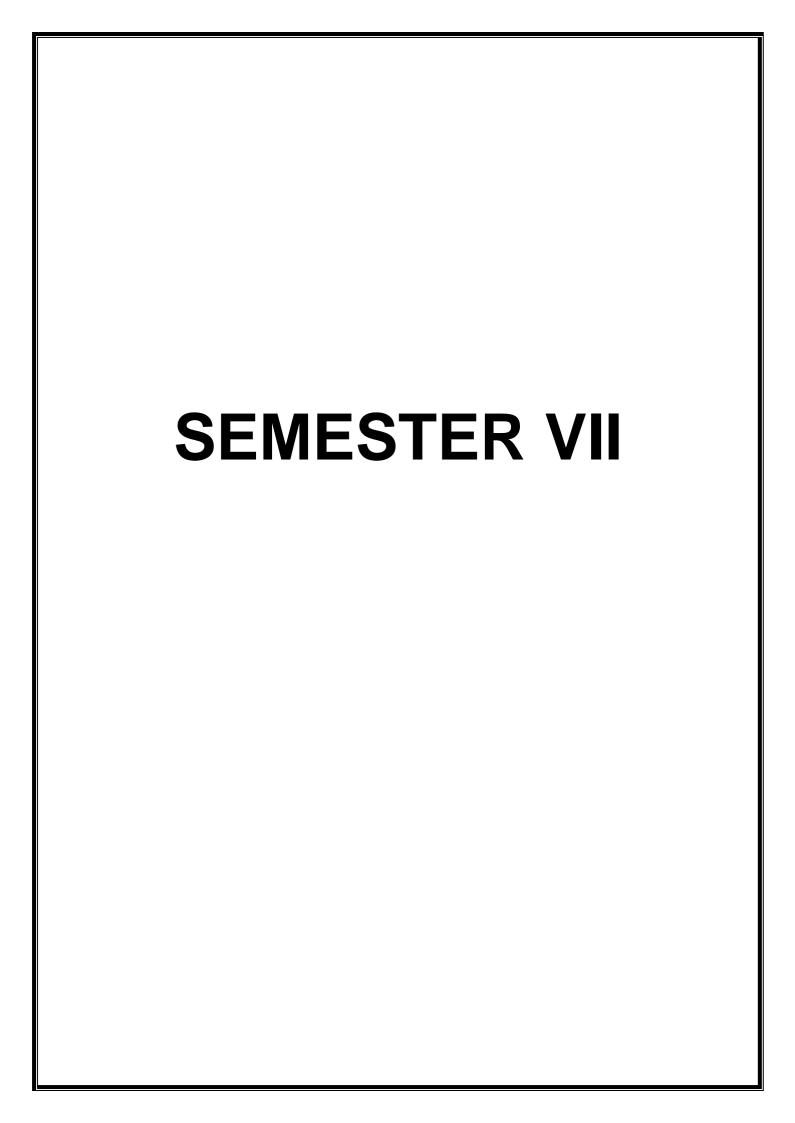| UNIT IV	LOCAL ADMINISTRATION	

Local Administration: Powers and functions of Municipalities and Panchayats System-Panchayat Raj- Co-operative Societies and Constitutional and Non-constitutional Bodies.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply knowledge of the fundamental rights and duties prescribed by Indian Constitution to prepare for various competitive examinations.
- Manage complex societal issues in society with the knowledge of judiciary and local administration.
- Interpret the societal, health, safety, legal and cultural issues with understanding of parliamentary system and electoral process through self-learning skills.
- Understand the ethical responsibilities of municipalities, panchayats and co-operative societies.
- Understand and distinguish the functioning of the parliamentary system followed in various countries

SEMESTER VII

SEMESTER VII

COURSE CODE		COURSE TITLE	L	T	P	C
THEORY						
21UME701	HS	Project Management and Finance	3	0	0	3
21UCD702	PC	Virtual Reality and Augmented Reality	3	0	0	3
21UCD703	PC	3D Modeling and Animation	3	0	0	3
	PE	Professional Elective – IV	3	0	0	3
	PE	Professional Elective – V	3	0	0	3
	OE	Open Elective – III	3	0	0	3
PRACTICAL						
21UCD707	PC	Virtual Reality and Augmented Reality Laboratory	0	0	2	1
21UCD708	PC	3D Modeling and Animation Laboratory	0	0	2	1
MANDATORY COURSES						
21UGM731	MC	Professional Ethics and human values	2	0	0	0
		TOTAL	**20**	**0**	**4**	**20**
Total No. of Credits – 20						

21UCD702	VIRTUAL REALITY AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To make students know the basic concept and framework of virtual reality

- To teach students the principles and multidisciplinary features of virtual reality

- To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behaviour.

- To teach students the technology for managing large scale VR environment in real time.

UNIT I	INTRODUCTION TO VIRTUAL REALITY	9

Virtual reality and virtual environments: Introduction, computer graphics, real-time computer graphics the historical development of VR, scientific landmarks, virtual environments requirements, benefits of virtual reality.

3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image.

UNIT II	USER INTERFACES	9

3D user interface input hardware: input device characteristics, desktop input devices, three dimensional tracking devices, Navigation and manipulation interfaces, Gesture interfaces Hardware technologies for 3D user interfaces: visual displays, auditory displays, haptic displays, choosing output devices for 3D user interfaces. Software technologies: database - world space, world coordinate, world environment, objects - geometry, position / orientation, hierarchy, bounding volume, scripts and other attributes, VR environment - VR database,

UNIT III	INTRODUCTION TO AUGMENTED REALITY	9

Augmented Reality - Definition and Scope, History, Examples. Displays - Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays. Tracking - Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

UNIT IV	VISION, INTERACTION, ANNOTATION AND COLLABORATION	9

Computer Vision - Marker Tracking, Natural Feature tracking, Incremental tracking and Outdoor tracking. Interaction - Tangible interfaces, Virtual User Interfaces on Real Surfaces, Multi-view Interfaces, Haptic Interaction, Annotation, Collaboration - properties, Co-located Collaboration, Remote Collaboration. Case Study: VR in Healthcare and Education.

UNIT V	APPLICATIONS OF VR AND AR	9

Applications - Gaming and Entertainment - Architecture and Construction - Science and Engineering - Health and Medicine - Aerospace and Defense - Education - Information and Big data visualization - Telerobotics and Telepresence.

TOTAL:45 Periods

:

After the successful completion of this course, the student will be able to

- Understand how the design of VR technology relates to human perception and cognition (Understand)

- Apply virtual environment technology for capturing user data (Apply)

- Apply different modeling techniques for VR systems (Apply)

- Analyze the fundamental aspects of designing and implementing empirical experiments using VR(Analyze)

- Analyze multimodal virtual displays and techniques for evaluating virtual interfaces (Evaluate)

- Develop virtual reality applications to conduct of scientific research, training and industrial design (Create)

REFERENCE BOOKS:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

4. John Vince, ¯Virtual Reality Systems ¯, Pearson Education Asia, 2007.

5. Sherman William R, Craig Alan B., Understanding Virtual Reality: Interface, Application and Design, First Edition, Morgan Kaufmann Publishers, 2002.

6. Steve Aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), 1st edition, Addison-Wesley, 2016

21UCD703	3D MODELING AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES :
- To introduce the fundamental concepts of Digital Audio.
- To understand the design aspects and audio synthesis.

UNIT I	INTRODUCTION	9

Configuring the user interface including hotkeys, interface color, marking menus, display modes - Adjusting cameras, displays, and viewports - Basic object creation - Core 3D Concepts - Cartesian Coordinates - Right handed rule - Basic 3D transforms -

UNIT II	CREATING A 3D SCENE	9

Optimizing the interface for working efficiently - Polygon components (vertices, edges, faces) - Creating and editing geometry from primitives - How modeling primitives relate to modern construction techniques - Understanding form, function, and structure - Additive vs. subtractive modeling - Manually manipulating component - Selection strategies for selecting and isolating component transform - Splitting polygons vs. deleting edges

UNIT III	MATERIALS AND TEXTURING	9

Overview of the rendering pipeline - Fundamental formulas and math functions (normal, tangents, cosines) - Defining nodes and attributes - Introduction to materials and shading groups - Basic rendering nodes and attributes - Lambert shader - Building off of lambert with phong and blinn shader - Defining textures vs. materials - Assigning textures to material attributes - Texture nodes and utility nodes - Sourced vs. procedural texture nodes and concepts for mathematically generated texturing - Understanding the four categories of shading nodes and how they work together to shape the rendered scene

UNIT IV	CAMERAS IN 3D	9

Cinematography references - Good and bad camerawork and composition - Laying out and populating a 3D scene - Animating a camera - Graph editor curves - The Five C's, Cinematography, Fundamental techniques for good camera work - The application of lighting in 3D - Types of lights and their uses - Good lights (directional, spot, point, and area) - Bad lights (ambient and volume)- Ray traced and depth mapped shadows - Soft shadows, penumbra, falloff, and other phenomena - Using the Render Settings window to prepare a scene for lighting - Memory efficiency and pipeline specific differences of each renderer

UNIT V	RENDERING	9

Rendering image sequences from Maya - Proper naming conventions (name.#.ext, etc.) - Importing image sequences into post production and compositing programs - Creating QuickTime movies - Understanding compression codecs, quality, compression, file size - Industry specific examples

TOTAL: 45 Periods

==COURSE OUTCOMES:==
After the successful completion of this course, the student will be able to
- Explain the fundamental concepts of 3D modeling. **[Understand]**
- Use appropriate digital technology to provide solutions for problems. **[Apply]**
- Compare the performance of various technologies for solving design oriented problems. **[Analyze].**
- Choose the best suitable format for 3D animation in a constraint environment. **[Evaluate]**
- Develop a 3D animation. **[Create]**

21UCD707	VIRTUAL REALITY AND AUGMENTED REALITY LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :
-

LIST OF EXPERIMENTS

1. Import VR SDK and make a Test Scene Work with the given Headset
2. Design UI for VR Space
3. Create an Interactive VR Experience
4. Import AR SDK and make a Test Scene Work with Android Device
5. Design UI for AR space
6. Create an Interactive AR app
7. Import MR SDK and make a Test Scene Work with the given Headset
8. Design UI for MR Space
9. Create an Interactive MR Experience
10. Create VR Version of the Game Designed

TOTAL : 30 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Use multiple AR and VR components with Unity. (Apply)

- Design an user interface for AR and VR space (Create)

- Create Virtual and Augmented Reality mobile apps with Unity (Create)

Take decision by organizing relevant information and defining alternatives (Create - Cognitive Domain)

HARDWARE & SOFTWARE REQUIREMENTS:

Visual Studio, Unity Tool, VR headset

21UCD708	3D MODELING AND ANIMATION LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :

-

LIST OF EXPERIMENTS

1. Using the provided planets scene file, animate the orbit and revolution of each of the planets, moons around the solar system. Learn familiarity with the Maya interfaces, including object selection, navigation, setting animation keys, and basic transforms. Save the scene and submit it to blackboard.

2. Create a metropolitan landscape from primitives and simple hierarchies. At least three separate building made with only polygon primitives, duplication, grouping, and parenting. Attempt to faithfully reproduce the most important details. See blackboard for specific details.

3. Populate the scene with at least three new sculpted polygon objects. These should complement the primitive models from the previous turn-in. For this phase of production we are focusing on sculpting through mesh editing techniques as detailed in class. One object should be a vehicle of some form. See blackboard for specific details.

