

B.Tech. – I Year I Semester (for Group-B Branches) ECE, EEE, CSE, AT&ML

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Engineering Physics	3	0	0	3
2	BS&H	Linear Algebra & Calculus	3	0	0	3
3	Engineering Science	Basic Electrical & Electronics Engineering	3	0	0	3
4	Engineering Science	Engineering Graphics	1	0	4	3
5	Engineering Science	Introduction to Programming	3	0	0	3
6	Engineering Science	IT Workshop	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	Engineering Science	Electrical & Electronics Engineering Workshop	0	0	3	1.5
9	Engineering Science	Computer Programming Lab	0	0	3	1.5
10	BS&H	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total			13	00	15	20.5

University College of Engineering Kakinada
Jawaharlal Nehru Technological University Kakinada

B. Tech. I Year Syllabus

Engineering Physics
(Common for all branches)
(R23 Regulation)

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PREAMBLE

There has been an exponential growth of knowledge base requirement in the recent past to open up new areas of challenges in understanding the basic laws of nature. This helped to the discovery of new phenomena in macro, micro and nano scale regime device technologies. The laws of Physics play a key role in the development of science, engineering and technology. Systematic knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments for their adoption in the field of engineering.

To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi of Engineering physics has been thoroughly revised keeping in view of the basic needs of all branches of Engineering by including the advanced topics of Physical Optics, Dielectric and Magnetic materials, Crystallography and X-ray Diffraction, Quantum Mechanics, Free Electron Theory and Semiconductors.

COURSE OBJECTIVES	
1	Bridging the gap between the Physics in school at 10+2 level and UG level engineering courses.
2	To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
3	Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law – Learning the structural analysis through X-ray diffraction techniques.
4	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
5	Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of de Broglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals.
6.	To Understand the Physics of Semiconductors and their working mechanism, Concepts utilization of transport phenomenon of charge carriers in semiconductors.

COURSE OUTCOMES	
CO1	Explain the need of coherent sources and the conditions for sustained interference (L2). Identify the applications of interference in engineering (L3). Analyze the differences between interference and diffraction with applications (L4). Illustrate the concept of polarization of light and its applications (L2). Classify ordinary refracted light and extraordinary refracted rays by their states of polarization (L2)
CO2	Interpret various crystal systems (L2) and Analyze the characterization of materials by XRD (L4). Identify the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique (L3). Analysis of structure of the crystals by Laue's and Powder techniques (L2).
CO3	Explain the concept of dielectric constant and polarization in dielectric materials (L2). Summarize various types of polarization of dielectrics (L2). Interpret Lorentz field and Claussius-Mosotti relation in dielectrics (L2). Classify the magnetic materials based on susceptibility and their temperature dependence (L2).
CO4	Describe the dual nature of matter (L1). Explain the significance of wave function (L2). Identify the role of Schrodinger's time independent wave equation in studying particle in one-dimensional infinite potential well (L3). Identify the role of classical and quantum free electron theory in the study of electrical conductivity (L3).
CO5	Classify the crystalline solids (L2). Outline the properties of charge carriers in semiconductors (L2). Identify the type of semiconductor using Hall effect (L2). Apply the concept of effective mass of electron (L3).

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Unit-I: Wave Optics

12hrs

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors 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

8hrs

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 by Laue's and powder methods.

Unit-III: Dielectric and Magnetic Materials

8hrs

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 .

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

Unit-IV: Quantum Mechanics and Free electron theory

10hrs

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) – Fermi-Dirac distribution - Density of states - Fermi energy - Quantum free electron theory – electrical conductivity based on quantum free electron theory .

Unit – V: Semiconductors**10hrs**

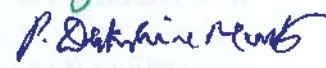
Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature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

Text books:

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

Reference Books:

1. "University Physics with Modern Physics" - Young Hugh D. and Freedman Roger .A Pearson Education, 2014
2. "Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
3. "Engineering Physics" - B.K. Pandey and S. Chaturvedi, Cengage Learning
4. "Engineering Physics" - M.R. Srinivasan, New Age international publishers (2009).

