SETHU INSTITUTE OF TECHNOLOGY

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

Pulloor, Kariapatti – 626 115.

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

CURRICULUM

(1st SEMESTER to 8th SEMESTER)

CHAIRPERSON

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

CHAIRMAN
ACADEMIC COUNCIL

CHAIRMAN
ACADEMIC COUNCIL
Sethu Institute of Technology
Pulloor, Kariapatti - 625 115

SETHU INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Department Vision

To produce high quality technologists for the dynamic societal needs in the field of Artificial Intelligence and Data Science.

Department Mission

- Providing quality education and support innovation in expert systems and data science to meet industry expectations.
- Offering holistic learning ambience.
- Developing the skills of the students to make successful engineers and entrepreneurs.
- Creating relationship with the industries for mutual knowledge transfer.
- Encouraging Research activities related to industry and society.

Core Values

✓ Excellence ✓ Loyalty ✓ Novelty ✓ Commitment ✓ Courtesy

PROGRAM EDUCATIONAL OBJECTIVES	
PEO – I	Graduates will succeed as successful engineers in the field of Artificial Intelligence and Data Science for pursuing inter disciplinary projects for the development of the nation**.[Core Competence]**
PEO – II	Graduates will work as team leaders and members with professional behaviour and ethics**.[Professionalism]**
PEO – III	Graduates will enrich their professional skills through higher studies, employability, and research activities for the benefit of the society. [**Life-Long Learning]**

PROGRAM SPECIFIC OUTCOMES	
PSO – 1 (Artificial Intelligence)	Interpret data, use software tools to conduct experiments, and apply AI & machine learning techniques to solve multi-disciplinary problems.
PSO – 2 (Data Science)	Apply standard practices, strategies and use appropriate models of data analytics to discover knowledge.

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.Tech. Degree Programme

CBCS CURRICULUM

Regulations 2021

B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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	21	17	22	21	19	25	21	14	160

SEMESTER I

Course Code	Category	Course Title	L	T	P	C
THEORY						
21UEN101	HS	English for Technical Communication (Common to All Branches Except CSBS)	2	0	0	2
21UMA102	BS	Matrix And Calculus (Common to All Branches Except CSBS)	3	1	0	4
21UPH103	BS	Engineering Physics (Common to All Branches Except CSBS)	3	0	0	3
21UCY105	BS	Applied Chemistry(CSE,ECE,EEE,IT, BME ,BT,AI&DS,CSD and CSE(AI&ML)	3	0	0	3
21UCS108	ES	Problem Solving and PYTHON programming (Common to All Branches Except CSBS)	3	0	0	3
21UCS107	ES	Problem Solving and C Programming (Common to All Branches)				
21UEE125	ES	Principles of Electrical Engineering (Common to CSBS,AI&DS and CSE(AI&ML)	3	0	0	3
PRACTICAL						
21UCS110	ES	Problem Solving and PYTHON programming Laboratory (Common to All Branches Except CSBS)	0	0	2	1
21UCS111	ES	Problem Solving and C Programming Laboratory(Common to All Branches)	0	0	2	1
21UEE128	ES	Electrical Engineering Laboratory (Common to CSBS,AI&DS and CSE(AI&ML)	0	0	2	1
21UGS113	BS	Basic Sciences Laboratory I (Common to All Branches Except CSBS)	0	0	2	1
MANDATORY COURSES						
21UGM131	MC	Induction Programme (Common to All Branches)	0	0	3	0
		TOTAL	**17**	**1**	**6**	**21**
Total No. of Credits – 21						

SEMESTER II

Course Code	Category	Course Title	L	T	P	C
THEORY						
21UEN201	HS	Communication Skills for Professionals (Integrated Course) (Common to All Branches 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 (CSE,ECE,EEE,IT, BME ,AI&DS, CSD and CSE(AI&ML)	3	0	0	3
21UAD204	ES	Foundations of Data Science	3	0	0	3
21UAD205	ES	Digital Logic and Design (Common to AI&DS and CSE(AI&ML))	3	0	0	3
PRACTICAL						
21UGS210	BS	Basic Sciences Laboratory – II (COMMON TO ALL, EXCEPT CSBS)	0	0	2	1
21UAD211	ES	Data Science using Python Laboratory	0	0	3	1.5
21UAD212	ES	Data Science using R Programming				
MANDATORY COURSES						
21UGM231	MC	Environmental Science (Common to All Branches)	3	0	0	P/F
21UGM331		Biology for Engineers	2	0	0	P/F
		TOTAL	**16**	**1**	**6**	**17**
Total No. of Credits – 17						

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
21UAD303	PC	Object Oriented Programming using Python (Integrated Course)	3	0	2	4
21UIT304	PC	Principles of Operating Systems (Common to CSE, IT, AI&DS, CSD)	3	0	0	3
21UCS305	ES	Computer Organization	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
21UGM431		Gender Equality	1	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
21UAD402	PC	Artificial Intelligence (Common to AI&DS and CSE (AI&ML))	3	0	0	3
21UCS403	PC	Algorithm Analysis (Common to CSE,IT,CSD,AI&DS, CSE (AI&ML))	3	0	0	3
21UAD404	PC	Data Mining and Warehousing	3	0	0	3
21UAD405	PC	Internet of Things and Sensors	3	0	0	3
21UAD406	PC	Computer Network and Security	3	0	0	3
PRACTICAL COURSES						
21UAD407	PC	Data Mining Tools Laboratory	0	0	2	1
21UAD408	PC	Artificial Intelligence Laboratory (Common to AI&DS and CSE (AI&ML))	0	0	2	1
MANDATORY COURSE						
21UGM431	MC	Gender Equality	1	0	0	P/F
21UGM231		Environmental Science (Common to All Branches)	3	0	0	P/F
		TOTAL	**19**	**1**	**6**	**21**
Total No. of Credits – 21						

SEMESTER V

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
	21UMA501	Linear Algebra	3	0	0	3
	21UAD502	Formal languages and Computation (Common to AI&DS and CSE (AI&ML))	3	0	0	3
	21UAD503	Machine Learning Techniques	3	0	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						
21UAD507	PW	Creative Thinking and Innovation	0	0	2	1
21UAD508	PC	Machine Learning Techniques Laboratory	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**	**19**
Total No. of Credits – 20						