4. Assign materials to the objects with the scene. Use the material properties to convey the appropriate type of physical look for the various surfaces in your scene. Stone, metal, glass, wood, earth, sky, plastic, marble, etc. Make sure to include at least three materials that have ‚specular' shading properties, at least one surface shader, and at least one material that uses incandescence. See blackboard for specific details

5. Assign textures to the objects with the scene. A fully UV unwrapped vehicle or objects to support accurate texturing. Use the mesh projection tools and UV texture editor menus to manually alight and sort out any problem UV areas for clean texturing. Use image editing programs to make sourced textures for color, bump, specular, and incandescence attributes. See blackboard for specific details. Setup a custom camera in Maya. Set it up with appropriate film gate, lens, and working settings. Use the camera's viewport as a director's viewfinder to layout and arrange the various assets of your city into the scene as a complex environment. See blackboard for specific details

6. Light the scene to establish a specific mood. Lighting reference will help to achieve the best possible emotional context and exposure quality for the scene. Animate the camera so that it makes a well-controlled cinematic camera move. Choreograph the vehicle's animation so that it travels in relation to the camera through a 10 second shot. See blackboard for specific details.

7. Setup the animated scene for rendering. Render the scene out as a sequence of images and then import the sequence into the post compositing program for final QuickTime output. See blackboard for specific details.

8. Add image planes to your profile orthographic cameras as modeling reference. Use NURBS curves to define the profile and contours for the objects. Use curve editing and surfacing operations to build out the shape of the chess pieces in NURBS. Then convert to polygons for any remaining detailing. Build at least two different chess pieces using NURBS and/or polygon techniques. See blackboard for specific details
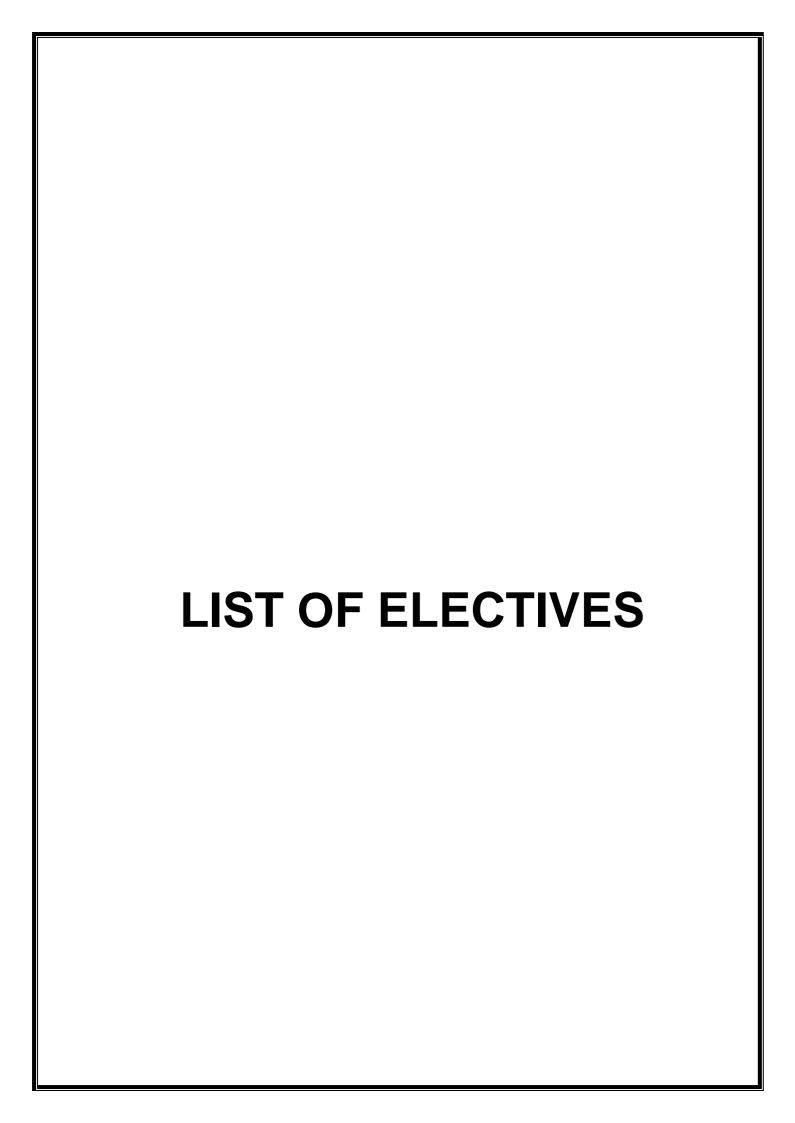
COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Use Maya software to develop 3D scenes (Apply)
- Develop 3D scenes (Create)

SOFTWARE REQUIREMENTS:

Maya software

LIST OF ELECTIVES

LIST OF ELECTIVES

S.No.	Course Code	Course Name	L	T	P	C
1.	21UCD901	Digital Marketing Strategy	3	0	0	3
2.	21UCD902	Wearable Applications, Research, Design, and Interactions	3	0	0	3
3.	21UCD903	Non Linear Editing	3	0	0	3
4.	21UCD904	Robotic Process Automation	3	0	0	3
5.	21UCD905	GPU Computing	3	0	0	3
6.	21UCD906	Digital Audio Design and Synthesis	3	0	0	3
7.	21UCD907	Spatial Explorations in Interaction Design	3	0	0	3
8.	21UCD908	Image Processing Techniques for Computer vision	3	0	0	3
9.	21UCD909	Artificial intelligence for games	3	0	0	3
10.	21UCD910	Machine Learning Algorithms	3	0	0	3
11.	21UCD911	Robotics	3	0	0	3
12.	21UCD912	Cloud Computing Techniques	3	0	0	3
13.	21UCD913	Data Science and Analytics	3	0	0	3
14.	21UCD914	Compiler Design tools and techniques	3	0	0	3
15.	21UCD915	Crypto Currency	3	0	0	3
16.	21UCD916	Visualization Analysis Techniques	3	0	0	3
17.	21UCD917	Cryptography Algorithms for Network Security	3	0	0	3
18.	21UCD918	Information retrieval Mechanisms	3	0	0	3
19.	21UCD919	Mobile Computing	3	0	0	3
20.	21UCD920	C# and .NET Programming	2	0	2	3
21.	21UCD921	Usability Studies and Evaluation	3	0	0	3

21UCD901	ADVANCED 3D ANIMATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :
- Developing more sophisticated skills for character performance
- Experimenting with both realistic and highly exaggerated styles of animation
- Identifying professional practices and standards in animation industry, while creating Demo-reel.

UNIT I	The Maya user interface	9

Introduction -The Maya interface, Creating, manipulating, and viewing objects, Creating a new scene, Primitive objects, Transformation tools. The Channel Box

UNIT II	Viewing the Maya 3D scene	9

Workflow overview, viewing objects in shaded mode, Grouping objects, The Hyper graph Selection modes and masks, Pivot points Components and attributes Template display Components The Attribute Editor Surface materials

UNIT III	Polygonal Modeling	9

Polygonal Modeling Modeling a polygonal mesh -Using 2D reference images Creating a polygon primitive Model symmetry Selecting edge loops, Editing components in the orthographic views, Editing components in the, perspective view ,Drawing a polygon ,Extruding polygon components, Bridging between edges Adding polygons to a mesh, Splitting polygon faces ,Terminating edge loops

UNIT IV	NURBS Modeling	9

Revolving a curve to create a surface Creating a profile curve ,Creating a revolve surface Editing a revolve surface Sculpting a NURBS surface Preparing a surface for sculpting, Basic sculpting techniques, Additional sculpting techniques. Sculpting a nose ,Sculpting eye sockets ,Sculpting eyebrows, Sculpting a mouth Sculpting other facial features

UNIT V	Subdivision Surfaces	9

Modeling a subdivision surface Splitting a surface in polygon proxy mode ,Extruding polygon faces ,Deleting polygon faces Subdivision surface levels Refining surface components Creating a crease in a subdivision surface

==COURSE OUTCOMES==:

After the successful completion of this course, the student will be able to
- Understand 3D animations' production pipeline by creating realistic and believable movements and emotions.
- Strengthen animation skills by exploring methods for creating movements.
- Analyze methods for creating solid acting choices that are unique and interesting.
- Evaluating animations based on various principles of animation.
- Create an independent animated project from start to completion in production standard

TEXT BOOKS:

- Roger King,‖3D Animation for the Raw Beginner Using Maya ‾
- John EdgarPark,‖Understanding 3D Animation Using Maya‖

REFERENCE BOOKS:
- Andy Beane.‖3D Animation Essentials‖

21UCD902	SERVICE DESIGN FOR ENTERPRISES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To learn about the Service Design
- To familiarize the problem solving strategy to provide solution for Enterprises
- To gain the wide knowledge of services to society
- To facilitate effective testing and evaluate the service Design

UNIT I	THE SERVICE ECONOMY AND ITS CHALLENGES	9

Defining Services-The Service Economy- The economics of Services-The Customer-Centric Organization-The Rise of the Social Economy-The Sharing Economy-Digital Services-The Digital Lie-The Internet of Things-Challenges of an increasingly digital world-The role of service Design in Digital Services

UNIT II	SERVICES FOR PUBLIC INTEREST	9

Services for Public interest - Service innovation and the public Sector - Service Design capability for the public sector - Social Innovation and Collaborative services - Learning Features

UNIT III	THE POLITICS OF SERVICE DESIGN	9

The Politics of Service Design – Introduction - The drama of Services - Environment Sustainability of services - Services as Systems and the issue of Organization Politics - Learning Features.

UNIT IV	PRINCIPLES OF SERVICE DESIGN	9

Deigning for Services-Introduction-Core Principles of Service Design-The Service Design Community-Starting the Service-Design Process-Introduction-Case Study-APAM Bus Company Manuta, Italy, by Intersezioni Design Integrated.- Case Study Analysis- Methods and Tools.

UNIT V	GENERATING OF SERVICE DESIGN	9

Generating of Service Design Concepts - Case Study - My Voice Project by Reboot - Methods and Tools - Implementation and Evaluation - Case Study - London Olympic Games 2012 - Case Study analysis - Methods and Tools.

TOTAL: 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Explain the objectives and concepts of Service Design. **(Understand)**
- Apply the tool and methods of service design for public interest **(Apply)**
- Analyze the strategies of service design to provide the solution for issues related to Organization **(Analyze)**
- Evaluate the performance of the design developed for the given problem with various parameters **(Evaluate)**
- Develop a new Design Process for a given real world scenario **(Create)**
- Practise in teams or as an individual to develop a design process. **(Affective Domain)**

TEXT BOOK:
1. ⁻An Introduction to Service Design: Designing the Invisible‖, Lara Penin- Bloomsbury Publishing, 17-May-2018

REFERENCE BOOK:
1. ⁻Service Design for Business: A Practical Guide to Optimizing the Customer Experience‖, Ben Reason, Lavrans Lovlie-Melvin Brand Flu-2016-Published by John Wiley & Sons, Inc.,

21UCD903	USABILITY STUDIES AND EVALUATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Human computer interaction

COURSE OBJECTIVES :
- To explain usability engineering lifecycle for designing a user-friendly software.
- Discuss usability design guidelines, their foundations, assumptions, advantages, and Weaknesses.
- To develop usability evaluation skills for software testing.
- To explain industry standards for designing and evaluating use-interfaces.
- To make aware of the current trends in usability engineering.

UNIT I	INTRODUCTION	9

What is Usability: Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences. Generations of User Interfaces: Batch Systems, Line-Oriented Interfaces, Full-Screen Interfaces, Graphical User Interfaces, Next-Generation Interfaces, Long-Term Trends in Usability.