Designation	Name	Organization	Signature
Chairperson	Dr. G. Padmaja Rani	JNTUK	
Internal member	Dr. P.Dakshina Murthy	JNTUK	
External member	Dr. V.R.K. Murthy	IITMadras	Attended Virtually
External member	Dr. D. Haranath	NIT-Warangal	Attended Virtually
External member	Dr. K. Venkateswara Rao	JNTUH	Attended Virtually

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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 enabled to

- CO1: Acquire a comprehensive idea for the concepts of wave optics phenomena for their utility to design an instrument with enhanced accuracy
- CO2: Understand the influence of electric and magnetic fields as response parameters for their device utility
- CO3: Analyze the gravitational fields, resonance and wave propagation in stretched strings
- CO4: Understand the ideological utility perspectives of quantum mechanics for its domain of viability in human life, for the device perspective of semiconductor materials as sensors etc.,
- CO6: Utilize the knowledge regarding the impact of doping in extrinsic semiconductor to realise tunable Conductivity, i.e., both in realistic and virtual modes.

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(Any TEN of the following listed experiments)

(Out of which any TWO experiments may be conducted in virtual mode)

List of Engineering Physics 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 semiconductor by four probe method.
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.

References:

1. "A Text Book of Practical Physics" - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
2. "Practical physics" by G.L.Squire, Cambridge University press, Fourth edition, 2001

URL: www.vlab.co.in

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives: To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

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

CO1: Apply the basic concepts of semiconductor devices

CO2: Illustrate the formation of p-n junction and how it can be used in diodes, Transistors in different modes of operation.

CO3: Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons..

CO4: Classify different number systems and apply to generate various codes. Design different types of combinational logic circuits.

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of Electronics , Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

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. 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, Comparators, Code converters

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 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.


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PART B: ELECTRONICS ENGINEERING LAB

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Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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

CO1: 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 gates using 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, Pearson Education, 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 implemented using both Hardware and Software.

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I Year - I Semester	IT Workshop (Common to all branches of Engineering)	L	T	P	C
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Course Objectives:

The main objectives of the course are to

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

Course Outcomes:

A student after completion of the course will be able to

- 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: Installation of MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Installation of 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: Installation of 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.

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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 TeX and 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

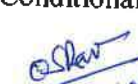
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

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.

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


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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 Anfinson 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

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I Year - I Semester	INTRODUCTION TO PROGRAMMING (Common to All branches of Engineering)	L	T	P	C
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Course Objectives:

The main objectives of the course are to

- Introduce students to the fundamentals of computer programming.
- Provide hands-on experience with coding and debugging.
- Foster logical thinking and problem-solving skills using programming.
- Familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- 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) and Unconditional statements: goto, Break and Continue.

UNIT III:

Arrays and Strings: Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings and string Operations

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, Recursive functions. Scope and Lifetime of Variables, Basics of File Handling

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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

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

Two handwritten signatures in blue ink. The first signature on the left is 'OSKaw' with a horizontal line underneath. The second signature on the right is a stylized 'P' with a checkmark-like stroke.

I Year - I Semester	COMPUTER PROGRAMMING LAB (Common to All branches of Engineering)	L	T	P	C
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Course Objectives:

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

Course Outcomes:

A student after completion of the course will be able to

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**Suggested Experiments/Activities****WEEK 1**

Objective: Getting familiar with the programming environment on the computer and writing the first program.

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 input and Output Statements
- iv) Simple Arithmetic Operations

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.

Tutorial 2: Problem-solving - Algorithms and Flow charts –

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- i) Simple statistics Operations- Sum and average etc
- ii) Conversion of Fahrenheit to Celsius and vice versa
- iii) Simple and Compound 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:

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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

Suggested Experiments/Activities:

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.

Tutorial 4: Operators Precedence and 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".

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

- i) Find the max and min of four numbers using if-else.
- ii) Generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Simulate a calculator using switch case.
- v) Find the given year is a leap year or not etc

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 goto, break and continue including when each of these statements is more appropriate to use.

Tutorial 6: Loops: while, do-while and for loops

Lab 6: Iterative problems e.g., series and sequences

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- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sin and cos series
- iv) Checking a number is palindrome or not
- v) Construct a pyramid of numbers.

UNIT III

Suggested Experiments/Activities:

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.

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D 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.

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

Suggested Experiments/Activities:

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

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

Tutorial 10: Self-Referential Structures, Linked lists

Lab10 : linked lists

- 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

Suggested Experiments/Activities:

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

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.

Lab 12: Recursive functions

- i) Generate Fibonacci series.
- ii) Find the lcm of two numbers.
- iii) Find the factorial of a number.
- iv) Ackermann function
- v) 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

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

- i) Swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem
- iii) Copy one string into another using pointer.
- iv) 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.

Lab 14: File operations

- i) Write and read text into a file.
- ii) Write and read text into a binary file
- iii) Copy the contents of one file to another file.
- iv) Merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Print last n characters of a given file.

