Department of CSE-Data Science

COURSE STRUCTURE & SYLLABUS

For UG-R23

B. TECH - COMPUTER SCIENCE AND ENGINEERING
with Specialization
DATA SCIENCE

(Applicable for batches admitted from 2023-2024)

ST.ANN'S COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

COURSE STRUCTURE

Year: I   Semester: I

Category	Course Code	Course Title	Theory/ Lecture (L / D)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
BS & H	23UEN01	Communicative English	2	0	0	--	0	30	70	100	2
BS & H	23UCH01	Chemistry	3	0	0	--	3	30	70	100	3
BS & H	23UMT01	Linear Algebra & Calculus	3	0	0	--	3	30	70	100	3
Engineering Science	23UCE01	Basic Civil & Mechanical Engineering	3	0	0	--	3	30	70	100	3
Engineering Science	23UCS01	Introduction to Programming	3	0	0	--	3	30	70	100	3
BS & H	23UEN02	Communicative English Lab	0	0	2	--	2	30	70	100	1
BS & H	23UCH03	Chemistry Lab	0	0	2	--	2	30	70	100	1
Engineering Science	23UME04	Engineering Workshop Lab	0	0	3	--	3	30	70	100	1.5
Engineering Science	23UCS03	Computer Programming Lab	0	0	3	3	3	30	70	100	1.5
BS & H	23UEN03	Health and wellness, Yoga and Sports	-	-	1	--	1	0	0	0	0.5
TOTAL			14	0	11	0	23	270	630	900	19.5

HS-Humanities & Sciences, BS-Basic Sciences, ES-Engineering Sciences, MC-Mandatory Course, PC-Professional Core, PE-Professional Elective, OE-Open Elective, OC-Online Course

Year: I   Semester: II

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
BS & H	23UPH01	Engineering Physics	3	0	0	--	3	30	70	100	3
Engineering Science	23UMT02	Differential Equations & Vector Calculus	3	0	0	--	3	30	70	100	3
Engineering Science	23UEE01	Basic Electrical & Electronics Engineering	3	0	0	--	3	30	70	100	3
Engineering Science	23UME01	Engineering Graphics	1	0	4	--	4	30	70	100	3
Engineering Science	23UCS02	Data Structures	3	0	0	0	3	30	70	100	3
Engineering Science	23UCS05	IT Workshop Lab	0	0	2	--	2	30	70	100	1
BS & H	23UPH02	Engineering Physics Lab	0	0	2	--	2	30	70	100	1
Engineering Science	23UCS04	Data Structures Lab	0	0	3	-	3	30	70	100	1.5
Engineering Science	23UEE04	Basic Electrical & Electronics Engineering Workshop Lab	0	0	3	-	3	30	70	100	1.5
BS & H	23UEN04	NSS/NCC/Scouts & Guides/Community Service	-	--	1	--	1	30	70	100	0.5
TOTAL			13	0	15	0	27	300	700	1000	20.5

Year: II   Semester: I

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
BS&H	23UMT01	Discrete Mathematics & Graph Theory	3	0	0	--	3	30	70	100	3
BS&H	23UMB01	Universal human values – understanding harmony and Ethical human conduct	2	1	0	--	3	30	70	100	3
Engineering Science	23UDS01	Introduction to Data Science	3	0	0	--	3	30	70	100	3
Professional Core	23UCS11	Advanced Data Structures &Algorithms Analysis	3	0	0	--	3	30	70	100	3
Professional Core	23UCS12	Object-Oriented Programming Through JAVA	3	0	0	0	3	30	70	100	3
Professional Core	23UDS02	Data Science Lab	0	0	3	--	3	30	70	100	1.5
Professional Core	23UCS14	Object-Oriented Programming Through JAVA Lab	0	0	3	--	3	30	70	100	1.5
Skill Enhancement course	23UCS15	Python programming	0	1	2	-	3	30	70	100	2
Audit Course	23UEN05	Environmental Science	2	0	0	-	2	30	70	100	0
TOTAL			16	2	8	0	26	270	630	900	20

Year: II   Semester: II

Category	Course Code	Course Title	Theory/ Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (SS)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
Management Course- I	23UME15	Optimization Techniques	2	0	0	--	2	30	70	100	2
Engineering Science/ Basic Science	23UDS03	Statistical methods for Data science	3	0	0	--	3	30	70	100	3
Professional Core	23UDS04	Data Engineering	3	0	0	--	3	30	70	100	3
Professional Core	23UCS17	Database Management Systems	3	0	0	--	3	30	70	100	3
Professional Core	23UCS10	Digital Logic and Computer Organization	3	0	0	0	3	30	70	100	3
Professional Core	23UDS05	Data Engineering Lab	0	0	3	--	3	30	70	100	1.5
Professional Core	23UCS20	Database Management Systems Lab	0	0	3	--	3	30	70	100	1.5
Skill Enhancement course	23UDS06	Exploratory Data Analysis with Python	1	1	2	-	3	30	70	100	2
BS & H	23UMB03	Design Thinking &Innovation	1	0	2	-	3	30	70	100	2
TOTAL			16	1	10	0	26	270	630	900	21

Year & Sem	I Year – I Semester					
Course Code	**23UEN01**	L	T	P	SS	C
Course Name	**COMMUNICATIVE ENGLISH**	2	0	0	0	2

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English,* is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

CO2: Apply grammatical structures to formulate sentences and correct word forms.

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.

CO4: Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.

CO5: Create a coherent paragraph, essay, and resume.

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening:	Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking:	Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading:	Skimming to get the main idea of a text; scanning to look for specific pieces of information.
Writing:	Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar:	Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary:	Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening:	Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
Speaking:	Discussion in pairs/small groups on specific topics followed by short structuretalks.
Reading:	Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing:	Structure of a paragraph - Paragraph writing (specific topics)
Grammar:	Cohesive devices - linkers, use of articles and zero article; prepositions.**Vocabulary:** Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Readinga text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV
Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

UNIT V
Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Textbooks:
1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:
1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Year & Sem	I Year – I Semester					
Course Code	23UCH01	L	T	P	SS	C
Course Name	**CHEMISTRY**	3	0	0	0	3

(Common to EEE, ECE, CSE, IT) & allied branches)

Course Objectives:
- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the students will be able to:
CO1: Compare the materials of construction for battery and electrochemical sensors.
CO2: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
CO3: Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.
CO4: Apply the principle of Band diagrams in the application of conductors and semiconductors.
CO5: Summarize the concepts of Instrumental methods.