UNIT II	THE USABILITY ENGINEERING LIFECYCLE	9

The Usability Engineering Lifecycle: Know the User, Competitive Analysis, Goal Setting, Parallel Design, Participatory Design, Coordinating the Total Interface, Guidelines and Heuristic Evaluation, Prototyping, Interface Evaluation, Iterative Design, Follow-Up Studies of Installed Systems, Meta-Methods, Prioritizing Usability Activities, Be Prepared.

UNIT III	USABILITY TESTING	9

Usability Testing: Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects of Tests with Human, Subjects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories. Usability Assessment Methods beyond Testing: Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Choosing Usability Methods.

UNIT IV	INTERFACE STANDARDS	9

Interface Standards: National, International and Vendor Standards, Producing Usable In-House Standards. International User Interfaces: International Graphical Interfaces, International Usability Engineering Guidelines for Internationalization Resource Separation, Multi-locale Interfaces.

UNIT V	FUTURE DEVELOPMENTS	9

Future Developments: Theoretical Solutions, Technological Solutions, CAUSE Tools: Computer Aided Usability Engineering, Technology Transfer, Ubiquitous Computing, Intelligent User interfaces, Simulation and Virtual Reality. Case Study: Usability Issues in Organizations, Organizational Roles and Structures, Ethics of Usability, Web Analytics.

TOTAL: 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Justify the theory and practice of usability evaluation approaches, methods and techniques.**(Analyze)**
- Compare and evaluate strengths and weaknesses of various approaches, methods and techniques for evaluating usability. **(Understand)**
- Design and implement a usability test plan, based on modelling or requirements specification. **(Apply)**

- Choose appropriate approaches, methods and techniques to evaluate the usability of a specified interactive system. **(Understand)**
- Develop User interface for industrial standards **(Apply)**
- Create Cause tools for Computer aided design in future development **(Create)**

TEXT BOOKS:
1. Jakob Nielsen, ⁻Usability Engineering‖, Morgan Kaufmann, An Imprint of Academic Press, Harcourt Science and Technology Company

REFERENCE BOOKS:
1. Rosson, M. B., & Carroll, J. M. (2001), ⁻Usability Engineering: Scenario-Based development of human-computer interaction‖, Elsevier.
2. Mayhew, D. (2199), ⁻The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design‖, Morgan Kaufmann.
3. Alan Cooper, About Face 3: The Essentials of Interaction Design,3ʳᵈ Edition, Wiley 2007

21UCD907	SPATIAL EXPLORATIONS IN INTERACTION DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the basic concepts of spatial interaction design and methods of user information gathering.
- To familiarize the students with the techniques for emotional interaction and designing interfaces.
- To impart the knowledge of how the sensory, cognitive and physical capabilities of users can be used to design interactive products.

UNIT I	BASICS OF SPATIAL INTERACTION	9

What is Interaction design? – The user experience – The Process of Interaction Design – Interaction Design and the User experience. Understanding and Conceptualizing Interaction: Understanding the Problem space and Conceptualizing Interaction- Conceptual models - Interface metaphors - Interaction types - Paradigms, Visions, Theories , Models and Frameworks

UNIT II	COGNITIVE ASPECTS AND EMOTIONAL INTERACTION	9

Cognitive aspects: Introduction - What is Cognition? - Cognitive Frameworks. Emotional Interaction: Introduction – emotions and the User experience – Expressive Interfaces – Annoying Interfaces - Detecting Emotions and Emotional Technology - Persuasive Technologies and Behavioral Change.

UNIT III	INTERFACES AND DATA GATHERING	9

Interfaces: Introduction – Interface types - Natural User Interfaces and Beyond – Choosing the appropriate interface. Data Gathering: Introduction – Issues – Methods for data gathering – Choosing and combining techniques for data gathering.

UNIT IV	DATA ANALYSIS, INTERPRETATION AND INTERACTION DESIGN PROCESS	9

Introduction – Types of analysis – Examples – Data analysis tools – Presentation of the analysis. Process of Interaction design: - Steps - Practical issues

UNIT V	DESIGN, PROTOTYPING , CONSTRUCTION AND EVALUATION	9

Introduction – Prototyping – Conceptual design – Concrete design – Generating prototypes for scenarios – Construction. Evaluation – Basic concepts – Types – Case studies.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the concepts of spatial interaction, various interfaces, data gathering, analysis and interpretation and design techniques. **(Understand)**
- Apply the concepts of spatial interaction, interfaces, analysis and interpretation of data towards design of an interactive product. **(Apply)**
- Select, adapt and apply suitable interaction design approaches and techniques towards the design of an interactive system. **(Analyze)**
- Demonstrate the ability to provide usable solutions to complex problems involving spatial interaction.**(Create)**
- Demonstrate the usage of various modern tools for spatial interaction and its computing to design and develop spatial interaction system.**(Apply)**
- Exhibit the ability to interact in a team and work as an individual developing a spatially interactive product following the project management principles.**(Affective Domain)**

TEXT BOOKS:
1. Jennifer Preece, Helen Sharp, Yvonne Rogers, ‾Interaction Design: Beyond Human-Computer Interaction‖, John Wiley & Sons , Fourth Edition, 2015.

REFERENCE BOOKS:
1. Charalampos Rizopoulos,Dimitris Charitos,‾The Experience of Spatial Interaction: Conceptualizing the User Experience of Virtual Environments‖, Lecture Notes in Computer Science book series (LNCS, volume 8530) , 2014.
2. Eva Eriksson, ‾Spatial Explorations in Interaction Design‖, Interaction Design, 2011.
3. https://www.interaction-design.org/courses

21UCD905	ARTIFICIAL INTELLIGENCE FOR GAMES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To familiarize students with techniques and issues of Artificial Intelligence (AI) for
- computer games
- To discuss the nature of path-finding in video games.
- To demonstrate the application of physics in game environment towards achieving realism

UNIT I	AI And Game	9

Game AI, Model of Game AI, Algorithms, Data Structures and Representations, Kinds OF AI in Games, Speed and Memory-Processor issues, Memory concerns, PC & console constraints, The AI Engine-Structure of AI Engine, Tool chain concerns.

UNIT II	Motor Control & Movements	9

Basics of Movement Algorithm - Two dimensional movement, Statics, Kinematics, Steering Behaviors - Variable matching, Path following, Collision avoidance, Predicting physics, Jumping & Motor Control, Movement in 3rd Dimension.

UNIT III	Path Finding	9

Graphs, Weighted Graphs, Cost functions, Path smoothing, Open Goal pathfinding, Dynamic pathfinding, Continuous time pathfinding, Movement Planning

UNIT IV	Trees and algorithms: Decision Trees	9

Problem- algorithm - Pseudo code - Implementation, State Machines, Behavior trees - Fuzzy Logic, Markov Systems.

UNIT V	Decision Making	9

Scheduling execution. Level Of Detail, The Design, Shooters, Driving, Real-Time strategy, Sports, Turn based strategy games, AI Based Game Genres

.**TOTAL:45 Periods**

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Identify aspects of computer games, which benefit from artificial intelligence.
- Implement artificial intelligence and machine learning techniques for traditional and modern computer games.
- Define the importance of physics and collision in game creation.
- Create custom navigation using path-finding algorithms.
- Demonstrate their skills in handling game engines for AI tasks.

Text Books:

1. Ian Millington and Morgan Kaufmann, ⁻Artificial Intelligence for Games‖, 2nd edition,Taylor & Francis, 2012.

Reference Book:

1. Jeff Heaton, ⁻Artificial Intelligence for Humans, Fundamental Algorithms‖, 1st edition,
2. Create Space Independent Publishing Platform, 2013.

21UCD906	SPECIAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To learn the advanced visual effects tools.
- To understand the tools and techniques of Warping and Morphing.
- To practice the categories in Resolution.

UNIT I		9

Single integrated application – vector paint – motion graphics design – animation – compositing - Full 3D compositing environment - Advanced visual effects tools - keying, color correction, tracking, grain management, and masking tools inherited from the Flame visual effects system.

UNIT II		9

Edit Operator – break free from your NLE – assemble clips complete with transitions right in Combustion – Rich set of effects-tools – fully integrated – interactive particle system – warping and morphing - 3D Post filters.

UNIT III		9

Comprehensive paint and rot scoping tools – Fully customizable brushes – Comprehensive animation tools -animation curve editor - key framing - Expressions - Intuitive schematic view to simplify visualization and organization of complex effects.

UNIT IV		9

OpenGL® application programming interface acceleration – multiprocessor support - extensive caching for improved system performance - Multiple simultaneous view ports.

UNIT V		9

Resolution -independence with 8-, 10, 12, 16, and 32-bit (float) per component image processing – real-time RAM looped playback.

TOTAL:45 Periods

<mark>**COURSE OUTCOMES**</mark>**:**
After the successful completion of this course, the student will be able to
- Gain good understanding about compositing process. **(Understand)**
- Demonstrate interactive particle system to warping and morphing. **(Apply)**
- Apply a view to simplify visualization and organization of complex effects. **(Apply)**
- Demonstrate an in-depth knowledge of grading and VFX principles, practice and system capabilities. **(Apply)**
- Create customized tools through software or scripting to allow for more creative application of special effects techniques. **(Create)**
- Create the techniques for processing the real-time RAM looped playback. **(Create)**

TEXT BOOKS:
1. Industrial Light & Magic: The Art of *Special Effects.* Thomas G. Smith Thomas G. Smith

21UCD907	PHOTOGRAPHY	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Computer Graphics and Multimedia and Animation

COURSE OBJECTIVES :

- To enable students to identify basic concepts of photography
- To enable students to explore different kinds of camera techniques.
- To enable students to gain exposure to outdoor and indoor photograph
- To enable students to impart the knowledge for advanced photography.

UNIT I	BASICS OF PHOTOGRAPHY	9

History of Photography- -Human eye – simplicity vs. complexity – visualization – photographic realism, abstraction and art - creativity - intuition - Camera: overview on photography –making a career in photography - categories of photography – photojournalism- advertising portrait-nature photography -shutter - aperture – depth of field – major type of camera - purpose and control over aperture- aperture -shutter speed – factors that affect D.O.F.

UNIT II	LENS AND FILMS	9

Lens :Types of lenses - focal length – wide angle, normal, and long focal length lenses - focus and depth of field-hyper focal distance – determining - History of Photography- Daguero type – Fox Talbot-Modern B/W chemistry – Eastman Kodak. Film: selecting and using film –tungsten film & daylight films – black and white films – monochrome films – infrared films and other special effects films-different formats-35m-120 mm - 220mm - 4 x 5 film -Film speed – How film responds to light-film grain - sensitivity - structure of film - light vs film

UNIT III	EXPOSURE AND IMAGE MAKING TECHNIQUES	9

Photography lighting techniques - Exposure and image making techniques: how an exposure meter works – ambient light meters –flash meter readings- built in meter – external light meter – metering techniques-incident light metering – reflective light metering – spot metering – gray scale- framing- perspective- texture -pattern – composition and design

UNIT IV	BLACK AND WHITE PHOTOGRAPHY	8

Black and White photography: Black and white film - Black and white filters - Developing - developing tank - structure of B/W film- Printing.-making a mask - photograms- push processing – pull processing – masters of B/W photography – Ansel Adams - identifying the various zones - sets and costume for photography - tools and techniques.