Text Books:

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,

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18-11-2023 

University Engineering College(A): J N T University Kakinada

Department of Mathematics

I Year I Semester

LINEAR ALGEBRA AND CALCULUS

(Common to All Branches)

COURSE OBJECTIVES

The main objective of this course is to provide the learner with variety of linear algebra techniques to solve linear systems, orthogonal representation of the quadratic surfaces and apply its knowledge in optimization problems. It aims further to calculate areas, surfaces and volumes in various coordinate systems.

COURSE OUTCOMES

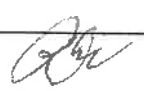
Upon completion of the course, the student will be able to:		Cognitive Level
CO1	Compute rank and inverse of a matrix and hence solves linear system of equations both homogeneous and non-homogeneous.	K2 or K3
CO2	Calculate eigen values and eigen vectors and hence orthogonalize the given matrix and represent given quadratic form into canonical form.	K2 or K3
CO3	Find the mean value of a given function and use it to estimate the bounds of a given function.	K2 or K3
CO4	Compute change in the dependent variable with respect to many independent variables and Jacobians. Apply the knowledge in optimizing functions of several variables.	K2 or K3
CO5	Compute double and triple integrals of functions of several variables and must be able to change the coordinate systems from polar, spherical and cylindrical coordinates.	K2 or K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 – Medium, 3 – High)

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

Members of BoS:

Dr. V.Ravindranath (Chairman)	Dr. T.V.S. Sekhar (Member)	Dr. Ch. Ramireddy (Member)	Dr. T. Hymavathi (Member)	Dr.G.V.S.R. Deekshitulu (Member)	Dr. S.K.Vali (Member)	Dr.K.Sobhan Babu (Member)
						

University Engineering College(A): J N T University Kakinada
Department of Mathematics

SYLLABUS

UNIT I

Matrices:

Rank of a matrix by echelon form, normal form. Diagonalization of a matrix. 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-Hamilton Theorem (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. Taylor's and Maclaurin series.

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 functions of 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).

TEXT BOOKS

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

REFERENCE BOOKS

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.

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Department of Mathematics

2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)
6. Advanced Engineering Mathematics by H. K Dass, S. Chand Publications, 2022, Twenty Two Edition (Reprint 2022).

WEB RESOURCES

1. https://en.wikipedia.org/wiki/System_of_linear_equations
2. https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
3. <https://www.math.hmc.edu/calculus/tutorials/eigenstuff/>
4. https://en.wikipedia.org/wiki/Quadratic_form
5. <https://en.wikipedia.org/wiki/Calculus>
6. https://en.wikipedia.org/wiki/Partial_derivative
7. https://www.whitman.edu/mathematics/calculus_online/section14.03.html
8. https://en.wikipedia.org/wiki/Multiple_integral
9. <http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx>

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ENGINEERING GRAPHICS

(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: 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, Involute, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

Practicing on a sketching book for few examples (Not for end examination).

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

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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.
Practicing on a sketching book for few examples*(Not for end examination)*..

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.

Practicing on a sketching book for few examples*(Not for end examination)*..

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.

Practicing on a sketching book for few examples*(Not for end examination)*..

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 of objects including PCB and Transformations using Auto CAD *(Not for end examination)*.

Practicing on a sketching book for few examples *(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.
4. Engineering Design and Visualization, Jon M. Duff and William A. Ross, CENGAGE Learning, India edition, 2009.

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R23 UCEK (A) – EEE Syllabus w.e.f 2023-24

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R23 COURSE STRUCTURE

I B.Tech I Semester

S.No	Course No	Course Name	P. Os	Category	L	T	P	Credits
1		Engineering Physics		BS&H	3	0	0	3
2		Linear Algebra & Calculus		BS&H	3	0	0	3
3		Basic Electrical & Electronics Engineering		Engineering Science	3	0	0	3
4		Engineering Graphics		Engineering Science	1	0	4	3
5		Introduction to Programming		Engineering Science	3	0	0	3
6		IT Workshop		Engineering Science	0	0	2	1
7		Engineering Physics Lab		BS&H	0	0	2	1
8		Electrical & Electronics Engineering Workshop		Engineering Science	0	0	3	1.5
9		Computer Programming Lab		Engineering Science	0	0	3	1.5
10		NSS/NCC/Scouts & Guides/Community Service		BS&H	-	-	1	0.5
				Total	13	00	15	20.5