SEMESTER VI

COURSE CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UAM601	PC	Intelligent Computer Vision (Common to AI&DS and CSE (AI&ML))	3	0	0	3
21UAD602	PC	Deep Learning	3	0	0	3
21UAD603	PC	Thinking in Java	2	0	2	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						
21UAD606	PC	Deep Learning Laboratory	0	0	3	1.5
21UAD607	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	CATE GORY	COURSE TITLE	L	T	P	C
THEORY COURSES						
21UME701	HS	Project Management and Finance (Common to ALL except CSBS)	3	0	0	3
21UAD702	PC	Natural Language Processing (Common to AI&DS and CSE (AI&ML))	3	0	0	3
21UAD603	PC	Big data visualization	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						
21UAD707	PC	Natural Language Processing Lab (Common to AI&DS and CSE (AI&ML))	0	0	3	1.5
21UAD708	PC	Intelligence and Analytics lab	0	0	3	1.5
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**	**21**
Total No. of Credits – 21						

SEMESTER VIII

COURSE CODE	CATE GORY	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						
21UAD801	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

SEMESTER I

Course Code	Category	Course Title	L	T	P	C
THEORY						
21UEN101	HS	English for Technical Communication	2	0	0	2
21UMA102	BS	Matrix And Calculus	3	1	0	4
21UPH103	BS	Engineering Physics	3	0	0	3
21UCY105	BS	Applied Chemistry	3	0	0	3
21UCS108	ES	Problem Solving and PYTHON programming	3	0	0	3
21UEE125	ES	Principles of Electrical Engineering	3	0	0	3
PRACTICAL						
21UCS110	ES	Problem Solving and PYTHON programming Laboratory	0	0	2	1
21UEE128	ES	Electrical Engineering Laboratory	0	0	2	1
21UGS113	BS	Basic Sciences Laboratory I	0	0	2	1
MANDATORY COURSES						
21UGM131	MC	Induction Programme	0	0	3	0
		TOTAL	**17**	**1**	**6**	**21**
Total No. of Credits – 21						

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 - CO2 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

COURSE OUTCOMES:

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.

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.

PRINCIPLES OF ELECTRICAL ENGINEERING

		L	T	P	C
21UEE125	(Common to B.Tech - Computer Science and Business Systems & Artificial Intelligence and Data Science)	3	0	0	3

COURSE OBJECTIVES:

- To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
- To impart knowledge on the phenomenon of resonance in series and parallel circuits and also to obtain the transient response of RC, RL and RLC circuits.
- To provide knowledge on the principles of electrostatics and electromechanical energy conversion devices.

  To learn the electrical measurement concepts and energy saving methods by different ways of illumination.

MODULE 1 INTRODUCTION **9**

Concept of potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

MODULE 2 DC CIRCUITS **9**

Simplifications of networks using series- parallel, Star/Delta transformation. Superposition theorem, Thevenin„s theorem, Norton„s Theorem, Maximum Power Transfer theorem.

MODULE 3 AC CIRCUITS **9**

AC waveform definitions, Average value, RMS value, form factor, peak factor, study of RL series circuit, RC series circuit,RLC series and parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits.

MODULE 4 PRINCIPLE OF ELECTROSTATICS **6**

Electrostatic field, electric field intensity, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors.

MODULE 5 PRINCIPLE OF ELECTROMECHANICS **6**

Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

MODULE 6 MEASUREMENTS AND SENSORS 6

lintroduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of
earthling, Safety devices & system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze DC and AC circuits and apply circuit theorems. [Analyze]
- Realize series and parallel resonant circuits. [Apply]
- Evaluate power in three phase AC circuits. [Evaluate]
- Understand the principles of electrostatics and electromechanical energy conversion devices.[Understand]

TEXT BOOKS:

1. B.L.Theraja, “A Textbook of Electrical Technology”, Vol. I Basic Electrical Engineering, S. Chandand Company Ltd., New Delhi.
2. R.Muthusubramanian, S.Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGrawHill Publishers, Edition 1, 2010.
3. H.Partab, **“**Art and Science of Utilization of Electrical Energy”, DhanpatRai and Co., New Delhi,2004.

REFERENCE BOOKS:

1. A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, “Electric Machinery”, Sixth Edition TataMcGraw Hill.
2. V.K. Mehta, “Basic Electrical Engineering”, S. Chand and Company Ltd., New Delhi.
3. J. Nagrath and Kothari, “Theory and problems of Basic Electrical Engineering”, Second EditionPrentice Hall of India Pvt. Ltd.
4. Edward Hughes, “Electrical Technology”, Tenth Edition, Pearson Education Publication.
5. Vincent. Del. Toro, “Electrical Engineering Fundamentals”, Second Edition, Prentice Hall, India.

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

COURSE OUTCOMES:

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 profitor 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. 3,000
   Ticket 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 theirseating 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 5^{th} 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

COURSE OUTCOMES:

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 salary
     Net 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

COURSE OUTCOMES:

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

		L	T	P	C
21UEE128	**ELECTRICAL ENGINEERING LABORATORY** (Common to B.Tech - Computer Science and Business Systems , AI&DS, B.E-CSE(AI&ML)	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

- To teach methods of experimentally analysing electrical circuits and transducers.

LIST OF EXPERIMENTS

1. Familiarization of electrical Elements, sources, measuring devices and transducers related toelectrical circuits.
2. Determination of resistance temperature coefficient.
3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum PowerTransfer theorem).
4. Simulation of R-L-C series circuits for XL>XC, XL< XC & XL= XC.
5. Simulation of Time response of RC circuit.
6. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
7. Demonstration of measurement of electrical quantities in DC and AC systems.

Total: 30 Periods

COURSE OUTCOMES

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

- Demonstrate the behavior of RLC circuits with electrical quantities.[Understand]
- Experimentally analyze the electric circuits and transducers [Analyze]
- Simulate the time response characteristics of RC and RLC Circuits [Apply]

21UGM131	INDUCTION PROGRAMME	L	T	P	C
		0	3	0	P/F

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 theCourse - 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.

SEMESTER II

Course Code	Category	Course Title	L	T	P	C
THEORY						
21UEN201	HS	Communication Skills for Professionals	1	0	1	1.5
21UMA210	BS	Engineering Mathematics – II (Common to AI& DS,CSD)	3	1	0	4
21UPH205	BS	Physics for Information Science	3	0	0	3
21UAD204	ES	Foundations of Data Science	3	0	0	3
21UAD205	ES	Digital Logic and Design	3	0	0	3
PRACTICAL						
21UGS210	BS	Basic Sciences Laboratory - II	0	0	2	1
21UAD2011	ES	Data Science using Python Laboratory	0	0	3	1.5
MANDATORY COURSES						
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 differenceequations 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).