UNIT V	ADVANCED PHOTOGRAPHY	10

Making a career in photography – categories of photography - Photo journalism – nature, scope, coverage of spot news – photo essay, feature and documentary- Overview and components of Travel and outdoor Photography, portraits, macro photography, fashion photography, ad photography, action, architectural, forensic and medical, wildlife, underwater, food etc. - Photo compositing - photo editing, Image manipulation – ways to market photography - trends in photography: Digital imaging – Latest trends in digital imaging- a career in digital imaging-digital photographers

TOTAL:45 Periods

After the successful completion of this course, the student will be able to
- Understand the basics concept of photography. **(Understand)**
- Identify the different categories of photography and its applications. **(Apply)**
- Analyze independently take outdoor and indoor shots. **(Analyze)**
- Apply the concept of Black and White photography with camera handling techniques. **(Apply)**
- Develop the experiment with different types of photography tools and lighting techniques. **(Create)**
- Design and development of the recent trends in photography for product, industrial & fashion. **(Create)**

TEXT BOOKS:
1. MukeshSrivatsa, Digital Photography, Unicorn books, 2012.
2. Scott Kalby. Digital Photography. Peachpit Press. 2010.
3. Kenneth kobre, Photo Journalism – The Professional's approach, Focal Press. 2003.
4. Paul Harcourt Davies. A complete guide to close up and Macro Photography. David Charles, 2001.

REFERENCE BOOKS:
1. John Hedgecoe, The Book of Photography, Dorling Kindersley, 2005
2. Micheal Langford. Advanced Photography. Focal Press, 7th Edition, 2008.
3. Bruce Barnbaum. The Art of Photography. Rockynook. 2010.
4. Langford's Advanced Photography 8th Edition, Focal Press, 2011.
5. Image Sensors and signal Processing for digital Still cameras, Junichi Nakamura, Taylor and Francis 2006.

21UCD908	NON LINEAR EDITING	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Digital Audio and Video design

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

UNIT I	AI And Game	9

Game AI, Model of Game AI, Algorithms, Data Structures and Representations, Kinds OF AI in Games, Speed and Memory-Processor issues, Memory concerns, PC & console constraints, The AI Engine-Structure of AI Engine, Tool chain concerns.

UNIT II	Motor Control & Movements	9

Basics of Movement Algorithm – Two dimensional movement, Statics, Kinematics, Steering Behaviors - Variable matching, Path following, Collision avoidance, Predicting physics, Jumping & Motor Control, Movement in 3rd Dimension.

UNIT III	Path Finding	9

Graphs, Weighted Graphs, Cost functions, Path smoothing, Open Goal pathfinding, Dynamic pathfinding, Continuous time pathfinding, Movement Planning

UNIT IV	Trees and algorithms: Decision Trees	9

Problem- algorithm - Pseudo code - Implementation, State Machines, Behavior trees – Fuzzy Logic, Markov Systems.

UNIT V	Decision Making	9

Scheduling execution. Level Of Detail, The Design, Shooters, Driving, Real-Time strategy, Sports, Turn based strategy games, AI Based Game Genres

.**TOTAL:45 Periods**

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Identify aspects of computer games, which benefit from artificial intelligence.
- Implement artificial intelligence and machine learning techniques for traditional and modern computer games.
- Define the importance of physics and collision in game creation.
- Create custom navigation using path-finding algorithms.
- Demonstrate their skills in handling game engines for AI tasks.

TEXT BOOKS:
1. Patrick Morris, ¯Non Linear Editing‖, Publishers Routledge, Released November2012.

REFERENCE BOOKS:
1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith under Dahl, ¯Digital Video for Dummies‖, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Patrick McGrath, ¯Editing Digital Video: The Complete Creative and Technical Guide‖, Digital Video and Audio, McGraw-Hill 2003.

21UCD909	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:
- Basic understanding of programming concepts
- Good logical reasoning ability

COURSE OBJECTIVES:
- To learn about the evolution and future of Robotic Process Automation.
- To learn how Robotic Process Automation works and its components.
- To learn about the basic concepts of UiPath.
- To learn activities related to UI Automation, System activities and various User Events.

UNIT I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	10

Emergence of Robotic Process Automation (RPA) - Evolution of RPA - Future of RPA - Differentiating RPA from Automation - Defining Robotic Process Automation & its benefits - Types of Bots - Application areas of RPA - RPA development methodology and key considerations - List of Robotic Process Automation Tools

UNIT II	UIPATH & PROCESS COMPONENTS AND ACTIVITIES	9

Introduction to UiPath platform and its components - Types of Templates - User Interface - Domains in Activities - Workflow Files in UiPath - UI Automation Activities - System Activities – Variables – Arguments - User Events

UNIT III	APP INTEGRATION, RECORDING AND SCRAPING	8

App Integration – Recording – Scraping – Selector - Workflow Activities – Debugging - Error Handling – Logging - Extensions - Project Organization

UNIT IV	ORCHESTRATOR COMMUNITY EDITION AND OTHER RPA TOOLS	8

UiPath Orchestrator Overview - Orchestrator activities - Introduction to Orchestrator CE - Orchestrator CE - Other RPA tools

UNIT V	IMPLEMENTING REFRAMEWORK & AUTOMATION	10

Introduction to REFramework - Purpose of REFramework - Using State Machine Layout - States of the State Machine - Workflows Involved - Workflows of the Framework - Exception Handling & Logging - Rules of Developing a Process using REFramework - Data Manipulation - Introduction to Native Citrix Automation - Text and Image Automation - PDF Automation

TOTAL:45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Understand insights into Robotic Process Automation Technology. **(Understand)**
- Apply several types of data inside a workflow. **(Apply)**
- Understand reusing of automation by implementing templates. **(Understand)**
- Apply REFramework to build a structured business automation process. **(Apply)**
- Organize a real-world workflow automation project. (**Create**)
- Develop skills in debugging a workflow. **(Psychomotor Domain)**

TEXT BOOKS:
1. Gerardus Blokdyk, RPA robotic process automation, second edition, 5 STARCooks, Oct 13, 2018.

21UCD910	WEARABLE APPLICATIONS, RESEARCH, DESIGN, AND INTERACTIONS	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Internet of Things

COURSE OBJECTIVES :

- To identify the need for development of wearable devices and its implications on various sectors.
- To design and development of various wearable inertial sensors and wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications.
- To discuss the usage of various biochemical and gas sensors as wearable devices.
- To acquaint various wearable locomotive sensors as assistive devices for tracking and navigation.
- To create awareness about need of energy harvesting in wearable applications.

UNIT I	FUNDAMENTALS OF WEARABLE TECHNOLOGIES	9

Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Types of wearable sensors: Invasive, Non-invasive; Intelligent clothing, Industry sectors' overview – sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.

UNIT II	WEARABLE DEVICES FOR HEALTHCARE	9

Wearable Bioelectric impedance devices for Galvanic skin response; Wearable ECG devices: Basics of ECG and its design, Wearable EEG devices: Principle and origin of EEG, Basic Measurement set-up, electrodes and instrumentation; Wearable EMG devices: EMG/ SEMG Signals, EMG Measurement – wearable surface electrodes, Wearable Blood Pressure (BP) Measurement: Cuff-Based Sphygmomanometer, Cuffless Blood Pressure Monitor. Study of flexible and wearable Piezo resistive sensors for cuffless blood pressure measurement. Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – Conductive textile electrodes, Knitted Piezo resistive Fabric (KPF) sensors.

UNIT III	WEARABLE BIOCHEMICAL AND GAS SENSORS	9

Wearable Biochemical Sensors: Parameters of interest, System Design -Textile based, Microneedle based; Types: Non invasive Glucose Monitoring Devices, GlucoWatch® G2 Biographer, GlucoTrack™; Pulse oximeter, Portable Pulse Oximeters, wearable pulse oximeter; Wearable capnometer for monitoring of expired carbon dioxide.
Wearable gas sensors: Metal Oxide (MOS) type, electro chemical type, new materials- CNTs, graphene, Zeolites; Detection of atmospheric pollutants.

UNIT IV	WEARABLE CAMERAS AND MICROPHONES FOR NAVIGATION	9

Cameras in wearable devices, Applications in safety and security, navigation, Enhancing sports media, Automatic digital diary. Cameras in smart-watches; Use of Wearable Microphones: MEMS microphones, Bioacoustics, Microphones and AI for respiratory diagnostics and clinical trials.
Wearable Assistive Devices for the Blind - Hearing and Touch sensation, Assistive Devices for Fingers and Hands, Assistive Devices for wrist, fore arm and feet, vests and belts, head-mounted devices.

UNIT V	ENERGY HARVESTING AND WEARABLES - CHALLENGES AND ITS FUTURE RESEARCH DIRECTIONS	9

Wearable Technologies - Energy Expenditure and Energy Harvesting. Technology of Connected Devices – Energy Considerations. Wearables: Challenges and Opportunities, Future and Research Roadmap.

TOTAL:45 Periods

After the successful completion of this course, the student will be able to
- Identify and understand the need for development of wearable devices and its influenceon various sectors. **(Understand)**
- Design and development of various wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications. **(Create)**
- Discuss and analyze the usage of various biochemical and gas sensors as wearabledevices.
  (Understand)
- Identify the use of various wearable locomotive tools for safety and security, navigation.(**Understand)**
- Acquaint the usage of wearable devices as assistive devices, diagnostic devices andother modern applications. **(Understand)**

TEXT BOOKS:
1. ¯Seamless Healthcare Monitoring‖, Toshiyo Tamura and Wenxi Chen, Springer 2018
2. ¯Wearable Sensors -Fundamentals, Implementation and Applications‖, by Edward Sazonov and Michael R. Neuman, Elsevier Inc., 2014.
3. ¯Wearable and Autonomous Biomedical Devices and Systems for Smart Environment‖, by Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, Springer 2010

REFERENCE BOOKS:
1. ¯Wearable Electronics Sensors - For Safe and Healthy Living‖, Subhas Chandra Mukhopadhyay, Springer 2015
2. Edward Sazonov, Michael R. Neuman (editors), Wearable Sensors: Fundamentals, Implementation and Applications, 2014, Academic Press/Elsevier, ISBN 978-0124186620

21UCD911	USER INTERFACE SOFTWARE AND TECHNOLOGY(UIST)	3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Describe the web user Interface
- Describe the structure of user Interface and design process
- Organize the web systems and control

UNIT I	INTRODUCTION	8

Human-Computer Interface - Characteristics Of Graphics Interface -Direct Manipulation Graphical System - Web User Interface -Popularity -Characteristic & Principles.

UNIT II	HUMAN COMPUTER INTERACTION	10

User Interface Design Process – Obstacles -Usability -Human Characteristics In Design – Human Interaction Speed -Business Functions -Requirement Analysis – Direct – Indirect Methods – Basic Business Functions - Design Standards - System Timings - Human Consideration In Screen Design - Structures Of Menus – Functions Of Menus- Contents Of Menu- Formatting – Phrasing The Menu – Selecting Menu Choice- Navigating Menus- Graphical Menus

UNIT III	WINDOWS	9

Characteristics- Components- Presentation Styles- Types- Managements- Organizations- Operations- Web Systems- Device- Based Controls Characteristics- Screen - Based Controls - Operate Control - Text Boxes- Selection Control- Combination Control- Custom Control- Presentation Control.

UNIT IV	MULTIMEDIA	9

Text For Web Pages - Effective Feedback- Guidance & Assistance- Internationalization- Accessibility- Icons- Image- Multimedia - Coloring.