UNIT I   Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II   Modern Engineering materials

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT III   Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV   Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT V   Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Textbooks:
1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

Reference Books:
1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Year & Sem	I Year – I Semester					
Course Code	23UMT01	L	T	P	SS	C
Course Name	**LINEAR ALGEBRA & CALCULUS**	3	0	0	0	3

(**Common to All Branches of Engineering**)

Course Objectives:
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to
CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications.
CO2: Utilize mean value theorems to real life problems.
CO3: Familiarize with functions of several variables which is useful in optimization.CO4:
Learn important tools of calculus in higher dimensions.
CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT I   Matrices
Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II   Eigenvalues, Eigenvectors and Orthogonal Transformation
Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-HamiltonTheorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem,Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III   Calculus
Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV   Partial differentiation and Applications (Multi variable calculus)
Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functionsof two variables, method of Lagrange multipliers.

UNIT V   Multiple Integrals (Multi variable Calculus)

Double integrals, change of order of integration, triple integrals, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, PearsonPublishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5thEdition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9thedition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

Year & Sem	I Year – I Semester					
Course Code	23UCE01	L	T	P	SS	C
Course Name	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	0	3

(Common to All branches of Engineering)

Course Objectives:
- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation'seconomy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: On completion of the course, the student should be able to:
CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role inensuring better society.
CO2: Know the concepts of surveying and to understand the measurement of distances, anglesand levels through surveying.
CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledgeon prefabricated technology.

UNIT I
Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering
- Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline
- Building Construction and Planning- Construction Materials-Cement - Aggregate -Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II
Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings- Contour mapping.

UNIT III
Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Qualityof water-

Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:
1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:
1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand andBrothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to
- Get familiarized with the scope and importance of Mechanical Engineering in differentsectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems andintroduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able toCO1:
Understand the different manufacturing processes.
CO2: Explain the basics of thermal engineering and its applications.
CO3: Describe the working of different mechanical power transmission systems and powerplants.
CO4: Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries andSociety-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining,

Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission -** Belt Drives, Chain, Rope drives, Gear Drives and theirapplications.
Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineeringsystems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengagelearning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

Year & Sem	I Year – I Semester					
Course Code	23UCS01	L	T	P	SS	C
Course Name	**INTRODUCTION TO PROGRAMMING**	3	0	0	0	3

(Common to All branches of Engineering)

Course Objectives
- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: A student after completion of the course will be able to
CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking. CO2:
Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language. CO4:
Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

UNIT I   Introduction to Programming and Problem Solving
History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II   Control Structures
Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

UNIT III   Arrays and Strings
Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings. String Concepts, String Input / Output Functions, Arrays of Strings, String Manipulation Functions

UNIT IV   Pointers & User Defined Data types
Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V   Functions & File Handling
Introduction to Functions, Function Declaration and Definition, Function call Return Types and

Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Textbooks:
1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

Reference Books:
1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad,CENGAGE, 3rd edition

Year & Sem	I Year – I Semester					
Course Code	**23UEN02**	**L**	**T**	**P**	**SS**	**C**
Course Name	**COMMUNICATIVE ENGLISH LAB**	**0**	**0**	**2**	**0**	**1**

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions. CO5: Create effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:
- Walden Infotech
- Young India Films

Reference Books:
1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed),Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
   https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Year & Sem	I Year – I Semester					
Course Code	**23UCH03**	L	T	P	SS	C
Course Name	**CHEMISTRY LAB**	0	0	2	0	1

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:
•   Verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

CO1: Determine the conductance of the solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of oxidizing agents.

CO4: Analyse the IR spectra of some organic compounds.

CO5: Calculate strength of acid in Pb-Acid battery.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method.

2. Conductometric titration of strong acid vs. strong base.

3. Conductometric titration of weak acid vs. strong base.

4. Determination of cell constant and conductance of solutions.

5. Potentiometry - determination of redox potentials and emfs.

6. Determination of strength of an acid in Pb-Acid battery.

7. Preparation of a Bakelite.

8. Verify Lambert-Beer's law.

9. Wavelength measurement of sample through UV-Visible Spectroscopy.

10. Identification of simple organic compounds by IR.

11. Preparation of nano materials by precipitation method.

12. Estimation of Ferrous Iron by Dichrometry.

13. Determination of Hardness of a groundwater sample.

14. Estimation of Dissolved Oxygen by Winkler's method.

15. Determination of $KMnO_4$ by using standard oxalic acid.

Reference:
- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition"
  Pearsonpublicationsby J. Mendham, R.C.Denney, J.D.Barnes and
  B. Sivasankar.

Year & Sem	I Year – I Semester					
Course Code	**23UME04**	L	T	P	SS	C
Course Name	**ENGINEERING WORKSHOP LAB**	0	0	3	0	1.5

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical housewiring skills

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.
CO2: Practice on manufacturing of components using workshop trades including fitting,carpentry, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in woodworking and make following joints.
   a) Half – Lap joint   b) Mortise and Tenon joint   c) Corner Dovetail joint or Bridlejoint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray   b) Conical funnel   c) Elbow pipe   d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the followingfitting exercises.
   a) V-fit   b) Dovetail fit   c) Semi-circular fit   d) Bicycle tire punctureand change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and makethe following connections.
   a) Parallel and series   b) Two-way switch   c) Godown lighting
    d) Tube light   e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes,Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding.Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe jointswith coupling for same diameter and with reducer for different diameters.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Year & Sem	I Year – I Semester					
Course Code	23UCS03	L	T	P	SS	C
Course Name	COMPUTER PROGRAMMING LAB	0	0	3	0	1.5

(Common to All branches of Engineering)

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

Course Outcomes:
CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I
WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs
i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.
i) Finding the square root of a given number

ii) Finding compound interest

iii) Area of a triangle using heron's formulae

iv) Distance travelled by an object

UNIT II
WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity
i) Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5
Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.
i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and
for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series
i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III
WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer

1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7: 1 D Array manipulation, linear search
i)   Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v)   Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort
i)   Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v)   Reverse a string using built-in and without built-in string functions

UNIT IV
WEEK 9:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array
and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.
i)   Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v)   Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields
i)   Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V
WEEK 11:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.
i)   Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:
Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions
i)   Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Simple functions using Call by reference, Dangling pointers.
i)   Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:
Tutorial 14: File handling
Lab 14: File operations
i)   Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Year & Sem	I Year – I Semester					
Course Code	**23UEN03**	**L**	**T**	**P**	**SS**	**C**
Course Name	**HEALTH AND WELLNESS, YOGA AND SPORTS**	**0**	**0**	**1**	**0**	**0.5**

(Common to All branches of Engineering)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to
    CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
    CO2: Demonstrate an understanding of health-related fitness components. **CO3:**
    Compare and contrast various activities that help enhance their health.**CO4:** Assess
    current personal fitness levels.
    CO5: Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:
  i) Organizing health awareness programmes in community
  ii) Preparation of health profile
  iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

  i) Participation in one major game and one individual sport viz., Athletics, Volleyball,

Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping andrunning.