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 201

21UAD204	FOUNDATIONS OF DATA SCIENCE	L	T	**P**	**C**
		3	0	0	3

PRE-REQUISITE: -
COURSE OBJECTIVES :

- Learn about the basics of Data Science impact and importance in the society
- To provide an overview of an exciting growing field of big data analytics‟
- Understand the various parts of Hadoop condition, for instance, Hadoop2.7, Yarn, Map Reduce, Pig, Hive, Hbase and Sqoop.

UNIT I INTRODUCTION AND R FOR DATA SCIENCE **9**

Introduction of Data Science – Basic Data Analytics using R -Overview of R, R data types variables – operators-Decision making –loops-functions-strings –vector-list-Matrices-Arrays-Factors –data frames-packages-data Reshaping –R data interfaces-R charts and graphs –R statistics Example – Data
Versus Presentation

UNIT II CLUSTERING METHODS AND ALGORITHMS **9**

Introduction To Clustering –Clustering Methods-Density based Methods- Hierarchical Based methods- Partioning Methods- Grid Based Methods - K-means - Perform a K-means Analysis using R – Application of Clustering in different fields–- Decision Trees- Bayes‟ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R

UNIT III BIG DATA AND ITS APPLICATIONS **9**

Introduction of Big data-Characteristics of Big data-Application of Big Data-Travel and Tourism- Health care- Telecommunication and Media-Social Media-Ecommerce-History of Hadoop- Components of Hadoop-Application Development in Hadoop- Hadoop Component

UNIT IV APACHE HADOOP HDFS ARCHICHTECURE **9**

HDFS Architecture – HDFS Concepts – Blocks – Functions of a Name Node –Name Node Failure-Data Pipelining- Secondary Name Node –- HDFS Federation – Basic File System Operations – Data Flow – Anatomy of File Read – Anatomy of File Write-Yarn-components of Yarn- benefits of Yarn - Hadoop Map reduce –Hadoop Subproject

UNIT V HADOOP MAP REDUCE AND ITS APPLICATION **9**

Map Reduce-Data Flow in Map reduce –Map Reduce API-Word Count example –Char count example –HBase- HBase Installation HBase- Read and Write- HBase command-Hive- Hive Installation –Hive Architecture –Pig- Pig Installation –Pig data types –Pig Run Modes- Sqoop – Sqoop Installation – Sqoop Import –export-Spark-Spark Installation- Spark architecture –Spark components

TOTAL: 45Periods

COURSE OUTCOMES:

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

- TEXT BOOKS:

David Dietrich, Barry Heller and Beibei Yang, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley, ISBN
- 13:9788126556533, 2015.
2. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, “Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data”, The McGraw-Hill Companies, ISBN : 978-0-07-179054-3, 2012.
3.Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly, ISBN: 9789352130672, 2015.
4.Biris Lublinsky, Kevin T. Smith and Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN 13:9788126551071, 2015

REFERENCE BOOKS:

Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012
W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, 2013.
Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, “Practical Data Science Cookbook”, Packt Publishing Ltd., 2014.
Nathan Yau, “Visualize This: The FlowingData Guide to Design, Visualization, and Statistics”, Wiley, 2011.
Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
http://bigdatauniversity.com/

21UAD205	DIGITAL LOGIC AND DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To familiarize the concepts of various number systems, Boolean algebra and various logic gates.
- To explain the concepts in designing and analyzing various combinational and sequential circuits.
- To impart the knowledge about the programmable memory logics.

UNIT I DIGITAL FUNDAMENTALS 9

Digital vs Analog, Digital Design Overview, Number Systems – Decimal, Binary, Octal, Hexadecimal, 1„s and 2„s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, 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 LOGIC 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder, Introduction to Hardware Description Language(HDL), HDL for combinational logic.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Design of Counters- Ripple Counters, Ring Counters, Shift
registers, Universal Shift Register,HDL Models of Sequential Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

Analysis and design of asynchronous sequential circuits ,cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits,Design Example.

UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS 9

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) –Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL. Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-outand fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Apply Boolean algebra, Karnaugh map and Tabulation method to design minimized logic circuits. (Apply)
- Design a combinational circuit by choosing appropriate Medium Scale Integration (MSI) devices for the given problem. (Analyze)
- Design and analyze synchronous and asynchronous sequential circuits to provide solutions for engineering problems. (Analyze)

- Compare between the designs of digital systems using various Programmable Logic devices in terms of optimality. (Evaluate)
- Apply the characteristics of electronic circuits in the design of logic gates. (Apply)
- Develop a digital system for the given application to meet the functional requirements.(Create)

TEXT BOOKS:

1. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 4thEdition,2016.
2. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
3. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

REFERENCE BOOKS:

1. LeachD,MalvinoA P &Saha, “Digital Principles and Applications” 8th Edition, TataMcGraw-HillPublishingCompany, 2014.
2. Thomas L. Floyd, “Digital Fundamentals”, 10thEdition, Pearson Education, NewDelhi,2009.
3. John.M Yarbrough, “Digital Logic Applications and Design”, Thomson -VikasPublishing House, New Delhi, 2002.
4. W H Gothman, “Digital Electronics: An introduction to theory and practice”, 2ndEdition,Prentice Hall of India, 2000.

WEB REFERENCES:

1. Digital System Design URL: http://nptel.ac.in/courses/117105080.
2. Introduction to Digital Circuits and Systems
3. URL:http://nptel.ac.in/video.php/subjectId=117106086.

Digital Logic URL:http://freevideolectures.com/Course/2319/Digital-Systems-Design/

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 modulusof 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 industrialeffluents.