UNIT V	WINDOWS LAYOUT-TEST	9

Prototypes – Kinds Of Tests – Retest – Information Search – Visualization – Hypermedia – WWW- Software Tools.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Describe the Characteristics of Graphics Interface and its Principles**(Understand)**
- Design the standards for Human computer interaction**(Understand)**
- Develop various types of menus**(Apply)**
- Apply the components of web systems and windows systems**(Apply)**
- Demonstrate the Guidance of multimedia systems and its accessibility**(Understand)**
- Summarize the concepts of windows layout and visualization**(Understand)**

TEXT BOOKS:
1. Wilbent. O. Galitz ,¯The Essential Guide To User Interface Design‖, John Wiley & Sons, 2nd edition,2011.
2. Ben Sheiderman, ¯Design The User Interface‖, Pearson Education, 2198

REFERENCE BOOKS:
1. Alan Cooper, ¯The Essential Of User Interface Design‖, Wiley – Dream Tech Ltd.,4thedition ,2015

21UCD912	INTRODUCTION TO TYPOGRAPHY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Make students aware of the role of typography in everyday life.
- Introduce them to the basic principles of micro- and macro-typography
- Enable them to assess the requirements of a project brief, research, plan and implement it
- Provide students with an understanding of how to use digital technology to implement design solutions

UNIT I	INTRODUCTION TO TYPOGRAPHY	9

Introduction-Learning Objectives-The typewriter- Origin and Development Of Typewriter-Importance of typewriter and computer-categories of typewriters:Standard-Noiseless-portable-electric-electronic-Computers-laptops

UNIT II	KEYBOARD OPERATIONS	9

Introduction-Objectives-Keyboard: QWERTY keyboard, key types, character key, Modifier key-Sitting Posture: Chair and table guidelines, placement of machine-Methods of keyboard operations-Sight Method: Merits, Demerits-Touch of Sight method: merits, Demerits-Learning Home Row-Learning Upper Row-Learning Bottom Row-Learning Number Row-Learning Special Signs and Symbols

UNIT III	COMPUTER HARDWARE	9

Storage Devices: Floppy Disk, Hard Disk, Compact Disk, DVD, Pen drive - Input devices: Keyboard, Mouse, joystick, Scanner, OCR, MICR, OMR, MIC- Output Devices: Monitor, Printer, Plotter, Speakers, Ports, Serial Ports, Parallel Ports, USB, AGP, Bluetooth, Firewire

UNIT IV	WINDOWS OPERATING SYSTEM	9

Logging On-Switching between accounts-Features of the Windows System: Desktop, Icon, Window, Dialogue Box, Start Menu, Task Bar, Tab Menu- Opening &Closing Applications-Manipulating Windows-Using Computer folder-Control panel-Locating files and folders-Search for file-Deleting a file-Renaming a file

UNIT V	INTRODUCTION TO OFFICE	9

 Introduction to word-Excel-Power point-outlook-Working with the Office Assistant-Processing with word: Creating a new Document, Inserting a Text, Deleting a Text, Selecting a Text, Copy and Paste Text, Drag and Drop Text, Finding Text, Replacing Text, Auto Correction, Save as Command-Working with Shapes and Styles-Printing-Clipart-Managing documents and Customizing Word

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Demonstrate a knowledge of the history of typographic letterforms as they relate to the history of graphic communication.(Understand)

- Create letterforms as part of a consistent alphabet.(Create)
- Apply typographic rules and measurements to composition. (Apply)
- Demonstrate the proper use of type as a design tool.(Understand)
- Recognize different type styles and categories and be able to apply them to the proper design situation.(Apply)
- Evaluate the basic components of the invention of printing. (Evaluate)

21UCD913	ADVANCED ALGORITHMS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :
- To introduce and practice advanced algorithms and programming technique necessary for developing sophisticated computer application programs
- To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
- To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements

UNIT I	ANALYSIS OF ALGORITHMS AND DATA STRUCTURES	9

Review of order rotation & growth of functions, recurrences, probability distributions, Average case analysis of algorithms, Basic data structures such as stacks, queues, linked lists, and applications.

UNIT II	NON-LINEAR DATA STRUCTURES	9

Direct access tables and hash tables, hash functions and relates analysis, Binary Search trees and Operations, AVL Trees and balancing operations, R B Trees, properties, operations

UNIT III	PROPERTIES AND OPERATIONS ON SETS AND GRAPHS	9

B-Trees – definition – properties, operations, data structures for disjoint sets, Graph algorithms, MST single source all pair shortest paths, BFS, DFS, topological sort, strongly connected components

UNIT IV	ADVANCED GRAPH ALGORITHMS	9

Quick sort randomized version, searching in linear time, More graph algorithms – maximal independent sets, coloring vertex cover, introduction to perfect graphs

UNIT V	OPTIMISTIC ALGORITHMS	9

Algorithmic paradigms Greedy Strategy, Dynamic programming, Backtracking, Branch-and-Bound, Randomized algorithms

TOTAL: 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to
- Understand the fundamental algorithmic techniques such as brute force, greedy, and divide and conquer.(UNDERSTAND)
- Apply advanced abstract data type (ADT) and data structures in solving real world problems.(APPLY)
- Effectively analyze and combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem. (ANALYZE)
- Assess the time and space complexity for various algorithms and derive an optimistic algorithm that best fits the solution.(EVALUATE)
- Construct modules and libraries built on advanced optimistic algorithms to deploy an effective software product to the end user.(CREATE)
- Discuss the performance of various algorithms and select the optimal algorithm in accordance with feedback of individual team members.(AFFECTIVE DOMAIN)

TEXT BOOKS:

1. Introduction to Algorithms, Second Edition, Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein, The MIT press, McGraw-Hill Book Company, Third Edition 2009.

REFERENCE BOOKS:

1. Algorithms, Jeff Erickson, First paperback edition,2021
2. An Introduction to Data structures and algorithms, Daniel R.Page, Page wizard games , Learning and entertainment, 2020.

21UCD914	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system.
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

UNIT I	INTRODUCTION	9

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies - Multiplexing – Spread spectrum - MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II	MOBILE TELECOMMUNICATION SYSTEM	9

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS UMTS – Architecture – Handover – Security

UNIT III	MOBILE NETWORK LAYER	9

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing -ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) -MANET Vs VANET – Security.

UNIT IV	MOBILE TRANSPORT AND APPLICATION LAYER	9

Mobile TCP- WAP - Architecture - WDP - WTLS - WTP –WSP - WAE - WTA Architecture - WML

UNIT V	MOBILE PLATFORMS AND APPLICATIONS	9

Mobile Device Operating Systems - Special Constraints & Requirements - Commercial Mobile Operating Systems - Software Development Kit: iOS, Android, BlackBerry, Windows Phone - MCommerce – Structure – Pros & Cons - Mobile Payment System - Security Issues

TOTAL:45 Periods

==COURSE OUTCOMES==:

After the successful completion of this course, the student will be able to

- Explain the basics of mobile telecommunication systems. **(Understand)**
- Illustrate the generations of telecommunication systems in wireless networks. **(Understand)**
- Determine the functionality of MAC, network layer and identify a routing protocol for a given Ad hoc network. **(Understand)**
- Explain the functionality of Transport and Application layers. **(Understand)**
- Develop a mobile application using android/blackberry/ios/Windows SDK.**(Apply)**

TEXT BOOKS:

1. Jochen Schiller, ¯Mobile Communications‖, PHI, Second Edition, 2003.

2. Prasant Kumar Pattnaik, Rajib Mall, ¯Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCE BOOKS:

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

21UCD915	INORMATION RETRIEVAL	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Data Mining

COURSE OBJECTIVES :

- To learn the information retrieval models.
- To impart the knowledge of Text Classification.
- To familiarize the concepts in Web Search Engine.
- To facilitate Multimedia Information Retrieval.

UNIT I	INTRODUCTION	9

Information Retrieval – The IR Problem-The IR System-User Interfaces for Search-Search Interfaces Today-Visualization in Search Interface-Design and Evaluation of Search Interfaces- IR search Applications -Working with Electronic Text-Open source Search engine Frameworks – Lucene, Indiri, Wumpus

UNIT II	INFORMATION RETRIEVAL MODELS	9

IR Models-Modelling and Ranking-Characteristics of an IR Model-The Boolean Model-The Vector Model-The Probabilistic Model-Other Models-Hyper Text Model-Web based Model

UNIT III	TEXT CLASSIFICATION	9

Text Classification-Characterization of Text Classification-Text Classification Algorithms-Unsupervised Algorithms- Clustering-Naïve Text Classification-supervised Algorithms- k-NN Classifier-The SVM Classifiers-Ensemble Classifiers-Feature Selection or Dimensionality Reduction-TF-IDF Weights-Information Gain-Chi Square

UNIT IV	WEB SEARCH ENGINE-WEB RETRIEVAL AND WEB CRAWLING	9

Search Engine Architecture -Search Engine Ranking-Managing Web Data- Web Crawling-Applications of Web Crawlers-Architecture and Implementation-Scheduling Algorithms

UNIT V	MULTIMEDIA INORMATION RETRIEVAL	9

Introduction-Multimedia IR-Text IR Verses Multimedia IR- The Challenges-Content Based Image Retrieval-Color Based Retrieval-Texture-Salient Points-Audio and Music Retrieval-Fingerprinting-Speech Recognition-Speaker Identification

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Understand the IR Concepts and its Applications **(Understand)**
- Identify the suitable Information Retrieval models for retrieving the Data for a given application **(Apply)**
- Able to Apply Text Classification using Clustering and Naïve Text Classification **(Apply)**
- Able to Apply Text Classification using various supervised Algorithms **(Apply)**
- Apply web searching techniques to search the web pages **(Apply)**
- Apply various suitable techniques to retrieve multimedia data **(Apply)**

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
3. OphirFrieder ¯Information Retrieval: Algorithms and Heuristics: The Information Retrieval
   Series ¯,2ndEdition, Springer, 2004.
4. Manu Konchady, ¯Building Search Applications: Lucene, Ling Pipe‖, First Edition,Gate Mustru Publishing, 2008.
5. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition, Wiley, 2010.

21UCD916	IMAGE PROCESSING TECHNIQUES FOR COMPUTER VISION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:
- Vectors, Linear algebra (i.e., Matrix operations, Solution of linear equations).
- Programming language (e.g. C).

COURSE OBJECTIVES:
- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand three-dimensional image analysis techniques.
- To understand Object detection and tracking.
- To study some applications of computer vision algorithms.

UNIT I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	9

Review of image processing techniques, classical filtering operations, Thresholding techniques, edge detection techniques, corner and interest point detection, mathematical morphology and textures.

UNIT II	SHAPES AND REGIONS	9

Binary shape analysis - connectedness - object labeling and counting - size filtering - distance functions - skeletons and thinning - deformable shape analysis - boundary tracking procedures - active contours - shape models and shape recognition - centroidal profiles - handling occlusion - boundary length measures - boundary descriptors - chain codes - Fourier descriptors - region descriptors - moments. Hough Transform (HT) for line detection

UNIT III	3D VISION AND MOTION	9

Methods for 3D vision - projection schemes - shape from shading - photometric stereo - shape from texture - shape from focus - active range finding - surface representations - point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion - triangulation - bundle adjustment - translational alignment - parametric motion - spline based motion - optical flow - layered motion.

UNIT IV	OBJECT DETECTION AND TRACKING	9

Introduction to Motion Detection , Applications of Motion Detection and Tracking, Background Subtraction (BGS), Basic BGS Algorithms, Mixture of Gaussians (MoG), Block matching for object tracking. Single object and multi-object tracking.

UNIT V	COMPUTER VISION APPLICATIONS	9

Application: Photo album - Face detection - Face recognition - Eigen faces - Active appearance and 3D shape models of faces Application: Surveillance - foreground-background separation - particle filters - Chamfer matching, and occlusion - combining views from multiple cameras - human gait analysis Application: In-vehicle vision system: locating roadway - road markings - identifying road signs – locating pedestrians. .