Reference Books:
1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

Year & Sem	I Year – II Semester					
Course Code	23UPH01	L	T	P	SS	C
Course Name	**ENGINEERING PHYSICS**	3	0	0	0	3

(Common for all branches of Engineering)

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.CO2: Familiarize with the basics of crystals and their structures.
CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
CO4: Summarize various types of polarization of dielectrics and classify the magneticmaterials.
CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.CO6: Identify the type of semiconductor using Hall effect.

UNIT I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-**ray diffraction:** Bragg's law - X-ray Diffractometer – crystal structure determination byLaue's and powder methods

UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation

polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility

and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

Year & Sem	I Year – II Semester					
Course Code	**23UMT02**	**L**	**T**	**P**	**SS**	**C**
Course Name	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**	**3**	**0**	**0**	**0**	**3**

(Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead theminto advanced level by handling various real-world applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Identify solution methods for partial differential equations that model physical processes.
CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO4: Estimate the work done against a field, circulation and flux using vector calculus.

UNIT I   Differential equations of first order and first degree

Introduction to First Order, First Degree - Variable Separable - Linear differential equations –Bernoulli's equations- Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay- Electricalcircuits.

UNIT II   Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III   Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV   Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Gradient Applications, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V   Vector integration

Line Integral, circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, PearsonPublishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones andBartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018,5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

Year & Sem	I Year – II Semester					
Course Code	23UEE01	L	T	P	SS	C
Course Name	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	3	0	0	0	3

(Common to All Branches of Engineering)

Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: After the completion of the course students will be able to

Course Outcomes:

CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

CO2: Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

CO4: Analyze different electrical circuits, performance of machines and measuring instruments.

CO5: Evaluate different circuit configurations, Machine performance and Power systems operation.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I   DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Star- Delta Transformation Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II   Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and watt meter and Energy meters.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops,Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricitytariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types,Safety Precautions to avoid shock.

Textbooks:
1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Reference Books:
1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications,2018, Second Edition.
5. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013

Web Resources:
1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles ofdigital electronics.

UNIT I   SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II   BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III   DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall,India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009.

Year & Sem	I Year – II Semester					
Course Code	**23UME01**	**L**	**T**	**P**	**SS**	**C**
Course Name	**ENGINEERING GRAPHICS**	**1**	**0**	**4**	**0**	**3**

(Common to All branches of Engineering)

**Course
Objectives:**

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3: Understand and draw projection of solids in various positions in first quadrant.
CO4: Explain principles behind development of surfaces.
CO5: Prepare isometric and perspective sections of simple solids.

UNIT I
Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

Year & Sem	I Year – II Semester					
Course Code	23UCS02	L	T	P	SS	C
Course Name	**DATA STRUCTURES**	1	0	4	0	3

(Common to CSE, IT & allied branches)

Course Objectives:
- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

Course Outcomes: At the end of the course, Student will be able to
CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.
CO6: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

UNIT I
Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

UNIT II
Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.
Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

UNIT III
Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.
Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT IV
Trees: Terminology-Representation of Trees-Binary Trees-Properties of Binary Trees-BinaryTree Representations-Binary Tree Traversal-Preorder-Inorder and Postorder Traversal.
Binary Search Trees-Searching-Insertion and Deletion from a Binary Search TreeHeight of Binary Search Tree, Heaps-Max Heap-Insertion into and Deletion from a Max Heap

UNIT V
Graph Theory: Terminology-Graph Representation-Graph Operations-Depth First Search-Breadth First Search, **Introduction to hashing and hash functions**, Collision resolution techniques:

chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Textbooks:
1.   Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2.   Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:
1.   Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2.   C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3.   Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4.   Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5.   Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

Year & Sem	I Year – II Semester					
Course Code	**23UCS05**	L	T	P	SS	C
Course Name	**IT WORKSHOP LAB**	1	0	4	0	3

(**Common to all branches of Engineering**)

Course Objectives:

• To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
• To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
• To teach basic command line interface commands on Linux.
• To teach the usage of Internet for productivity and self-paced life-long learning
• To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:
CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation
Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web
Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy

settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE

for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD
Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT
Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.
• Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
• Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
• Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:
1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

Year & Sem	I Year – II Semester					
Course Code	**23UPH02**	**L**	**T**	**P**	**SS**	**C**
Course Name	**ENGINEERING PHYSICS LAB**	**0**	**0**	**2**	**0**	**1**

(Common to All Branches of Engineering)

Course Objectives:
To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes: The students will be able to
CO1: Operate optical instruments like travelling microscope and spectrometer.
CO2: Estimate the wavelengths of different colours using diffraction grating.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5: Calculate the band gap of a given semiconductor.
CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:
1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:
- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources
- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Year & Sem	I Year – II Semester					
Course Code	**23UCS04**	L	T	P	SS	C
Course Name	**DATA STRUCTURES LAB**	0	0	2	0	1

(**Common to CSE, IT & allied branches**)

Course Objectives:

The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

Course Outcomes: At the end of the course, Student will be able to

CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges.
CO5: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation
i)   Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques – Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation
i)   Implement a singly linked list and perform insertion and deletion operations.
ii) Develop a program to reverse a linked list iteratively and recursively.
iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications
i)   Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.
iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation
i)   Implement a doubly linked list and perform various operations to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations
i)   Implement a stack using arrays and linked lists.
ii) Write a program to evaluate a postfix expression using a stack.
iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations
i)   Implement a queue using arrays and linked lists.
ii)   Develop a program to simulate a simple printer queue system.
iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications
i)   Use a stack to evaluate an infix expression and convert it to postfix.
ii)   Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree
i)   Implementing a BST using Linked List.
ii)   Traversing of BST.

Exercise 9: Hashing
i)   Implement a hash table with collision resolution techniques.
ii)   Write a program to implement a simple cache using hashing.

Textbooks:
1.   Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2.   Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:
1.   Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2.   C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3.   Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4.   Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5.   Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

Year & Sem	I Year – II Semester					
Course Code	**23UEE04**	**L**	**T**	**P**	**SS**	**C**
Course Name	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP**	**0**	**0**	**3**	**0**	**1.5**

(Common to All branches of Engineering)

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

CO1: Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
CO2: Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO4: Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.