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 rigiditymodulus 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 Engineeringproperties 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

21UAD211	DATA SCIENCE USING PYTHON LAB	L	T	P	C
		0	0	3	1.5

PRE-REQUISITE :

COURSE OBJECTIVES:

- Learn the data science basics with Python
- Study Data Analysis and interpretation with Numpy on statistical parameters
- Understand various methods of Data Preparation and Manipulation with Pandas
- Learn Data Visualization using matplotlib and seaborn
- Learn Machine learning fundamentals concepts such as Feature Engineering and various techniques

LIST OF EXPERIMENTS

1. NumPy Arrays Computations - Aggregations-Sorting -Arrays-Structured Data
2. Pandas Dataframe- Manipulations from CSV
3. Data Acquisition using python web Scraping
4. Classification and tabulation of data and Graphical and diagrammatic presentation of data.
5. Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis.
6. Determination of point and interval estimates.
7. Solving linear regression, polynomial regression and non-linear regression based problemsand solving multiple regression and correlation analysis based problems.
8. Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts.
9. Apply Classification, Clustering and SVM techniques for Web Scraped Datasets
10. Decision Trees and Random Forests-PCA for Intrusion Detection
11. Mini Project

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Understand the various analysis methods in Numpy and Pandas (CO1-Understand)
- Apply the concept of Classification and tabulation of data (CO2-APPLY)
- Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skew ness, moments and kurtosis.(CO3-UNDERSTAND)
- Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts. (CO4-APPLY)
- Apply the concepts of various machine learning techniques to solve problem (CO5-APPLY)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

Python 2.7 and higher versions

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

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the concepts of Environment and ecosystem.
- To acquire knowledge about the impact of environmental pollution.
- To understand the importance of environmental issues in the society.
- To gain knowledge about the impact of environment related to human health.
- To gain knowledge in alternative energies.

UNIT I	ENVIRONMENT AND ECOSYSTEMS	9 Hrs

Definition, scope and importance of environment – Need for public awareness – Conceptofecosystem- Structureandfunctionofecosystem-Producers,consumersand 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 Hrs

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 Hrs

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 Hrs

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 Hrs

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

- Express the concepts of an ecosystem. (Understand)
- Describe the impact of environmental pollution. (Understand)
- Explain the importance of environmental issues to the society. (Understand)
- Analyze the impact of environmental issues related to human health .(Analyze)
- Identify alternate energy sources for technological applications. (Understand)
-

TEXT BOOKS:

1. Anubha Kaushik, kaushik C.P., “Environmental Science and Engineering”, ThirdEdition, New Age International, New Delhi, 2009.
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill, NewDelhi, 2

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-SciencePublicatio Jaipur,2

SEMESTER III

Course Code	Category	Course Title	L	T	P	C
THEORY						
21UMA328	BS	Discrete Mathematics (Common to AI& DS,CSD)	3	1	0	4
21UAD302	PC	Programming Data Structures	3	0	0	3
21UAD303	PC	Database Systems	3	0	0	3
21UAD304	PC	Object Oriented Programming Concepts	3	0	2	4
21UAD305	ES	Computer Architecture and Organization	3	0	0	3
21UAD306	PC	Operating System Concepts	3	0	0	3
PRACTICAL						
21UAD307	PC	Programming Data Structures Laboratory	0	0	2	1
21UAD308	PC	Database Systems Laboratory	0	0	2	1
MANDATORY COURSES						
21UGM332	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
	(COMMON TO Artificial Intelligence And Data Science, Computer Science and Design)				
		3	**1**	**0**	**4**

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 graph models, their representation, connectivity and exposure to the development of the algebraic structures, lattices and Boolean algebra and todemonstrate the utility of Boolean laws.

UNIT I LOGIC AND PROOF METHODS 9 + 3

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

UNIT II COMBINATORICS 9 + 3

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

UNIT III ALGEBRAIC STRUCTURES 9 + 3

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

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

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

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 insolving 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 andcorrectness of the algorithm. (CO6) U – K2

TEXT BOOKS:

1. KENNETH H.ROSEN, “Discrete Mathematics and its Applications”, Special IndianEdition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 5th Edition, (2008).
2. TREMBLY J.P and MANOHAR R, “Discrete Mathematical Structures with Applicationsto 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 AppliedIntroduction”, 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‟sOutlines, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).
4. VEERARAJAN, T. “Discrete Mathematics with Graph Theory and Combinatorics”, TataMcGraw-Hill, New Delhi, 7th Edition, (2008).

21UAD302	PROGRAMMING DATA STRUCTURES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To impart knowledge on linear and non-linear data structures.
- To learn sorting, searching and hashing algorithms.

UNIT I C PROGRAMMING BASICS 9 Hrs

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types –Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two- dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9 Hrs

Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.

UNIT III LINEAR DATA STRUCTURES 9 Hrs

Basic Terminologies: Elementary Data Organizations, Abstract Data Types (ADTs) – List ADT – array- based implementation – linked list implementation –singly linked lists- circularly linked lists- doubly- linked lists - Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue

UNIT IV NON LINEAR DATA STRUCTURES 9 Hrs

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree -B+ Tree – Heap .Graphs: – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Dijkstra‟s Single source shortest Path Problem –Minimum Spanning Trees

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9Hrs

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

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of list structures to solve complex engineering problems. (Apply)
- Apply the concepts of stack and queue to solve problems complex engineering problems.(Apply)
- Identify suitable tree structures for solving computing problems. (Analyze)
- Design solutions forreal world complex engineering problems using graph algorithms.(Create)
- Use sorting and searching to organize the data in ordered manner. (Apply)
- Employ Hash technique to index data. (Apply)

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, PearsonEducation, 2011
2. Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education, Special IndianEdition, 2014.

REFERENCE BOOKS:

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

Course Code	Course Name	L	T	P	C
21UAD303	Object oriented programming using python	3	0	2	4

COURSE OBJECTIVES :

- Aims at providing the basic understanding of the fundamentals of python programming such as variables, conditional and iterative execution, methods, etc.
- Also aims at providing the fundamental knowledge of object-oriented programming in python including defining classes, invoking methods, using class libraries, etc.
- It also aims to equip the students to approach programming tasks using techniques learned and write pseudo-code.
- This course involves a lab component which is designed to give the student a hands-on experience with the programming concepts.

UNIT I	INTRODUCTION TO OOPS	9+6

Object oriented analysis and design – Objects and classes – Abstraction – Overview of inheritance and its types – object oriented programming – creating python classes – initializing objects – modules and packages – third party libraries

Case study:

a) Consider a scenario in which two numbers are given as inputs say Variable A and B. The task is to find the closest number to A that is divisible by B. Develop a solutionusing python class and libraries.

b) Create a python class that possesses a member function that checks whether a given number is a Lucky number or not. A number is said to be a lucky number if all the digits of the number are different.