TOTAL: 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Implement fundamental image processing techniques required for computer vision. **(Apply)**
- Implement boundary tracking techniques. **(Apply)**
- Apply Hough Transform for line, circle. **(Apply)**
- Implement motion related techniques. **(Apply)**

- Apply the techniques of Objects detection and tracking. **(Apply)**
- Develop skills to develop applications using computer vision techniques. **(Apply)**

TEXT BOOKS:
1. Simon J. D. Prince, ⁻Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.

REFERENCES:
1. R. Davies, ⁻Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, ⁻Computer Vision: Algorithms and Applications‖, Springer 2011.
3. Mark Nixon and Alberto S. Aquado, ⁻Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., ⁻Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.
5. Jan Erik Solem, ⁻Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.
6. Sudha Challa, ⁻Fundamentals of Object Tracking‖, Cambridge University Press, 2011.
7. http://kercd.free.fr/linksKCD.html
8. http://www.cs.ubc.ca/spider/lowe/vision.html
9. http://www.teiath.gr/seyp/optics/Vision.htm
10. http://www.visionscience.com/

21UCD917	GPU COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To understand the basics of GPU architectures
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models

UNIT I	GPU ARCHITECTURE	12

Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Me

UNIT II	CUDA Programming	8

Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III	Programming issues	8

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT IV	OPENCL BASICS	8

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Heterogeneous computing- Basic OpenCL Examples.

UNIT V	ALGORITHMS ON GPU	9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

TOTAL:45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Describe GPU Architecture. **(Understand)**
- Write programs using CUDA, identify issues and debug them **(Apply)**
- Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication **(Analyze)**
- Write simple programs using OpenCL. **(Apply)**
- Identify efficient parallel programming patterns to solve problems. **(Evaluate)**
- Efficient Memory handling using CUDA **(Apply)**

TEXT BOOKS:
1. Shane Cook, CUDA Programming: ˉA Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, ˉHeterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.

REFERENCE BOOKS:
1. Nicholas Wilt, ˉCUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013.
2. Jason Sanders, Edward Kandrot, ˉCUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.

21UCD918	DATA ANALYTICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Data Mining, Programming Skill (R programming, Python)

COURSE OBJECTIVES:
- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

UNIT I	INTRODUCTION TO BIG DATA ANALYTICS	9

Big Data Overview - State of the Practice in Analytics - Key Roles for the New Big Data Ecosystem-Examples of Big Data Analytics, Data Analytics Lifecycle, Analytical approaches - Data analytics using R, Exploring basic features of R, Exploring R GUI, Reading data sets, Manipulating and processing data in R, Functions and packages in R, - Statistical Methods for Evaluation -Performing graphical analysis.

UNIT II	CLUSTERING, CLASSIFICATION AND REGRESSION	UNIT II

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions, Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes_ Theorem - Naïve Bayes Classifier, Regression-Linear Regression - Logistic Regression.

UNIT III	ASSOCIATION AND RECOMMENDATION	9

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV	MINING DATA STREAMS	9

Introduction to Streams Concepts - Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments - Counting oneness in a Window - Decaying Window - Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

UNIT V	NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION	9

NoSQL Databases: Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding--Hbase - Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

TOTAL:45 Periods

<mark>COURSE OUTCOMES</mark>:

After the successful completion of this course, the student will be able to
- Work with big data tools and its analysis techniques. **(Apply)**
- Compare and Evaluate data by different data mining techniques like classification, prediction, clustering and Regression. **(Evaluate)**
- Analyze different mining algorithms and recommendation systems for large volumes of data. **(Analyze)**
- Perform analytics on real-time streaming data. **(Analyze)**

- Develop the ability to build and assess data-based models in NoSQL. **(Create)**

- Apply R software tools for big data analytics in various applications like social media. **(Apply)**

TEXT BOOKS:
1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.

REFERENCE BOOKS:
1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
2. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
3. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
4. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

21UCD919	COMPILER DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE: AUTOMATA THEORY

COURSE OBJECTIVES :
- To learn various phases of compiler.
- To learn the design techniques of lexical analyzer for a language.
- To give knowledge on various parsing techniques.
- To give knowledge on different levels of translation and various optimization techniques.

UNIT I	LEXICAL ANALYSIS	9

Introduction-Compilers– Phases of a compiler -Role of Lexical Analyzer – Input Buffering. Specification and Recognition of Tokens -LEX -Finite Aotomata-Regular expressions to auttomata .

UNIT II	SYNTAX ANALYSIS	9

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III	INTERMEDIATE CODE GENERATION	9

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expression.

UNIT IV	RUN TIME ENVIRONMENTS AND CODE GENERATOR	9

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

UNIT V	CODE OPTIMIZATION	9

Principal Sources of Optimization – Peep-hole optimization – DAG- Optimization of Basic Blocks-Global Data Flow Analysis - Efficient Data Flow Algorithm.

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Design Finite Automata for recognizing the given pattern.(Create)
- Design the parser for the a given grammar.(Apply)
- Translate parsed source statements into three address statements.(Apply)
- Identify the right storage structure for the programming language (Apply)
- Design a simple code generator for the given programing Language.(Create)
- Apply the optimization techniques for target code generation.(Apply)

TEXT BOOKS:

1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, ‟Compilers- Principles, Techniques, and Tools‖, Pearson Education Asia, 2007.
2. Holub, Allen I., ‟Compiler Design in C‖, PHI, 2003.

REFERENCE BOOKS:

1. Randy Allen, Ken Kennedy, ¯Optimizing Compilers for Modern Architectures: A Dependence- based Approach‖, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, ¯Advanced Compiler Design and Implementation, ¯Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, ¯Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, ¯Crafting a Compiler with C‖, Pearson Education, 2008

21UCD920	INFORMATION STORAGE MANAGEMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE: Database Systems, Computer Networks

COURSE OBJECTIVES:
- To introduce storage architectures and key data center elements in classic, virtualized, and cloud environments.
- To explain storage networking technologies such as FC SAN, IP SAN, FCoE, NAS and object-based and unified storage.
- To impart the knowledge of Backup and Archive in virtualized and non-virtualized environment.

UNIT I	STORAGE SYSTEMS	9

Introduction to information storage - evolution of storage architecture, key data center elements, virtualization, and cloud computing - Data center environment - Details key data center elements – host (or compute), connectivity, storage, and application in both classic and virtual environments- RAID - RAID implementations, techniques, and levels along with the impact of RAID on application performance - Intelligent storage system - Details components of intelligent storage systems.

UNIT II	STORAGE NETWORKING TECHNOLOGIES	10

Fibre Channel Storage Area Network (FC SAN) - FC SAN components, connectivity options, and topologies including access protection mechanism „zoning". IP SAN and Fibre Channel over Ethernet (FCoE) - iSCSI and FCIP protocols for storage access over an IP network. Converged protocol FCoE and its components. Network Attached Storage (NAS) - File sharing technology using NAS and covers its benefits, components, and implementations. File level storage virtualization. Object based and Unified Storage - Emerging areas of object-based storage and unified storage solutions. Content addressed storage (CAS) as an implementation of an object-based solution.

UNIT III	BUSINESS CONTINUITY, BACKUP AND ARCHIVE	9

Introduction to Business Continuity -Information Availability, BC Terminology, Life cycle, Failure analysis, Business Impact Analysis, BC Technology solutions, Backup and Recovery: Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, process, backup and restore operations, Deduplication technology to optimize data backups along with archival solutions to address fixed content storage requirements.

UNIT IV	REPLICATION TERMINOLOGY	8

Local Replication: Replication Terminology- Uses of Local Replicas- Replica Consistency-Local Replication Technologies- Tracking Changes to Source and Replica- Restore and Restart Considerations- Creating Multiple Replicas- Local Replication in a Virtualized Environment,
Remote Replication: Modes of Remote Replication- Remote Replication Technologies- Three-Site Replication- Data Migration Solutions- Remote Replication and Migration in a Virtualized Environment

UNIT V	SECURING AND MANAGING STORAGE INFRASTRUCTURE	9

Securing the Information Infrastructure - Framework and domains of storage security along with covering security implementation at storage networking. Security in virtualized and cloud environments. Managing the Information Infrastructure - storage infrastructure monitoring and management - storage tiering, information lifecycle management (ILM), and cloud service management activities.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, CAS. (Analyze)
- Articulate business continuity solutions - backup, replication, plus archive in storage area networks. (Apply)
- Examine emerging technologies including IP-SAN. (Apply)
- Identify information security and analyze different storage virtualization technologies. (Analyze)
- Apply the logical and physical components of a storage infrastructure. (Apply)
- Identify components of managing and monitoring the data center. (Understand)

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management‖, Wiley, ISBN number: 04702942134.
2. Robert Spalding , ‾Storage Networks: The Complete Reference ‖, Tata McGraw Hill, Osborne, 2003.

REFERENCE BOOKS:

1. G. Somas Sundaram, AlokShrivastava, , ‖ Information Storage and Management ‖, Wiley, India,.
2. Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, ‖ Storage Network explained : Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE ‖, Wiley, India,.
3. Marc Farley,‖ Building Storage Networks ‖, Tata McGraw Hill, , Osborne, 2001.
4. Meeta Gupta,‖ Storage Area Network Fundamentals ‖, Pearson Education Limited, 2002.

21UCD921	MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To impart basic concepts and techniques in Machine Learning.
- To familiarize the concepts of Supervised and Unsupervised learning techniques
- To study probabilistic model based learning
- To introduce neural networks and Deep Learning

UNIT I	INTRODUCTION TO MACHINE LEARNING	9

Introduction to Machine learning-Types of machine learning-Applications of ML-Languages /Tools in ML-Preparing Model-ML activities-Basic types of data in ML-Exploring structure of data-Data quality and remediation-Data pre-processing-Modelling and Evaluation-Selecting a model-Training a model-Model representation and interpretability-Evaluating performance of a model-Basics of Feature Engineering-Feature Transformation-Feature subset selection.

UNIT II	PROBABILISTIC MODELS	9

Brief review of probability-Basic concept of probability, random variables- Discrete distributions-Binomial, Poisson, Bernoulli, etc. Continuous Distributions -Uniform, Normal, Laplace- Central theorem-Central theorem, Monte Carlo approximation.
Bayesian concept learning- Bayes theorem- Prior and Posterior probability, Likelihood, Bayes' theorem and Concept learning- Bayesian Belief network.

UNIT III	SUPERVISED LEARNING	9

Supervised Learning-Classification-Basics of supervised learning-Classification model -K-nearest neighbor- Decision tree-Random Forest-Support Vector Machine.
Supervised Learning- Regression-Linear regression-other regression techniques

UNIT IV	NEURAL NETWORK MODELS	9

Basics of Neural Network-Understanding the biological neuron and artificial neuron-Types of activation functions- Early implementations of ANN -McCulloch Pitt's , Rosenblatt's Perceptron, ADALINE – Architectures of neural network- Learning process in ANN- Back propagation-Deep learning

UNIT V	UNSUPERVISED LEARNING	9

Unsupervised learning- Basics of unsupervised learning-Clustering techniques-Association rules-Instance Based Learning-Ensemble Learning.