3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

- Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Speed control of DC shunt motor
3. Magnetization Characteristics of DC shunt Generator
4. Measurement of Power and Power factor using Single-phase wattmeter
5. Measurement of Earth Resistance using Megger
6. Calculation of Electrical Energy for Domestic Premises
7. Calibration of Single Phase Energy meter

Reference Books:
1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:
- To impart knowledge on the principles of digital electronics and fundamentals ofelectron devices & its applications.

Course Outcomes: At the end of the course, the student will be
able toCO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron
devices.CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) **Reverse** bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.

3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters,AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implementedusing both Hardware and Software.

Year & Sem	I Year – II Semester					
Course Code	**23UEN04**	L	T	P	SS	C
Course Name	**NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE**	0	0	1	0	0.5

(Common to All branches of Engineering)

Course Objectives:
The objective of introducing this course is to impart discipline, character, fraternity, teamwork,social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

UNIT I   Orientation
General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:
i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care Activities:
i)   Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v)   Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III   Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Surveyin the village, identification of problems- helping them to solve via media-authorities-experts-etc.

Year & Sem	II Year – I Semester				
Course Code	**23UMT08**	**L**	**T**	**P**	**SS**	**C**
Course Name	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**3**	**0**	**0**	**0**	**3**

Course Objectives:

1. To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
2. To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

Course Outcomes: At the end of the course students will be able to

1. Build skills in solving mathematical problems (L3)
2. Comprehend mathematical principles and logic (L4)
3. Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L6)
4. Manipulate and analyze data numerically and/or graphicallysing appropriate Software (L3)
5. How to communicate effectively mathematical ideas/results verbally or in writing (L1)

UNIT–I: Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method ofProof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory:
Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations:
Basis of Counting, Permutations, Permutations withRepetitions, Circular and Restricted Permutations, Combinations, RestrictedCombinations, Binomial and Multinomial Coefficients and Theorems.

Recurrence Relations:
Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations,

Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic

Roots, Solving Inhomogeneous Recurrence Relations

UNIT-IV: Graph Theory:

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

Unit-V: Multi Graphs

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCE BOOKS:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby andSharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)
(Strong – 3, Moderate – 2, Weak – 1)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	-	-	3
CO2	3	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

Year & Sem	II Year – I Semester				
Course Code	**23UMB01**	**L**	**T**	**P**	**SS**	**C**
Course Name	**UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**	**2**	**1**	**0**	**0**	**3**

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

1. Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
2. Identify one's self, and one's surroundings (family, society nature) (L1, L2)
3. Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
4. Relate human values with human relationship and human society. (L4)
5. Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility
(HolisticDevelopment and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic
HumanAspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural
Acceptance

UNIT II   Harmony in the Human Being (6 lectures and 3 tutorials for practice
session) Lecture 7: Understanding Human being as the Co-existence of
the self and thebody.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self
andbody.
Lecture 9: The body as an Instrument of the
selfLecture 10: Understanding Harmony in
the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the
selfLecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III   Harmony in the Family and Society (6 lectures and 3 tutorials for
practicesession)
Lecture 13: Harmony in the Family – the Basic Unit of Human
InteractionLecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of
TrustLecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human
RelationshipLecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV   Harmony in the Nature/Existence (4 lectures and 2 tutorials for
practicesession)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment
amongthe Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of

NatureLecture 21: Realizing Existence as Co-existence at All
Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V   Implications of the Holistic Understanding – a Look at Professional
Ethics (6lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human
Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution
andUniversal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in
Education Lecture 27: Holistic Technologies, Production Systems and
Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and
Profession Tutorial 14: Practice Session PS14 Exploring Steps of
Transition towardsUniversal Human Order

Practice Sessions for UNIT I – Introduction to Value
EducationPS1 Sharing about Oneself
PS2 Exploring Human
ConsciousnessPS3 Exploring
Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human
BeingPS4 Exploring the difference of Needs of self and
body
PS5 Exploring Sources of Imagination in the
selfPS6 Exploring Harmony of self with the
body

Practice Sessions for UNIT III – Harmony in the Family and
SocietyPS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature
(Existence)PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautifu*l - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topicsat hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions

commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content.Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202023-

25%20Ethics%20v1.pdf

8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	2	-	2	2	-	-	-	1
CO.2	3	3	3	-	2	-	-	-	-	-		2
CO.3	2	3	2	3	3	-	-	-	-	2	-	1
CO.4	3	2	3	3	2	-	-	2	1	3		2
CO.5	2	3	3	2	3	-	-	-	2	3	2	2

Year & Sem	II Year – I Semester					
Course Code	**23UDS01**	L	T	P	SS	C
Course Name	**INTRODUCTION TO DATA SCIENCE**	3	0	0	0	3

COURSE OBJECTIVES: From the course the student will learn

1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science;
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

COURSE OUTCOMES:
1. Able to **understand** data science process.
2. Able to **Create** Machine Learning models on large data.
3. Able to **Apply** NoSql for handling Big Data.
4. Able to **Apply** Data Analytics tools for various data science applications.
5. Able to **Create** Interactive Dash Boards.

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

Unit II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: Tools and Applications of Data Science: Introducing **Neo4j**for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.

Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	2	2	-	-	-	2
CO.2	3	2	2		3	-	-	-	-	-		2
CO.3	2	3	2	3	3	-	-	-	-	2	-	2
CO.4	3	2	3	-	-	1	-	2	1	3		2
CO.5	1	3	3	2	3	-	-	-	2	3	2	2

Textbook:

1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016
2) Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

Reference Books:

1) Joel Grus, "Data Science From Scratch", OReilly, 2019
2) Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Year & Sem	II Year – I Semester					
Course Code	**23UCS11**	**L**	**T**	**P**	**SS**	**C**
Course Name	**ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS**	**3**	**0**	**0**	**0**	**3**

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes:

1. Students will critically evaluate and apply algorithm analysis, AVL Trees and B-Trees.
2. Students will synthesize and implement efficient heap structures, graph traversals and divide and conquer strategies.
3. Students will analyse and develop optimal solutions for complex problems using greedy algorithms and dynamic programming.
4. Students will critically apply backtracking, branch and bound techniques to solve combinatorial optimization problems.
5. Students will explore and apply concepts related to NP-Hard and NP-complete problems.

UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion operations and applications B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications
Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number DecisionProblem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:
1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition University Press

Reference Books:
1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:
1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari, 1. Introduction to Algorithms (youtube.com)

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	1							2
CO.2	3	3	3	2	1							2
CO.3	2	3	3	2	1							1
CO.4	3	3	3	2	1							2
CO.5	3	3	3	2	1							2

Year & Sem	II Year – I Semester					
Course Code	23UCS12	L	T	P	SS	C
Course Name	OBJECT-ORIENTED PROGRAMMING THROUGH JAVA	3	0	0	0	3

Course Objectives: The learning objectives of this course are:
1. To understand the OOP concepts through java program structure.
2. To learn Data type, control statements, method/constructor overloading, and overriding.
3. To learn Arrays and different types of inheritances and interfaces.
4. To understand creating package and handling exception.
5. To learn producer-consumer problem and creating Table, Database and access using JDBC.