UNIT II	ENCAPSULATION AND STATIC METHODS	9+6

Public and Private data access -Encapsulation - Getter and Setter - Pass by reference-Collection of Objects - List of Objects - Dictionary of objects - Static -Need for staticvariables - Need for static methods -Static variables and Methods

Case study:

c) In the Athlete class given below, make all the attributes private and add the necessaryaccessor and mutator methods Represent Maria, the runner and make her run.

```
class Athlete:
    def init (self,name,gender):
        self.name=name
        self.gender=gender
    def running(self):
        if(self.gender=="girl"):
            print("150mtr running")else:
            print("200mtr running")
```

d)

Ticket
-passenger_name -ticket_id -source -destination +counter -> static
__init_(passenger_name,source, destination) +validate_source_destination() +generate_ticket() + get_ticket_id() +get_passenger_name() +get_source() +get_destination()

UNIT III	CONSTRUCTORS AND POLYMORPHISM	9+6

Class Relationships -Aggregation - Dependency -Association- Basic constructors – Parameterized and multiple constructor - Copy and Dynamic constructors- Polymorphism

Case study:

e) Develop a python program to check whether an object has the given named attribute and return true if present, else false.

Create a class head that consists of member function to accept two input strings. Derive another class tail from class head that contains a method called meta( ) that checks whether the two input strings obtained from the parent class are metastrings of each other or not. Metastrings are the strings which can be made equal by exactly one swap in any of the strings

UNIT IV	EXCEPTION HANDLING	9+6

Abstract base classes-Abstract methods - Abstract Sub classes - Exception handling - Raising exceptions – Effects of exception – Handling the exception – Exception hierarchy – Creating our own exception

Case study:

g) ABC DTH (Direct to Home) firm wants to calculate monthly rent for its consumers. A consumer can register for one Base Package. Write a python program to implement the same.

BasePackage class:

validate_base_pack_name():

Validate base pack name. Valid values are "Silver", "Gold" and "Platinum".

If invalid, set attribute, base_pack_name as "Silver" and display "Base package name is incorrect, set to Silver"

calculate_monthly_rent():

Check if subscription period is between 1 and 24 (both inclusive). If so,
Validate base pack name
Identify monthly rent based on base pack. Refer table given.

Consumers are eligible for discount of one month's rent, if subscription period is more than 12 months

Calculate final monthly rent as per the formula given below:

final monthly rent = ((monthly rent * subscription period) – discount amount)/subscription period

Return the calculated final monthly rentIf
not, return -1

For testing:

Create objects of BasePackage class

Invoke calculate_monthly_rent() on BasePackage object
Display the details

Develop a python program to check the validity of an IP address. An IP address is said to be valid, if the octet values falls within the range of (0-255).

UNIT V	PATTERNS AND TESTING	9+6

Regular expressions – Matching patterns – Matching a selection of characters – Escaping characters – Grouping patterns together – Serializing objects – Customizing pickles – Serializing web objects – Testing object oriented programs – Unit testing and test driven development – py.test automated testing suite mock module

Case study:

i) Develop a python program that matches a word contain gin „g‟ followed by one or more e‟s using regex

j) Develop a python program to find all the patterns of “1(0+)1” in a given string using python regex.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

- Understand the fundamentals and advanced concepts of object oriented programming in python
- Solve Real world problems through Object Oriented Approach
- Analyze and identify the appropriate modules, packages andSuitable object oriented approaches in python to reduce the complexity in solving real world problems.
- Assess the different object programming concepts and adopt the suitable technique to build real time applications.
- Create a full stack web / enterprise application using python libraries and tools.
- Make use of various software tools and frameworks to build, test and deploy standard python applications

Textbook:

- "Python 3 Object Oriented Programming, Harness the power of python 3 objects", DustyPhillips

Reference book:

- Python 3 Object-Oriented Programming - Third Edition: Build robust and maintainablesoftware with object-oriented design patterns in Python 3.8, 3rd Edition
- Introduction to computation and Programming using python, Revised and ExpandedEdition", John.V.Guttag

COURSE CODE	COURSE NAME	L	T	P	C
21UIT304	PRINCIPLES OF OPERATING SYSTEMS (Common to CSE, IT, CSD ,AI-DS)	3	0	0	3

COURSE OBJECTIVES :

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

FUNDAMENTALS AND PROCESS CONCEPTS

UNIT I **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

PROCESSSYNCHRONIZATION AND SCHEDULING

UNIT II **8**

Threads: Overview, Multithreading models, Threading issues

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.

UNIT IV VIRTUAL MEMORY MANAGEMENT AND VIRUTALIZATION **10**

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

- Realize the concepts of operating system structures, services and functionalities.
- Apply Various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms. Deadlock detection and avoidance techniques for providing Operating System functionalities
- Analyze various process management concepts (including scheduling, synchronization and deadlocks), Memory Management strategies and Design considerations of file system.
- 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
- Evaluate the Multiprogramming, Synchronization and Virtual Memory Concepts
- Make an effective communication and presentation in a team to demonstrate the concepts of OS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating Systems Concepts,9thEdition, 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

COURSE CODE	COURSE NAME	L	T	P	C
21UCS305	COMPUTER ORGANIZATION	3	0	0	3

COURSE OBJECTIVES :

- To familiarize the components of computer system and instructions
- To discuss in detail the operation of the arithmetic unit.
- To design pipelining and parallel processing architecture
- To give knowledge on memory and I/O systems

OVERVIEW AND INSTRUCTIONS

UNIT I **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..

ARITHMETIC OPERATIONS **9**

UNIT II

Addition and Subtraction of signed numbers – Multiplication of unsigned and signed numbers – Fast Multiplication – Integer division – Floating point numbers and operations –

UNIT III PIPELINING & PARALLEL PROCESSORS **9**

Pipelining – Instruction and Arithmetic Pipeline – Data hazards – Instruction hazards – Superscalar operation.Parallel processors: Introduction to parallel processors, Concurrent access to memory and cache coherency

UNIT IV MEMORY CONCEPTS **9**

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs- Memory Management Requirements

UNIT V I/O SYSTEMS **9**

Input/output system-Accessing I/O Devices – Interrupts – Direct Memory Access – Bus Structure – Bus Operation – Arbitration – Interface Circuits – USB

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the functional units and components of a computer system. (Understand)
- Apply the principles of computing to identify solutions for complex computing problems. (Apply)
- Analyze the design issues in terms of speed, technology, and cost to improve the performance of CPU. (Analyze)
- Analyze the technologies used to measure and improve the cache performance. (Analyze)
- Design a processor considering the performance issues of memory and CPU. (Create)
- Work individually or in teams and communicate effectively to justify the computing practice based on legal and ethical principles. (Affective domain)

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.
2. David A. Patterson and John L. Hennessey, “Computer organization and design the hardware / software interface”, Morgan Kauffman / Elsevier, Fifth edition, 2014.