TOTAL: 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Understand the concepts of machine learning for solving various complex problems of engineering.   **(Understand)**
- Apply the knowledge of machine learning to solve complex engineering problems based on regression, classification and Clustering.   **(Apply)**
- Identify the suitable Machine learning algorithm for complex engineering problems for reaching sustained conclusions using the principles of mathematics. **(Analyze)**
- Design solutions for complex engineering problems to predict or forecast the results for engineering, business, health care and environmental applications.**(Apply)**
- Interpret the data and synthesize the information using Machine Learning algorithms and

statistical methods to provide valid conclusions.**(Evaluate)**

- Design a model for a given problem using modern tools for predicting the results of the complex engineering problems, considering the limitations of the model.**(Create)**

TEXT BOOKS:
1. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson,2021.
2. Tom M Mitchell, ¯Machine Learning, First Edition, McGraw Hill Education, 2013.

REFERENCE BOOKS:
1. Hastie, Trevor, Tibshirani, Robert, Friedman, Jerome, The Elements of Statistical Learning. Data Mining, Inference, and Prediction, Second Edition, February 2009, Springer.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
3. Peter Flach, ¯Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
4. Jason Bell, ¯Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014
5. Ethem Alpaydin, ¯Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014

21UCD922	ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
- To summarize the functions of the basic components of a Robot.
- To familiarize the various types of robot driven system and End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.
- To impart knowledge about industrial robots for their control and design.

UNIT I	INTRODUCTION TO ROBOTICS	7

Robotics: Robot Anatomy–Need for Robots-Types and components of a robot-Classification of robots,-closed-loop and openloop control systems.-Kinematics systems: Definition of mechanisms and manipulators-Social issues and safety- Applications of Robots.

UNIT II	ROBOT ACTUATION SYSTEM AND KINEMATICS	10

Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators-Robot Kinematics and Dynamics : Kinematic Modelling: Translation and Rotation Representation- Coordinate transformation-DH parameters, Jacobian, Singularity, and Statics- Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

UNIT III	SENSORS AND VISION SYSTEM	9

Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc.-Introduction to Cameras-Camera calibration-Geometry of Image formation-Euclidean/Similarity/Affine/Projective transformations-Vision applications in robotics.

UNIT IV	ROBOT CONTROL	10

Basics of control: Transfer functions-Control laws: P, PD, PID-Non-linear and advanced controls.

UNIT V	CONTROL HARDWARE AND INTERFACING	9

Embedded systems: Architecture and integration with sensors-actuators-components-Programming for Robot Applications**,** Robot software – simulation software- Computer aided analysis of robots (using roboanalyzer software) -Industrial Robot.

TOTAL:45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Apply the basic engineering knowledge to configure a Robot. [Apply]
- Identify the various Robot system and Kinematics for the design of Robotics. [Analyze]
- Apply the knowledge of Sensors to implement a robot system.[Apply]
- Select the hardware and interfacing method for robot to find the solution.[Apply]
- Develop a programming knowledge for industrial robot applications.[Create]
- Design the Robot for real life applications.[Create]

Text Books
1. Saha, S.K., ‾Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Mikell P. Grooveret. al., "Industrial Robots -Technology, Programming and Applications", McGraw Hill, New York, 2008 (Reprint).

REFERENCES BOOK:
1. John J.Craig , ‾Introduction to Robotics, Pearson, 3rd edition, 2009(Reprint).
2. R.K. Mittal, I.J. Nagrath, Robotics and control, Tata McGraw-Hill, 2003.
3. Ghosal, A., ‾Robotics‖, Oxford, New Delhi, 2006.

4. Niku Saeed B., ⁻Introduction to Robotics: Analysis, Systems, Applications‖, PHI, New Delhi.
5. Mukherjee S., ⁻Robotics and Automation‖, Khanna Publishing House, Delhi.
6. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, ⁻Robot Modelling and Control‖,
   John Wiley and Sons Inc, 2005
7. Steve Heath, ⁻Embedded System Design‖, 2nd Edition, Newnes, Burlington, 2003
8. Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, ⁻Intelligent Mechatronic System: Modeling, Control and Diagnosis‖, Springer.
9. Deb S. R. and Deb S., ⁻ Robotics Technology and Flexible Automation ,Tata McGraw Hill Education Pvt. Ltd, 2nd edition, 2010(Reprint).
10. http://nptel.ac.in/courses/112108093,http://www.roboanalyzer.com/tutorials.html

21UCD929	CLOUD COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

PRE-REQUISITES : COMPUTER NETWORKS

COURSE OBJECTIVES:
• To introduce the essentials of building fully featured applications on various cloud models.
• To familiarize the concepts of designing and developing various service models (IaaS, PaaS and SaaS) and deployment models (Public, Private and Hybrid clouds).
• To impart the knowledge of Multi-cloud management systems and business clouds.

UNIT I	OVERVIEW OF CLOUD COMPUTING	7

Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.

UNIT II	PRIVATE CLOUDS	10

Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Private Cloud Building blocks namely Physical Layer, Virtualization Layer, Cloud Management Layer, Challenges to private Cloud, Virtual Private Cloud.

UNIT III	PUBLIC CLOUDS	10

What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service.

UNIT IV	CLOUD SECURITY	9

Security concerns in Traditional IT, Challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Different vendors offering Cloud Security for public and private clouds.

UNIT V	MULTI-CLOUD MANAGEMENT SYSTEMS AND BUSINESS CLOUDS	9

Concept of multi-cloud management, Challenges in managing heterogeneous clouds, benefits and advantages of multi-cloud management systems. Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education).

TOTAL :45 Periods

After the successful completion of this course, the student will be able to
• Explain the concepts of Cloud Computing and the various deployment and service models of Cloud Computing.
• Describe the Building blocks of Private Cloud.
• Explain about the various Players of Public Cloud and their offerings.
• Describe the Security concerns of Cloud Computing.
• Describe the Multi-Cloud management System.

TEXT BOOKS:

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski,‖ Cloud Computing: Principles and paradigms‖, Wiley 2013.

REFERENCE BOOKS:

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

2. Michael Miller,‾Cloud Computing‖, Pearson Education, New Delhi, 2009.

3. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, ‾Cloud Computing For Dummies‖, Wiley 2010.

21UCD924	CRYPTO CURRENCY	L	T	P	C
		3	0	0	3

PRE-REQUISITE: NIL

COURSE OBJECTIVES :

- To understand what Blockchain is and its importance.
- To understand the various layers of blockchain
- To discuss various real-time use cases
- To understand components of blockchain
- To understand the working mechanism of Bitcoin
- To know how ethereum helps in creating business blockchain
- To build an ethereumD App

UNIT I	INTRODUCTION TO BLOCKCHAIN	9

What is Blockchain – Centralized Vs. Decentralized Systems – Layers of Blockchain – Why is Blockchain Important – Blockchain uses and Use Cases - Blockchain foundation – Cryptography – Game Theory – Merkle Trees – Properties of Blockchain solutions – Blockchain Transactions – Distributed Consensus Mechanisms – Blockchain Applications - Scaling Blockchain.

UNIT II	WORKING OF BITCOIN	9

History of Money – Dawn of Bitcoin – The Bitcoin Blockchain – The Bitcoin Network - Bitcoin Scripts – Full Nodes vs SPVs – Bitcoin Wallets.

UNIT III	WORKING OF ETHEREUM	9

From Bitcoin to Ethereum – Ethereum Blockchain – Merkle Patricia Tree – RLP Encoding – Ethereum Transaction and Message Structure - State Transaction Function – Gas and Transaction Cost – Smart Contracts – Ethereum Virtual Machine – Ethereum Ecosystem : Swarm – Whisper - DApp – Development Components

UNIT IV	ENTERPRISE BLOCKCHAIN	9

Blockchain Vs Distributed Databases, How does an enterprise view blockchain?, Types of blockchain technology, what is blockchain in business?, Blockchain for business – how does the blockchain work?, Business benefits of blockchain, Example use cases, Challenges in enterprise adoption, Hyperledger, Corda, Example Enterprise Applications.

UNIT V	HANDS-ON PROJECTS : BUILDING ETHEREUM DAPP	9

DApp - Setting up a Private Ethereum Network: Install go-etherum - Create geth Data directory - Create a geth account - create genesis.json configuration File - Run the first Node of the Private Network - Run the second node of the Network - Creating Smart Contract - Deployingthe Smart Contract - Client Application.

TOTAL:45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Explain the concept of Blockchain and its importance. (Understand)
2. Apply the functional/operational aspects of crypto currency in various Use cases and its Applications (Apply)

3. Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain (Apply)
4. Analyze the Digital Currencies and its Market Usage.(Analyze)
5. Design block chain based solutions supports smart contract using Ethereum Framework.(Create)
6. Work individually or in Teams and demonstrate the solutions to the given exercises through blockchain Applications. (Affective Domain)

TEXT BOOKS:

1. Beginning Blockchain – A Beginner's Guide to Building Blockchain Solutions, Authors: Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda, Apress Publication.

2. Blockchain for the Enterprise: The definitive guide to adoption of blockchain in the enterprise, Author &Publisher : Manav Gupta, ISBN-10: 1999387104

REFERENCE BOOKS:

1. The Truth Machine - The Blockchain and the Future of Everything, Authors: Michael J. Casey and Paul Vigna, St.Martin's Press.

2. Mastering   Bitcoin – Programming the Open Blockchain, Author: Andreas M. Antonopoulos, O'Reilly Publication

21UCD925	VISUALIZATION ANALYSIS TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :
The student should be made to:
- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis.
- To understand visualization for correlation analysis.
- To understand visualization for multivariate analysis.
- To apply structured approach to create effective visualizations thereby building visualization dashboard to support decision making.

UNIT I	INTRODUCTION - CORE SKILLS FOR VISUAL ANALYSIS	9

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT II	TIME-SERIES, RANKING, AND DEVIATION ANALYSIS	9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

UNIT III	DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS	9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT IV	INTRODUCTION TO INFORMATION DASHBOARD DESIGN	9

Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices – visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design – Achieving eloquence.

UNIT V	ANALYSIS AND DESIGNING OF GRAPHICS DASHBOARD	9

Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard. Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines –Critical Design Practices – Putting it all together- Unveiling the dashboard.

	TOTAL: 45 Periods

After the successful completion of this course, the student will be able to

- Apply the knowledge of various core skills for visualization analysis techniques to the solution of complex engineering problems. (APPLY)

- Apply the knowledge of various time series and deviation analysis techniques to the solution of complex engineering problems. (APPLY)

- Apply the knowledge of complex engineering problems for distribution, correlation, and multivariate analysis techniques.   (APPLY)
- Apply the knowledge of visual perception for computer applied complex engineering problems.   (APPLY)
- Apply the knowledge of visual design process for problem solving of complex engineering problems.   (APPLY)
- Design various dashboard for computer applied complex engineering problems of graphics and multimedia techniques and solve real-world problems.   (APPLY)

TEXT BOOKS:

1. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
2. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.

REFERENCE BOOKS:

1. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
2. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013
3. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

21UCS926	CRYPTOGRAPHY ALGORITHMS FOR NETWORK SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand cryptography theories, algorithms and systems.
- To understand necessary approaches and techniques to build protection mechanisms in order to secure computer networks.

UNIT I	INTRODUCTION	9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security - Security attacks, services and mechanisms - OSI security architecture - Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid"s algorithm- Congruence and matrices - Groups, Rings, Fields-Finite fields- SYMMETRIC KEY CIPHERS: SDES - Block cipher Principles of DES - Strength of DES - Differential and linear cryptanalysis - Block cipher design principles - Block cipher mode of operation - Evaluation criteria for AES - Advanced Encryption Standard – RC4 – Key distribution.