Course Outcomes: By the end of the course, the student will be
1. Able to **Demonstrate** OOP concepts through java program structure.
2. Able to **Practice** Data types, control statements to search for an element in a given list of elements, method/constructor overloading and method/constructor overriding.
3. Able to **Compare** different types of Inheritances and implement Interfaces.
4. Able to **Create**, User defined Package, and Handle different types of Exceptions.
5. Able to **Design** a solution for producer - consumer problem using multi-threading and able Practice the Database connectivity.

UNIT I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, PassingArguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded

Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)

CO – PO MAPPINGS

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	2	-	2	2	-	-	-	2
CO.2	3	3	3	3	2	-	-	-	-	-		2
CO.3	2	3	3	2	2	-	-	-	-	-	-	2
CO.4	2	3	3	3	2	1	-	-	-	3		2
CO.5	2	2	3	3	3	-	-	-	2	-	-	2

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2.
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0128804645476 18816347_shared/overview

Year & Sem	II Year – I Semester					
Course Code	**23UDS02**	L	T	P	SS	C
Course Name	**DATA SCIENCE LAB**	0	0	3	0	1.5

Course Objectives: The main objective is to inculcate the basic understanding of Data Science and it's practical implementations using Python.
1. To perform various operations using the Numpy module.
2. To Analyse the dataset using the Pandas module.
3. To perform data visualization and analysis using Matplotlib module.
4. To perform data preprocessing techniques
5. To learn drawing different plots

Course Outcomes: Upon successful completion of the course, the student will be able to:
1. Able to perform various operations on numpy arrays
2. Able to analyse data pandas module from different file formats
3. Able to draw different types of charts using matplotlib
4. Able to perform Data pre-processing such as removing duplicate records, filling the empty fields, deleting the records which are not needed.
5. Able to create different plots and perform data analysis.

List of Experiments

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array

    a. Slicing 1-D NumPy arrays
    b. Slicing 2-D NumPy arrays
    c. Slicing 3-D NumPy arrays
    d. Negative slicing of NumPy arrays

5. Stacking and Concatenating Numpy Arrays
    a. Stacking ndarrays
    b. Concatenating ndarrays
    c. Broadcasting in Numpy Arrays

6. Perform following operations using pandas
    a. Creating dataframe
    b. concat()
    c. Setting conditions
    d. Adding a new column

7. Perform following operations using pandas
    a. Filling NaN with string
    b. Sorting based on column values
    c. groupby()

8. Read the following file formats using pandas
    a. Text files
    b. CSV files
    c. Excel files
    d. JSON files

9. Read the following file formats
    a. Pickle files
    b. Image files using PIL
    c. Multiple files using Glob
    d. Importing data from database

10. Demonstrate web scraping using python

11. Perform following preprocessing techniques on loan prediction dataset
    a. Feature Scaling
    b. Feature Standardization
    c. Label Encoding
    d. One Hot Encoding

12. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot

13. Getting started with NLTK, install NLTK using PIP

14. Python program to implement with Python Sci Kit-Learn & NLTK

15. Python program to implement with Python NLTK/Spicy/Py NLPI.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)

COs- POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	3	3	-	-	2	-	1	1	1	-	3
CO.2	1	3	3	-	-	-	2	1	1	1	-	2
CO.3	1	2	3	-	-	-	-	1	1	1	-	2
CO.4	2	3	-	2	-	-	-	1	1	1	-	1
CO.5	1	3	3	-	-	-	-	1	1	1	-	1

Web References:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6.
6. https://www.nltk.org/book/ch01.html

Year & Sem	II Year – I Semester				
Course Code	23UCS14	L	T	P	SS	C
Course Name	OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB	0	0	3	0	1.5

Course Objectives: The aim of this lab is to
1. Understanding the basics such as Operators, expressions and control statements.
2. Performing operations using the class, object and methods.
3. Understanding various types of Inheritances, and exception handling
4. To create threads and running threads, and create package and importing packages.
5. To create table and fetching table from the database using JDBC

Course Outcomes: By the end of the course student will be able to write java program for
1. Able to perform basic operations, expression and use control statements.
2. Able to create class, object, methods and use them.
3. Able to implement various types of inheritances such as single, multiple, and multi-level
4. Able to create threads and run them and able to create packages and import them.
5. Able to create table and fetch table from the database using JDBC.

Sample Experiments:
Exercise – 1:
a) Write a JAVA program to display default value of all primitive data type of JAVA
b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2
a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
c) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3
a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
b) Write a JAVA program implement method overloading.
c) Write a JAVA program to implement constructor.
d) Write a JAVA program to implement constructor overloading.

Exercise - 4
a) Write a JAVA program to implement Single Inheritance

b) Write a JAVA program to implement multi level Inheritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

a) Write a JAVA program give example for "super" keyword.

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism

b) Write a JAVA program Illustrating Multiple catch clauses

● Write a JAVA program for creation of Java Built-in Exceptions

● Write a JAVA program for creation of User Defined Exception

Exercise - 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)

b) Write a program illustrating **is Alive** and **join ()**

c) Write a Program illustrating Daemon Threads.

d) Write a JAVA program Producer Consumer Problem

Exercise – 8

1. Write a JAVA program that import and use the user defined packages
2. Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
3. Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

1. Write a java program that connects to a database using JDBC

b) Write a java program to connect to a database using JDBC and insert values into it.

c) Write a java program to connect to a database using JDBC and delete values from it

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)

COs- POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	2	3	-	-	2	-	1	1	1	-	1
CO.2	1	2	3	-	-	-	2	1	1	1	-	1
CO.3	1	2	3	-	-	-	-	1	1	1	-	1
CO.4	2	3	-	2	-	-	-	1	1	1	-	1
CO.5	-	-	-	-	-	-	-	1	1	1	-	1

Year & Sem	II Year – I Semester					
Course Code	**23UCS15**	L	T	P	SS	C
Course Name	**PYTHON PROGRAMMING** (Skill Enhancement Course)	0	1	2	0	2

Course Objectives: The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these
4. Introduce Object Oriented programming concepts and exception handling
5. Demonstrate Pandas modules for handling Large datasets

Course Outcomes:

1. Able to **Practice** Data types, Type Conversion, selecting a statement based on condition and repeatedly executing set of statements to calculate running total.
2. Able to **Apply** searching for given substring in a string, and data encryption.
3. Able to **Differentiate** different data structures such as list, tuple, dictionary and set.
4. Able to **Create** application such as ATM using the class, and object concepts.
5. Able to **Apply** pandas module to large datasets

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and

Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:
1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. Addition   ii. Insertion   iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:
1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

UNIT-IV: Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:
1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be

lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:
1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
   a)   Apply head () function to the pandas data frame
   b)   Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	-	-	-	2	2	-	-	-	-	2
CO.2	3		-		-	-	-	-	-	-		2
CO.3	2	3	-	2	-	-	-	-	-	-	-	2
CO.4	1	2	3	-	-	1	-	2	1	3		2
CO.5	1	2	3	-	-	-	-	-	2	-	2	2

Reference Books:
1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:
1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Year & Sem	II Year – I Semester					
Course Code	**23UEN05**	**L**	**T**	**P**	**SS**	**C**
Course Name	**ENVIRONMENTAL SCIENCE**	**2**	**0**	**0**	**0**	**0**

Course Objectives:

1. To make the students to get awareness on environment
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
3. To save earth from the inventions by the engineers.

Course Outcomes:

1. Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.
2. Understand flow and bio-geo-chemical cycles and ecological pyramids.
3. Understand various causes of pollution and solid waste management and related preventive measures.
4. About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
5. Casus of population explosion, value education and welfare programmes.

UNIT–I

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use andover utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems–Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies–

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, casestudies.–Energy resources

UNIT–II

Ecosystems: Concept to fan ecosystem.–Structure and function of an ecosystem–Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids–Introduction, types, characteristicfeatures, structure and function of the following ecosystem:

   a. Forest ecosystem.
   b. Grassl and ecosystem
   c. Desert ecosystem
   d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction Definition: genetic, species and ecosystem

diversity–Bio-geographical classification of India–Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and locallevels – India as a mega-diversity nation – Hot-sports of biodiversity – **Threats to biodiversity:** habitat loss,poaching of wildlife, man-wildlife conflicts– Endangered and endemic species of India –Conservation of biodiversity:In-situand Ex-situ conservation of biodiversity.

UNIT–III

Environmental Pollution:Definition, Cause, effects and control measures of:
  a. Air Pollution.
  b. Water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution
  g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Roleof an individual in prevention of pollution – Pollution case studies – Disaster management: floods,earthquake,cycloneandlandslides.

UNIT–IV

Social Issues and the Environment: From Unsustainable to Sustainable development– Urban problems related to energy – Water conservation, rain water harvesting, watershed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions–Climate change, global warming, acidrain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wastel and reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act–Wild life Protection Act–Forest Conservation Act–Issues involved inenforcement of environment allegislation–Public awareness.

UNIT–V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education–HIV/AIDS–Women and Child Welfare–Role of information Technology in Environment and human health–Case studies. Field Work:Visit to a local area to document environmental assets River/ forest grassland/ hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants,insects, and birds–river, hills lopes,etc..

Text books:

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission,Universities Press.

2. Palaniswamy,"Environmental Studies",Pearson education

3. S.AzeemUnnisa,"Environmental Studies"Academic Publishing Company

4. K.RaghavanNambiar,"Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt.Ltd.

Reference Books:

1. DeekshaDaveandE.SaiBabaReddy, "Text book of Environmental Science",Cengage Publications.

2. M.AnjiReddy,"Text book of Environmental Sciences and Technology",BSPublication.

3. J.P.Sharma,Comprehensive Environmental studies,Laxmi publications.

4. J.GlynnHenryandGaryW.Heinke,"Environmental Sciences and Engineering",Prentice Hall of India Private limited

5. G.R.Chatwal,"A Text Book of Environmental Studies"Himalaya Publishing House

6. Gilbert M.Masters and WendellP.Ela,"Introduction to Environmental Engineering and Science,Prentice Hall of India Private limited.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	2	3	-	2	-	2	-	-	-
CO.2	2	2	3	2	-	2	3	-	-	-	-	-
CO.3	3	2	3	2	-	-	2	-	-	-	-	3
CO.4	2	2	3	2	-	-	2	2	-	-	-	-
CO.5	2	2	3	2	3	-	3	-	-	-	-	3

Year & Sem	II Year – II Semester					
Course Code	**23UME15**	L	T	P	SS	C
Course Name	**OPTIMIZATION TECHNIQUES**	**2**	**0**	**0**	**0**	**0**

Pre-requisite:

Course Objectives:
1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

Course Outcomes: At the end of the course, student will be able to
1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
4. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
5. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

UNIT I: Introduction and Classical Optimization Techniques:
Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.
Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming :
Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex

method, simplex algorithm.

UNIT III: Transportation Problem:

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV: Nonlinear Programming:

Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of PenaltyFunction method, Basic approaches of Interior and Exterior penalty function methods,

UNIT V: Dynamic Programming:

Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

Textbooks:
1. "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. "Introductory Operations Research", H.S. Kasene& K.D. Kumar, Springer (India), Pvt.LTd.

Reference Books:
1. "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr.S.D.Sharma, Kedarnath, Ramnath& Co

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	3		-							2
CO.2	3	3	3	2	-							1
CO.3	2	2	3	2								2
CO.4	2	3	2	2								2
CO.5	2	3	4	3								2

Year & Sem	II Year – II Semester					
Course Code	**23UDS03**	**L**	**T**	**P**	**SS**	**C**
Course Name	**STATISTICAL METHODS FOR DATA SCIENCE**	**3**	**0**	**0**	**0**	**3**

Pre-requisite:

Course Objectives: This course aims at providing knowledge on basic concepts of Statistics,Estimation and testing of hypotheses for large and small samples .

Course Outcomes: Student will be able to

1. Analyze data and draw conclusion about collection of data and fitting of distributions
2. Analyzing the testing of hypothesis for Large and Small samples.
3. Develop skills in problem solving of the regression analysis
4. Understanding the significance of Time Series data in various fields
5. Understanding the classification using Logistic Regression

UNIT – I: Data Visualization and Distributions

Data Visualization Techniques: Introduction to Statistical methods- Exporatory Data Analysis- Charts (Line, Pie, Bar); Plots (Bubble, Scatter); Maps (Heat, Dot Distribution); Diagrams (Trees and Matrics)-Principle Components Analysis

 Introduction to Data Distributions - Probability Distributions – discrete (binomial, Poisson), Continuous Distributions (Normal, exponential).

UNIT – II: Hypothesis Testing

Introduction to Parametric estimation-Parametric Confidence Intervals Choosing a Statistic - Hypothesis Testing - Parametric test: the T-test - Applications to Hypothesis tests-Pairwise comparisons.