REFERENCE BOOKS:

1. William Stallings “Computer Organization and Architecture” , Seventh Edition , Pearson Education, 2006.
2. Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Second Edition, Pearson Education, 2005.
3. Govindarajalu, “Computer Architecture and Organization,Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
4. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 1998.

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 – SQL fundamentals – Advanced SQL – Embedded SQL – Dynamic SQL

UNIT II DATABASE DESIGN 9

Entity-Relationship model – ER Diagrams – Enhanced ER Model – ER to Relational Mapping – 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

RAID – 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 ADVANCED TOPICS 9

Database Security: Authentication, Authorization and access control, DAC, MAC andRBAC models, Intrusion Detection-Object oriented and object relational databases - Web databases - Distributed databases-Parallel Databases-Temporal Databases- Spatial Databases.

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 DBMS.(Understand)
- Apply the concepts of DBMS to find solutions to a broad range of queries(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)
- Workindividuallyorinteamsanddemonstratethesolutionstothegivenexercisesthrough 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

REFERENCE BOOKS:

1. RamezElmasri and ShamkantB.Navathe, "Fundamentals of Database Systems", Fifth
Edition, Pearson Education, 2008.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata McGraw
Hill, 2010.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson
Education, Eighth Edition, 2006.
4. AtulKahate, "Introduction to Database Management Systems", Pearson Education, New
Delhi, 2006.
5. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing
House Private Limited, New Delhi, 2003

21UGM331	BIOLOGY FOR ENGINEERS	L	T	P	C
	(Common to All B.E/B.Tech. Branches - except BME & BT)	2	0	0	P/F

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 APPLICATION 5

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

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the 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 and procedures needed to solve societal issues. [Analyze]

TEXTBOOKS:

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”,15thEdition,Wiley publications, 2016.

Course Code	Course Name	L	T	P	C
21UIT307	DATA STRUCTURES LABORATORY	0	0	3	3

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. Implementation of Polynomial Arithmetic using Linked List.
3. Applications of Stacks and Queues.
4. Balancing Brackets.
5. Implementation of Binary search tree.
6. Expression of Tree construction and Traversals.
7. Minimum spanning Tree
8. Single Source shortest path.
9. Implementation of Insertion sort and Bubble sort.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

	Course Outcome	Taxonomy Level	Domain	PO
CO1	Apply the linear and non-linear data structures and sorting searching and hashing algorithms appropriately to develop solutions	Apply	Cognitive	PO1, PSO1
CO2	Analyze the different Program to implement various data structure algorithms.	Analyze	Cognitive	PO2, PSO1
CO3	Develop efficient linear, non-linear,sorting, searching and hashing data structure algorithms to solve problems for real world complex engineering problems.	Design	Cognitive	PO3, PSO1
CO4	Work as an individual and as a member or leader in diverse teams for solving data structure problems.	Apply	Cognitive	PO9, PSO1
CO5	Communicate and present various algorithm design techniques for developing algorithms and collaborate with others	Receive & Respond	Affective	PO10, PSO1
CO6	Identify the requirement and take further preparation in order to adopt Technological change	Apply	Cognitive	PO11, PSO1

HARDWARE AND SOFTWARE REQUIRMENTS

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.Thedata includes information about actors who play in the series,and directors who direct the episodes of theseries. 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 oneseries?
   iv. How many times has the first episode of the series „The Devil‟ been transmitted? At whattimes?
   v. How many directors are employed by thecompany?
   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 allpatients at ahospital. 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 andsomecough.The database also contains data about diseases. Each disease is characterized bydifferent symptoms: apatient with a cold should have fever and a cough, a malaria patientshould 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(projNbr, name, city)
Products(prodNbr, name, color)
Suppliers(supplNbr, name, city)
Deliveries(*supplNbr, prodNbr, projNbr*, number)

i. Write a trigger which displays a message whenever an entry is made in the table „Deliveries".
ii. Write a trigger which is invoked automatically whenever a product is supplied to the city „London".
iii. Execute an exception if the „number" field in „Deliveries" table is zero.

TOTAL : 30 Periods

COURSE OUTCOMES:

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 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 and PL/SQL. (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 REQUIREWMENTS:
  Personal Computers – 30 Numbers
- SOFTWARE REQUIREMENTS:
  Front end: VB or Equivalent

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

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
21UAD402	PC	Artificial Intelligence (Common to AI&DS and CSE (AI&ML))	3	0	0	3
21UCS403	PC	Algorithm Analysis (Common to CSE,IT,CSD,AI&DS, CSE (AI&ML))	3	0	0	3
21UAD404	PC	Data Mining and Warehousing	3	0	0	3
21UAD405	PC	Internet of Things and Sensors	3	0	0	3
21UAD406	PC	Computer Network and Security	3	0	0	3
PRACTICAL COURSES						
21UAD407	PC	Data Mining Tools Laboratory	0	0	2	1
21UAD408	PC	Artificial Intelligence Laboratory (Common to AI&DS and CSE (AI&ML))	0	0	2	1
MANDATORY COURSE						
21UGM431	MC	Gender Equality	1	0	0	P/F
21UGM231		Environmental Science (Common to All Branches)	3	0	0	P/F
		TOTAL	**19**	**1**	**6**	**21**
Total No. of Credits – 21						

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).

21UAD402	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

COURSE DESIGNATION :
PRE-REQUISTIES:
COURSE OBJECTIVE:

- To impart knowledge on build intelligent agents for search and games
- To impart knowledge for solve AI problems through programming with python
- To develop learning optimization and inference algorithms for model learning

UNIT I INTRODUCTION **9**

Concept of AI, history, current status, scope, agents, environments, Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents – Typical Intelligent Agents - Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

UNIT II SEARCH ALGORITHMS **9**

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

UNIT III PROBABILISTIC REASONING **9**

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

UNIT IV MARKOV DECISION PROCESS **9**

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT V REINFORCEMENT LEARNING **9**

Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning

Total: 45 Periods

Content beyond Syllabus:
First Order Logic

Course outcomes

At the end of the course the student will be able to

CO No	Course outcomes	Level	Domain	PO Mapping
CO1	Explain concepts of AI, agents, search algorithms and reinforcement learning	Understand	Cognitive	-
CO2	Apply search algorithms, probabilistic reasoning, Markov decision trees and Reinforcement learning	Apply	Cognitive	PO1, PSO1
CO3	Analyze various searching algorithms for a given scenario	Analyze	Cognitive	PO2, PSO1
CO4	Design game playing, Bayesian networks, Hidden Markov model and learning	Create	Cognitive	PO3, PSO1
CO5	Find neighboring location using search algorithm	Apply	Cognitive	PO5, PSO1
CO6	Communicate and present in a team on minimax algorithm	Value	Affective	PO4, PO10, PO11, PSO1, PSO2

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hll
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill
3. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.