UNIT III	PUBLIC KEY CRYPTOGRAPHY	9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes - Primality Testing – Factorization - Euler_s totient function, Fermat_s and Euler_s Theorem - Chinese Remainder Theorem - Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem - Key distribution - Key management - Diffie Hellman key exchange – ElGamal cryptosystem - Elliptic curve arithmetic-Elliptic curve cryptography

UNIT IV	MESSAGE AUTHENTICATION AND INTEGRITY	9

Authentication requirement - Authentication function - MAC - Hash function - Security of hash function and MAC - SHA -Digital signature and authentication protocols - DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols-Authentication applications - Kerberos, X.509

UNIT V	SECURITY PRACTICE AND SYSTEM SECURITY	9

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders - Malicious software - viruses - Firewalls

After the successful completion of this course, the student will be able to

- Explain the various security algorithms, techniques and methodologies. (Understand)
- Analyze the techniques that protect and defend information, information systems by ensuring authentication. (Analyze)
- Apply symmetric cryptographic algorithms to ensure data secrecy. (Apply)
- Apply the mathematics of public key cryptographic algorithms. (Apply)
- Apply appropriate techniques to ensure message authentication and integrity.(Apply)
- Analyze the suitability of security algorithms for real time applications. (Analyze)

TEXT BOOK:

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

REFERENCE BOOKS:

1. K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

21UCS927	DIGITAL MARKETING STRATEGY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To elaborate the concepts in digital marketing
- To illustrate advertising in social media
- To learn about content marketing

UNIT I	INTRODUCTION	9

Digital Strategy – Digital Marketing – History – 4 P's of marketing – Porter's five forces – Brand – Customer lifetime value – segmentation – Aligning with your business strategy – customer centricity – Business model – global strategy – brand – vision – culture – KPIs – Barriers and considerations – Technology – skills – budgets and resources – Regulation

UNIT II	PLANNING AND SEO	9

The planning process – the planned approach – goals – objectives and strategies – action plans – controls – people – budgeting and forecasting – History of SEO – researching – technical SEO – site structure and content – mobile – location – penalties – Paid search – setting up a campaign – measurement and optimization

UNIT III	SOCIAL MEDIA	9

Display: Programming advertising – types and formats of digital advertising – Ad servers and technological delivery – types of display campaigns – planning and targeting – social media – history – customer service and reputation management – SEO angle – types of social media – content – social advertising – measurement – User experience – digital transformation

UNIT IV	CRM AND RETENTION	9

Defining CRM and retention – contract strategy – cross selling and upselling – predictive analysis – CRM systems – social CRM – True personalization – user defined – behavioral – tactical – customer service principles – service channels – social customer service – measurement

UNIT V	ANALYTICS AND REPORTING	9

Content marketing – people and process for creating content – international content – audit checklist – data landscape – analytics – tools and technology – attribution modelling – Presenting your strategy: decision making – budget – key channel benefits – how channels react – website

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the strategies to be adopted for digital marketing (Understand)
- Apply the potential challenges and strategies for successful digital marketing (Apply)
- Analyze the possibilities within the relevant digital channels and touch points for marketing a product (Analyze)
- Evaluate the optimal delivery of products using various parameters (Evaluate)
- Create an optimal business strategy for marketing a product (Create)
- Present the ideas for developing effective digital marketing strategy through presentation or group discussion (Affective Domain)

TEXT BOOK:

1. Simon Kingsnorth, ¯Digital marketing strategy – An integrated approach to online marketing‖, KoganPage Limited.

REFERENCE BOOKS:

1. Ryan Deiss and Russ Henneberry, ¯Digital Marketing for dummies‖, 2nd Edition, John Wiley & Sons.
2. Gary Vaynerchuk, ¯Jab, Jab, Jab Right Hook – How to tell your story in a noisy social world‖, HarpercOllins Publishers.

LIST OF OPEN ELECTIVES OFFERED TO OTHER PROGRAMS

S.No.	Course Code	Course Name	L	T	P	C	Sem
1.	21UCD971	Digital Media and Society	3	0	0	3	V
2.	21UCD972	UX Design for Engineers	3	0	0	3	VI
3.	21UCD973	UI Design for Engineers	3	0	0	3	VII
4.	21UCD974	Visual Effects	3	0	0	3	VIII

21UCD971	DIGITAL MEDIA AND SOCIETY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES:
- To understand the convergence and technology which explains the process of technological as well as digital convergence, implication of digital convergence in society
- To study trends in new media that include user generated as well as computer generated communication, convergence of media, Web 2.0, blogging, virtual community, etc.
- To understand media culture, democracy, activism and performance of media in the society.
- To make students aware of contemporary media development and challenges in India.
- To help students develop the capability to assess, criticize and appreciate the role of media in fulfilling the aspirations of people.

UNIT I	DIGITAL MEDIA AND COMMUNICATION	9

Introduction - Information Society - Elements in the transition to an information society - Characteristics of information society, New World Information Order, Information and Communication Technologies (ICT) - Advantages and Disadvantages of ICT - Media Convergence

UNIT II	SOCIAL MEDIA	9

Digital Society – Social Media – Cyber Debates - Interaction and Identity - Communities and Networks - The Evolution of Digital Platforms - Types of digital platforms and digital platform companies – Platform economics and Multisided markets

UNIT III	EMERGING TRENDS IN NEW MEDIA	9

Digital visuality and visibility – Feeling digital – digital citizenship – Digital Power and Exploitation – Digital activism – Mobile culture – Software, algorithms and data

UNIT IV	DIGITAL SOCIAL RESEARCH	9

Introduction – Digital Social Research – The Research process – Digital Ethnography – Mapping and mining digital society – A theory of digital media and social change

UNIT V	MEDIA EFFECTS AND CULTURAL APPROACHES TO RESEARCH	9

Early media research method – Research on media effects – Media literacy and the critical process – Cultural approaches to media research - media research and democracy

TOTAL: 45 Periods

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
- Describe the digital media technology and its implications in the society (Understand)
- Apply a suitable social media technology for a given scenario. (Apply)
- Analyze the new social opportunities for controlling whom we interact with, how, and when have been introduced through mobile communication (Analyze)
- Analyze the significance of digital platforms whose implications go beyond communications. (Analyze)

REFERENCES:

1. http://www.tezu.ernet.in/tu_codl/Uploads/NEW%20MEDIA%20MODULE%20II%20SLM.pdf
2. Richard Campbell, Christopher R.Martin, Bettina Fabos, Media and culture, Eleventh Edition, Macmillan Learning, 2017.
3. Simon Lindgren, Digital Media and Society, SAGE Publications, 2017
4. Terry Flew, Regulating Platforms, Digital Media and society series, Polity Press, 2021.
5. Joseph B. McFadden, Understanding Media and Culture: An introduction to Mass Communication, University of Minnesota Libraries publishing edition, 2016.

21UCD972	UX DESIGN FOR ENGINEERS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES:

- To create amazing user experiences for products from scratch, user personas and also understand the importance of a good UX design and the role of a UX designer.
- To know the different stages of designing a UX and the application of various principles of psychology in UX design.
- To learn how to conduct user research and market research, which is crucial to creating a great UX

UNIT I	UI DESIGN PROCESS	9

What is UX? – UX Design Vs UI Design – Why is UX so Important – Full Stack Design – UX Design Process – Discovery and Planning
– The UX Strategy – UX Research: Discover – Explore – Test – Listen – UX Analysis

UNIT II	USER RESEARCH	9

User Behavior Basics – The Gestalt Theory – Psychology in UX – User Research – Market Research Vs User Research – Benefits ofUser Research – Getting to Know Your Users – Grouping Customer Information – How to Conduct User Interviews?.

UNIT III	USER PESONAS AND AFFINITY DIAGRAM	9

User Personas: What are User Personas? – Creating a Persona – Four Different Perspectives on Personas – Benefits of Personas – Affinity Diagrams: Affinity Diagram – Work Activity Affinity Diagram – Capture, Grouping and Labeling

UNIT IV	INFORMATION ARCHITECTURE AND VISUAL DESIGN PRINCIPLES	9

Information Architecture: Navigation – Task Flow – Content Strategy – Site Map – Gestures – Basics of Visual Design – Lines – Shapes – Colors – Font/Typography – Textures – Forms – Design Principles – Alignment – Hierarchy – Contrast – Repetition – Proximity –Balance – Space – Visual Design Toolsnge

UNIT V	WIREFRAMES AND PROTOTYPING	9

What is Wireframe? – How to Create Wireframes? – Types of Wireframes – Wireframing Tools: Sketch Wireframes – Stenciling andPaper cutouts – Wireframing Software – What is Prototyping – Prototyping Methods – Paper Prototypes – Digital Prototypes – Coding Prototypes – The process of Creating Prototypes – Prototyping Tools

TOTAL: 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Describe the concepts of UX design process (Understand)
- Apply the principles and procedures to conduct user research. (Apply)
- Design user personas and construct affinity diagram for product or service (Create)

TEXT BOOKS:

1. Elvis Canziba ‾Hands-On UX Design for Developers: Design, Prototype, and Implement Compelling User Experiences from Scratch‖, First Edition, Packet Publishing, 2018

2. Rex Hartson, Pardha S. Pyla, ‾The UX Book Process and Guidelines for Ensuring a Quality User Experience‖, 1st Edition, MorganKaufmann Publisher, Elsevier, 2012 2018

3. https://www.netsolutions.com/insights/information-architecture/ 2018

4. https://boldist.co/design/gesture-based-interfaces/

5. https://www.usertesting.com/blog/affinity-mapping

21UCD973	UI DESIGN FOR ENGINEERS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES:

- To create amazing user experiences for products from scratch, user personas and also understand the importance of a good UX design and the role of a UX designer.
- To know the different stages of designing a UX and the application of various principles of psychology in UX design.
- To learn how to conduct user research and market research, which is crucial to creating a great UX

UNIT I	INTRODUCTION	9

UI Is Communication Concept - Communication Design Principles- UI Design Situation - Core Principles of UI Is Communication - Effective Communication - Intuitive UI- Necessary And Unnecessary Consistency - Unintuitive UI- Inductive UI- Deductive UI

UNIT II	INTERACTION AND VISUAL DESIGN	9

Interactions -Controls - Commands - Labels And Instructions - Feedback - Task Steps and Navigation - Surfaces - Errors And Notifications - Dynamic Elements - Importance of Visual Design - Graphic Designers – Layout -- Typography And Text – Color - Affordances   -Icons And Glyphs- Animations And Transitions - Demanding Attention

UNIT III	COMMUNICATION DESIGN PROCESS	9

Communicating to People - Emotional Connection - Personality - Attributes - Good Tone -Motivating Users - Minimizing Effort - Forgiveness - Building Trustworthiness - Courageous Design - communication-driven design process- Basic design process – Mistakes - Planning phase - Design phase -Refinement phase.

UNIT IV	MATERIAL DESIGN AND COMPONENTS	9

Material Design: Introduction, Principles. Material Environment: Surfaces. Elevation. Light and Shadows. Basic Components: App barsBottom and Top, Bottom Navigation, Buttons, Cards, Text Fields, Navigation Drawer

UNIT V	ADVANCED COMPONENTS	9

Advanced Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogs, Dividers, Image List, Lists, Menus, Progress Indicators, Radio Buttons, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Tabs, Tool Tips, Time Pickers

TOTAL: 45 Periods

==COURSE OUTCOMES==**:**
After the successful completion of this course, the student will be able to

- Explain the baseline principles of UI design as a form of effective human communication (Understand)
- Apply the principles for designing UI. (Apply)
- Design a simple user interface by applying the advanced material components. (Create)

REFERNCE BOOKS:

1. McKay, Everett N. UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication.Newnes, 2013.
2. https://material.io/components