UNIT- III: Linear Regression and Multiple Regression

Regression: Linear Regression, Curvilinear Regression: Exponential Regression- Polynomial Regression- Power Model.

Practical Examples - The nature of the 'relationship' - Multiple Linear Regression - Importantmeasurements of the regression estimate - Multiple Regression with Categorical Explanatory Variables - Inference in Multiple Regression - Variable Selection.

UNIT -IV: Time Series

Time Series: Significance of Time Series, Components of Time Series Analysis: Trend, Seasonality, Cyclical, Irregularity, Stationary TS, Non- Stationary TS, Methods to Check Stationarity: Augmented Dickey-Fuller (ADF) Test or Unit Root Test, Kwiatkowski–

Phillips– Schmidt–Shin (KPSS) Test; Converting Non-Stationary Into Stationary: Detrending,Differencing, Transformation;

Time Series: The Moving Average (MA) (or) Rolling Mean: Simple Moving Average (SMA), Cumulative Moving Average (CMA), Exponential Moving Average (EMA), Auto- Correlation Function (ACF), Partial Auto-Correlation (PACF)

UNIT-V: Logistic Regression

The classification problem - Logistic Regression Setup - Interpreting the Results - Comparing Models - Classification Using Logistic Regression.

Textbooks:

1. Elizabeth Purdom, "Statistical methods for Data science"

Reference Books:

1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing ofHypotheses, Prentice Hall of India, 2014.

2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and StatisticalInference,9th edition, Pearson publishers,2013.

Online Learning Resources: epurdom.github.io/Stat131A/Rsupport/index.html.Proposed by Prof. V.Ravindranath, J N T U Kakinada.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	2	2					2		2
CO.2	2	3	3	3	2					2		2
CO.3	2	3	3	2	2					2		2
CO.4	2	3	2	3	2					2		2
CO.5	3	3	3	3	3					2		2

Year & Sem	II Year – II Semester					
Course Code	**23UDS04**	L	T	P	SS	C
Course Name	**DATA ENGINEERING**	3	0	0	0	3

Course Objectives:

1. Explain basic concepts of Data Engineering
2. Discuss bout Data Engineering Life Cycle
3. How to design Good Data Architecture

Course Outcome:

1. Able to **Differentiate** between data engineering and Data Science
2. Able to **Understand** the Data Engineering Life Cycle
3. Able to **Design** Data Architecture
4. Able to **Implement** different data storages and ways to Data Ingestion
5. Able to **Apply** transformation to the data

UNIT-I:
Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,

Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT-II:
Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT-III:
Designing Good Data Architecture: Enterprise Architecture, Data Architecture**,** Principles of Good Data Architecture, Major Architecture Concepts.

Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

UNIT-IV:
Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering

Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.

Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT-V:

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

   Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Text Books:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc.,June 2022,ISBN: 9781098108304

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data forAnalytics, O'Reilly Media, 1st Edition, 2021

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	2	2	–	–	–	–	–	2	–	2
CO.2	1	3	3	2	-	–	–	–	–	–	–	2
CO.3	1	3	3	3	2	–	–	–	–	2	–	2
CO.4	1	3	3	1	2	–	–	–	–	2	–	2
CO.5	2	2	3	3	1	–	–	–	–	2	–	2

Year & Sem	II Year – II Semester					
Course Code	**23UCS17**	**L**	**T**	**P**	**SS**	**C**
Course Name	**DATABASE MANAGEMENT SYSTEMS**	**3**	**0**	**0**	**0**	**3**

Course Objectives: The main objectives of the course is to

1. Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
2. Introduce the concepts of basic SQL as a universal Database language
3. Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
4. Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes: By the end of the course, the student will be able to

1. Describe a relational database and object-oriented database
2. Create, maintain and manipulate a relational database using SQL
3. Describe ER model and normalization for database design
4. Examine issues in data storage and query processing and can formulate appropriate solutions
5. Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage

UNIT I: Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable),

relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependencyLossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, ACID properties, Concurrent

Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks,Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1.   https://nptel.ac.in/courses/106/105/106105175/
2. ttps://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202 2456_shared/overview

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO) (Strong – 3, Moderate – 2, Weak – 1)
COS- POS MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	–	–	–	–	–	–	–	3
CO.2	3	2	3	2	–	–	–	–	–	–	–	2
CO.3	3	3	3	1	–	–	–	–	–	–	–	2
CO.4	3	3	3	1	–	–	–	–	–	–	–	2
CO.5	3	3	3	1	–	–	–	–	–	–	–	2

Year & Sem	II Year – II Semester					
Course Code	**23UCS10**	L	T	P	SS	C
Course Name	**DIGITAL LOGIC & COMPUTER ORGANIZATION**	3	0	0	0	3

Course Objectives: The main objectives of the course is to

- provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

UNIT – I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes
Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters
Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT – III:

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations
Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT – IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V:
Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Textbooks:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.

2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.

3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.

2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.

3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/103/106103068/

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO) (Strong – 3, Moderate – 2, Weak – 1)
COS- POS MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1												
CO.2												
CO.3												
CO.4												
CO.5												

Year & Sem	II Year – II Semester					
Course Code	**23UDS05**	L	T	P	SS	C
Course Name	**DATA ENGINEERING LAB**	0	0	3	0	1.5

Course Objective:

- The main objective of this course is to teach how build data engineering infrastructure and data pipelines.

Allocation

Course Outcomes: At the end of the course student will be able to:

1. Build our Data Engineering Infrastructure
2. Demonstrate Reading and Writing files
3. Build Data Pipelines and integrate with Dashboard
4. Deploy the Data Pipeline in production

Experiments:

1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elasticsearch, Kibana, PostgreSQL, pgAdmin 4
3. Reading and Writing files
   a. Reading and writing files in Python
   b. Processing files in Airflow
   c. NiFi processors for handling files
   d. Reading and writing data to databases in Python
   e. Databases in Airflow
   f. Database processors in NiFi
4. Working with Databases
   a. Inserting and extracting relational data in Python
   b. Inserting and extracting NoSQL database data in Python
   c. Building database pipelines in Airflow
   d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
   a. Performing exploratory data analysis in Python
   b. Handling common data issues using pandas
   c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
   a. Staging and validating data
   b. Building idempotent data pipelines
   c. Building atomic data pipelines
9. Version Control with the NiFi Registry

    a. Installing and configuring the NiFi Registry
    b. Using the Registry in NiFi
    c. Versioning your data pipelines
    d. Using git-persistence with the NiFi Registry

10. Monitoring Data Pipelines
    a. Monitoring NiFi in the GUI
    b. Monitoring NiFi using processors
    c. Monitoring NiFi with Python and the REST API

11. Deploying Data Pipelines
    a. Finalizing your data pipelines for production
    b. Using the NiFi variable registry
    c. Deploying your data pipelines

12. Building a Production Data Pipeline
    a. Creating a test and production environment
    b. Building a production data pipeline
    c. Deploying a data pipeline in production

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020.