REFERENCE BOOKS:

1. Saroj Kaushik,”Artificial Intelligence”, Cengage Learning India, 2011.
2. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computation Agents”, Cambridge University Press 2010.

21UCS403 **ALGORITHM ANALYSIS**

L	T	P	C
3	0	0	3

(Common to CSE ,IT,CSD,AI&DS, CSE(AI&ML))

PRE-REQUISTE:

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 - Important Problem Types – Fundamentals of the Algorithm Analysis- Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

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 AND 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

- Understand the concept of Notation of Algorithm that apply in various methodologies like brute force divide and Conquer, Greedy Techniques **[Understand]**
- Apply various Methodology based algorithm and different types of searching sorting techniques for providing Betterment solution for the problems. **[Apply]**
- Analyze various methodology based algorithm for enhancing the efficiency of the problem **[Analyze]**
- Analyze different set of problem and to Design a solution using algorithm design methodology **[Design]**
- Evaluate running time, efficiency of the problem using different set of algorithm **[Evaluate]**
- 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, SartajSahni, SanguthevarRajasekaran, "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.

Course Code	Course Name	L	T	P	C
21UAD404	DATAWARE HOUSING AND DATA MINING	3	0	0	3

COURSE OBJECTIVE:

- To understand the fundamental processes, concepts and techniques of data mining and develop an appreciation for the inherentcomplexity of the data- mining task.
- To develop skills for using recent data mining software to solve practical problems in a variety of disciplines
- To gain experience doing independent study and research

UNIT I DATA WAREHOUSING 9

Introduction to Data Warehousing-An overview and definition-Differences between Operational Database Systems and Data Warehouses- Difference between OLTP&OLAP -Multi-dimensional Data Model- Star, Snowflakes, and Fact Constellations Schemas for Multi-dimensional Databases-OLAP Operations in Multi-dimensional Data Model:Roll-up,Drill Down, Slice& Dice, Pivot(Rotate) Indexing OLAP Data-Type of OLAP Servers-OLAP versus MOLAP versus HOLAP-Data Warehouse Architecture–The Design of a Data Warehouse-The Process of Data Warehouse Design-A3-Tier Data Warehouse Architecture.

UNIT II DATA MINING 9

Introduction–Data–Types of Data–Data Mining Functionalities– Interestingness of Patterns–Classification of DataMining Systems–Data Mining Task Primitives–Integration of a Data Mining system with a Data Warehouse–Issues–Data Preprocessing.

UNIT III ASSOCIATION RULE MINING AND CLASSIFICATION 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules– Correlation Analysis – Constraint Based Association Mining –Classification and Prediction –Basic Concepts – Decision Tree Induction–Bayesian Classification – Rule Based Classification– Classification by Back propagation – Support Classification–Lazy Learners–Other Classification Methods–Prediction.

UNIT IV CLUSTERING 9

Cluster Analysis- Types of Data – Categorization of Major Clustering Methods- K-means –Partitioning Methods–Hierarchical Methods–Density-Based Methods – Grid Based Methods –Model-Based Clustering Methods– Clustering High Dimensional Data-Constraint–Based Cluster Analysis–Outlier Analysis.

UNIT V ADVANCED MINING 9

Web mining- Web content mining- Introduction to Spatial mining & its primitives- spatial classification algorithm(ID3extension)-Spatial clustering algorithm(SD)-Introduction to temporal mining-Time series- Temporal association rule.

CO No	Course outcomes	Level	Domain	PO Mapping
CO1	Understand the basic concepts of Data warehousing, Data mining techniques and its tools.	Understand	Cognitive	-
CO2	Apply the knowledge of OLAP models & schema, and implement various DM algorithms in an optimized way to solve the complex engineering problems using various tools.	Apply	Cognitive	PO1,PSO2
CO3	Analyze how data analytics and data mining maps to current industry.	Analyze	Cognitive	PO2,PSO2
CO4	Create a model for various real time big data mining applications using the concepts of Schema, DM algorithms and big data tools & techniques to solve the complex engineering problems.	Create	Cognitive	PO3,PSO2
CO5	Apply management principles for function effectively in the project team for project execution.	Evaluate	Cognitive	PO5
CO6	Communicate effectively when working on Mini projects as team.	Value	Affective	PO10

TEXT BOOKS:

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann.
2. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.

21UAD405 INTERNET OF THINGS AND SENSORS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of IoT and its working models
- To know the various of protocols
- To analyze the various IoT physical devices and endpoints
- To know the security and privacy issues connected with IoT
- To apply the concept of internet of things in a real world scenario.

Unit 1 – FUNDAMENTALS OF IOT 9

Introduction to Internet of Things - Definitions and characteristics of IoT - Physical Design of IoT - Logical Design of IoT - IoT Functional Blocks - IoT Communication Models - IoT Communication APIs- Sensors, Actuators.

Unit 2 – IOT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.

Unit 3 – DESIGN AND DEVELOPMENT 9

Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

Unit4 – DATA ANALYTICS AND SUPPORTING SERVICES 9

Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest-Role of Machine Learning-IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M,

Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

Unit 5 - INDUSTRIAL APPLICATIONS 9

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments, Industry 4.0 concepts.

TOTAL PERIODS:45

Course outcomes

At the end of the course the student will be able to

CO. No	Course Outcome	Taxonomy level	Domain	PO & PSO Mapping
CO1	Explain the concept of IoT.	Understand	Cognitive	-
CO2	Apply various sensors and actuators in real-time projects	Apply	Cognitive	PO1, PSO1
CO3	Analyze various protocols for IoT.	Analyze	Cognitive	PO2, PSO1
CO4	Design a portable IoT using Arduino/Raspberry pi/equivalent boards.	Create	Cognitive	PO3, PSO1
CO5	Understand how to analyze and organize the data.	Evaluate	Cognitive	PO4, PSO1
CO6	Design varied applications through IoT projects	Create	Affective	PO5,9,10, PSO1

TEXT BOOKS

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes,

Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

2. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN:

9788173719547

3. Internet of Things: Architecture, Design Principles and Applications, Raj Kamal, McGraw Hill Higher Education

REFERENCE BOOKS

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and

Wiley, 2012 (for Unit2).