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
CO – PO MAPPING:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	2	3	–	–	–	–	–	2	–	2
CO.2	1	3	3	3	-	–	–	–	–	–	–	2
CO.3	1	3	3	3	2	–	–	–	–	2	–	2
CO.4	1	3	3	1	2	–	–	–	–	2	–	2
CO.5	2	2	3	3	1	–	–	–	–	2	–	2

Year & Sem	II Year – II Semester					
Course Code	**23UCS20**	L	T	P	SS	C
Course Name	**DATABASE MANAGEMENT SYSTEMS LAB**	0	0	3	0	1.5

Course Objectives: This Course will enable students to

1. Populate and query a database using SQL DDL/DML Commands
2. Declare and enforce integrity constraints on a database
3. Writing Queries using advanced concepts of SQL
4. Programming PL/SQL including procedures, functions, cursors and triggers,

Course Outcomes:

1. Able to **Apply** DDL, DML, DCL commands
2. Able to **Write** Queries, nested queries, built-in functions,
3. Able to **Implement** PL/SQL programming- control structures
4. Able to **Write** Procedures, Functions, Cursors, Triggers,
5. Able to **Implement** Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
    i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
    ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.

8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

12. Create a table and perform the search operation on table using indexing and non-indexing techniques.

13. Write a Java program that connects to a database using JDBC

14. Write a Java program to connect to a database using JDBC and insert values into it

15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
<u>**COs-POs Mapping**</u>

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	3	3	2	1	–	–	–	–	–	–	2
CO.2	1	2	3	2	3	–	–	–	–	–	–	1
CO.3	1	3	3	1	3	–	–	–	–	–	–	3
CO.4	2	2	3	1	3	–	–	–	–	–	–	2
CO.5	1	2	3	1	3	–	–	–	–	–	–	2

Year & Sem	II Year – II Semester					
Course Code	**23UDS06**	L	T	P	SS	C
Course Name	**EXPLORATORY DATA ANALYSIS USING PYTHON (SKILL DEVELOPMENT COURSE)**	**0**	**1**	**2**	**0**	**2**

Course Objectives:

1. This course introduces the fundamentals of Exploratory Data Analysis
2. It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.

Course Outcomes:

1. Enumerate the fundamentals of Exploratory Data Analysis.

2.Visualize the data using basic graphs and plots.

3. Apply different Data Transformation Techniques.

4. Summarize the data using descriptive statistics.

5. Evaluate the Models and select the best model

UNIT-I

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

Sample Experiments:

1. a) Download Dataset from Kaggle using the following link :
   https://www.kaggle.com/datasets/sukhmanibedi/cars4u

   b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib,seaborn)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas dataframe
4. Selecting rows and columns in the dataframe

UNIT-II

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart
Case Study:EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

Sample Experiments:

1. Apply different visualization techniques using sample dataset

a) Line Chart b) Bar Chart c) Scatter Plots d)Bubble Plot

2. Generate Scatter Plot using seaborn library for iris dataset

3. Apply following visualization Techniques for a sample dataset

a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart

4. Generate the following charts for a dataset.

a) Polar Chart b)Histogram c)Lollipop chart

5. Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT-III

Data Transformation: Merging database-style dataframes, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

Sample Experiments:

1. Perform the following operations

   a) Merging Dataframes

   b) Reshaping with Hierarchical Indexing

   c) Data Deduplication

   d) Replacing Values

2. Apply different Missing Data handling techniques

   a) NaN values in mathematical Operations

   b) Filling in missing data

   c) Forward and Backward filling of missing values

   d) Filling with index values

   e) Interpolation of missing values

3. Apply different data transformation techniques

   a) Renaming axis indexes

   b)Discretization and Binning

   c) Permutation and Random Sampling

   d) Dummy variables

UNIT-IV

Descriptive Statistics: Distribution function, Measures of central tendency, Measures ofdispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis **Sample Experiments:**

1. Study the following Distribution Techniques on a sample data

   a) Uniform Distribution

   b) Normal Distribution

   c) Gamma Distribution

   d) Exponential Distribution

   e) Poisson Distribution

   f) Binomial Distribution

2. Perform Data Cleaning on a sample dataset.

3. Compute measure of Central Tendency on a sample dataset

   a) Mean b)Median c)Mode

4. Explore Measures of Dispersion on a sample dataset

   a) Variance b) Standard Deviation c) Skewness d) Kurtosis

5. a) Calculating percentiles on sample dataset

   b) Calculate Inter Quartile Range(IQR) and Visualize using Box Plots

6. Perform the following analysis on automobile dataset.

a) Bivariate analysis   b)Multivariate analysis

7. Perform Time Series Analysis on Open Power systems dataset

UNIT-V

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

Case Study:EDA on Wine Quality Data Analysis

Sample Experiments:

1. Perform hypothesis testing using statsmodels library

a) Z-Test   b)T-Test

2. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.

22. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

Text Book:

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.

References:

1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020
2. Radhika Datar,Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, Ist Edition, Packt Publishing, 2019

Web References:

1. https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/#h-conclusion
3. https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
COS- POS MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	–	–	–	–	–	2	–	3
CO.2	3	3	3	2	–	–	–	–	–	2	–	2
CO.3	3	3	3	1	–	–	–	–	–	2	–	2
CO.4	3	3	3	2	–	–	–	–	–	2	–	2
CO.5	3	3	3	2	–	–	–	–	–	2	–	2

Year & Sem	II Year – II Semester					
Course Code	**23UMB03**	L	T	P	SS	C
Course Name	**DESIGN THINKING & INNOVATION**	1	0	2	0	2

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

UNIT – I   Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II   Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III   Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to

innovation, Debate on value-based innovation.

UNIT - IV   Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V   Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Contribution of Course Outcomes (CO) towards the achievement of programme outcomes (PO)   (Strong – 3, Moderate – 2, Weak – 1)
COS- POS MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	–	–	–	–	–	2	–	3
CO.2	3	3	3	2	–	–	–	–	–	2	–	2
CO.3	3	3	3	1	–	–	–	–	–	2	–	2
CO.4	3	3	3	2	–	–	–	–	–	2	–	2
CO.5	3	3	3	2	–	–	–	–	–	2	–	2