2. “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”,Jan Ho¨ ller,

VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

3. Architecting the Internet of Things,DieterUckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.

4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,MichaelMargolis,Arduino Cookbook and

O‟Reilly Media,2011.

Course Code	Course Name	L	T	P	C
21UAD406	COMPUTER NETWORK AND SECURITY	3	0	0	3

COURSE OBJECTIVES:

- To describe the various functionalities of the different layers of the network
- To know the functions of protocols of each layer of TCP/IP protocol suite And To visualize the end-to-end flow of information.
- To learn the functions of network layer and the various routing protocols
- 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 security.

Unit 1 – INTRODUCTION AND PHYSICAL LAYER 9

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

Unit 2 - DATA LINK LAYER AND NETWORK LAYER 9

Data-Link Layer Protocols – HDLC – PPP -Media Access Control- Wired LANs- Ethernet – Wireless LAN- IEEE 802.11 -Bluetooth – Connecting Devices -Network Layer Services – Logical Addressing- Internet Protocols (IPV4 and IPv6)- Address Mapping - Routing Protocol (Unicast – Multicast)

Unit 3 – TRANSPORT LAYER AND APPLICATION LAYER 9

Transport Services – Elements of Transport Protocols -Process to Process Communication- UDP,
TCP and SCTP- Congestion Control- QoS improving techniques- RPC - WWW and HTTP- FTP -Email-Telnet-DNS-SNMP.

Unit 4 – AUTHENTICATION APPLICATIONS 9

Authentication applications - Kerberos, X.509, PKI - Electronic Mail security - PGP, S/MIME – IP security -Web Security Considerations - SSL, TLS, Secure Electronic Transaction.

Unit 5 - SYSTEM SECURITY 9

System security - Intruders IDS - Honey pots - Malicious software - viruses - Firewalls - Security
Standards.

Course outcomes

At the end of the course the student will be able to

CO. No	Course Outcome	Taxonomy level	Domain	PO & PSO Mapping
CO1	Understand the data communication components and the various functionalities of different network layers (Understand)	Understand	Cognitive	-
CO2	Apply the knowledge of layer functionalities to provide error free and congestion freedata flow. (Apply)	Apply	Cognitive	PO1, PSO1
CO3	Analyze the working principles of various protocols for effective data communication. (Analyze)	Analyze	Cognitive	PO2, PSO1
CO4	Estimate the performance of various network parameters to improve QoS. (Evaluate)	Evaluate	Cognitive	PO3, PSO1
CO5	Design a LAN network with the principles of protocol stack for a given real world scenario. (Create)	Create	Cognitive	PO4, PSO1
CO6	Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)	Value	Affective	PO5,9,10, PSO1

TEXT BOOKS

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
3. William Stallings, Cryptography and Network security Principles and Practices, 6th edition, Pearson Education, 2014.

REFERENCE BOOKS

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2012.

Course Code	Course Name	L	T	P	C
21UAD407	Data Warehousing and Data Mining Laboratory	0	0	3	1.5

COURSE OBJECTIVE:

- To develop skills for using recent data mining software and mining tools to solve practical problems in a variety of disciplines.

List of Experiments:

1. Design and implement a Data Warehouse.
    - Identify source tables and populate sample data.
    - Create the dimension table and fact table in the data warehouse
    - Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, salesetc.).
2. Explore WEKA Data Mining/Machine Learning Toolkit
    i) Downloading and/or installation of WEKA data mining toolkit.
    ii) Understand the features of WEKA tool kit such as Explorer, Knowledge flow interface, Experimenter, command-line interface.
    iii) Navigate the options available in the WEKA(ex. select attributes panel,preprocess panel, classify panel, cluster panel, associate panel and visualize)
    iv) Study the ARFF file format
    v) Explore the available data sets in WEKA
    vi) Load a data set (ex.Weather dataset,Iris dataset,etc.)
3. Implementation of Apriori Algorithm.
4. Implementation of FP-Growth Algorithm.
5. Implementation of Bayesian Classification.
6. Implementation of Decision Tree, If-Then Rule.
7. Implementation of K-Nearest Neighbor Classification.
8. Implementation of Support Vector Machines and Regression.
9. Implementation of K-means clustering.
10. Implementation of any Hierarchical clustering algorithm.

21UIT408	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	2	1

COURSE DESIGNATION :

PRE-REQUISTIES:

COURSE OBJECTIVE:

- To impart knowledge on build intelligent agents for search and games
- To impart knowledge for solve AI problems through programming with python
- To develop learning optimization and inference algorithms for model learning

List of Experiments:

1. Write a program to conduct uninformed and informed search
2. Write a program to conduct game search
3. Write a program to construct a Bayesian network from given data
4. Write a program to infer from the Bayesian network
5. Write a program to run value and policy iteration in a grid world.
6. Write a program to do reinforcement learning in a grid world.
7. Mini Project work.

Total: 30 Periods

Course outcomes

At the end of the course the student will be able to

CO No	Course outcomes	Level	Domain	PO Mapping
CO1	Apply the good programming skills to formulate the solution for problems using Uninformed, Informed and game search algorithms	Apply	Cognitive	PO1, PSO1
CO2	Develop programs to analyze various searching algorithms for a given scenario	Analyze	Cognitive	PO2, PSO1
CO3	Design programs to implement the Bayesian networks and reinforcement learning in a grid world.	Create	Cognitive	PO3, PSO1
CO4	Demonstrate and enrich knowledge to	Apply	Cognitive	PO5, PSO1

	select and apply tools to develop product.			
CO5	Formulate valid solutions for problems to assess societal, health, safety, legal and cultural issues by using AI techniques.	Apply	Cognitive	PO6, PSO1
CO6	Demonstrate knowledge of the wider solutions for environment and sustainable development	Apply	Cognitive	PO7, PSO1
CO7	Make use of problem solving approaches to work challenges and make decisions in teams	Value	Affective	PO9, PSO1
CO8	Develop a mini project work in various domains to demonstrate through reports and presentation.	Value	Affective	PO4, PO10, PO11, PSO2
CO9	Recognize the significance of latest changes in the AI technologies to engage lifelong learning.	Apply	Cognitive	PO12

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements:

Computer required: 30 No's

Minimum Requirement: Processor: Processor: Pentium IV, Ram: 1GB, Hard Disk: 80GB

Software requirements:

Python

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)