I B.Tech II Semester

S.No	Course No	Course Name	P. Os	Category	L	T	P	Credits
1		Communicative English		BS&H	2	0	0	2
2		Engineering Chemistry / Chemistry / Fundamental Chemistry		BS & H	3	0	0	3
3		Differential Equations & Vector Calculus		Engineering Science	3	0	0	3
4		Basic Civil & Mechanical Engineering		Engineering Science	3	0	0	3
5		Electrical Circuit Analysis - I		Professional Core	3	0	0	3
6		Communicative English Lab		BS&H	0	0	2	1
7		Engineering Chemistry / Chemistry / Fundamental Chemistry Lab		BS&H	0	0	2	1
8		Engineering Workshop		Engineering Science	0	0	3	1.5
9		Electrical Circuits Lab		Professional Core	0	0	3	1.5
10		Health and wellness, Yoga and Sports		BS&H	-	-	1	0.5
				Total	14	00	11	19.5

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			Attended Online	



R23 UCEK (A) – EEE Syllabus w.e.f 2023-24

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech I Semester

COURSE CODE – R2011XXYY	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (For EEE Branch only)	CATEGORY Engineering Science	L-T-P 3-0-0	CREDITS 3
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Apply basic concepts of electrical circuits to solve the different electrical network problems	3
CO2	Apply magnetic field concepts to analyse the various types of magnetic circuit problems	3
CO3	Choose different electrical wiring schemes, compute electricity bill for domestic consumers using tariff methods and understand safety measures.	3
CO4	Explain basic concepts of semiconductor physics necessary for electronic devices	2
CO5	Illustrate the characteristics of various electronic devices	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
	PART A: BASIC ELECTRICAL ENGINEERING	
UNIT - 1	Introduction to Electrical Circuits Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchhoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.	8
UNIT - 2	Magnetic Circuits Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.	8

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			Attended Online	



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT - 3	Electrical Wiring, Electricity Bill & Safety Measures Electrical Wiring: Simple Lamp circuits, stair case wiring scheme, godown wiring scheme, types of service mains, types of electrical wiring, cost estimation of indoor wiring, wiring layout of workshop/ electrical laboratory. Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc., Types of electricity tariff, 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.	8
PART B: BASIC ELECTRONICS ENGINEERING		
UNIT - 4	Review of Semi-Conductor Physics Electrons and holes in an intrinsic semiconductor, conductivity of a semiconductor, carrier concentrations in an intrinsic semiconductor, donor and acceptor impurities, charge densities in a semiconductor, Fermi Dirac function, Fermi level in intrinsic and extrinsic semiconductors, continuity equation, Hall effect and its applications.	8
UNIT - 5	Junction Diode Characteristics Energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, law of junction, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.	8
UNIT-6	Special Semiconductor Devices Operation and V-I characteristics of Zener Diode, Breakdown mechanisms, Zener diode as voltage regulator; LED, Photodiode, Tunnel diode, SCR and UJT.	8
Total		

Part A: BASIC ELECTRICAL ENGINEERING

Textbooks:

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. Electrical Wiring Estimating and Costing –Dr. S. L. Uppal-Khanna Publishers-1987

Reference Books:

1. Circuit Theory, Abhijit Chakrabarti, Dhanpat Rai & Co. Publications, 8th edition, 2023.
2. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, First Edition, 2019

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended Online	



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

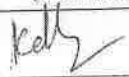
Part B: BASIC ELECTRONICS ENGINEERING

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition, 2007
2. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

Reference Books:

1. Albert Paul Malvino, David J. Bates, Electronic Principles, 8th edition, McGraw Hill 2015.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press.

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended online	



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP (For EEE Branch only)	CATEGORY Engineering Science	L-T-P 0-0-3	CREDITS 1.5
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Study and identification of various electrical circuit components	2
CO2	Measure and verify voltage, current and power in an electric circuit	2
CO3	Choose and assemble various wiring schemes, calculate electrical energy and measure earth resistance for domestic premises	3
CO4	Solder active & passive components in a circuit, assemble electronic components and understand the usage of CRO	2
CO5	Illustrate the characteristics of various electronic devices	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

Note: Minimum Six Experiments to be performed from each Part**PART A: ELECTRICAL ENGINEERING LAB**

S. No.	List of Experiments	Contact Hours
1.	Identification of various types of resistors and capacitors and understand the usage of digital multi-meter.	
2.	Study various types of electrical cables/wires, switches, fuses, fuse carriers, MCB, ELCB, RCCB and MCCB with their specifications and usage.	
3.	Measurement of voltage, current and power in a DC circuit.	
4.	Verification of KCL and KVL	
5.	Measurement of Earth Resistance using Megger	
6.	Calculation of Electrical Energy for Domestic Premises	
7.	Wiring of backup power supply for domestic installations including inverter, battery, and load.	
8.	Hospital wiring/Tunnel wiring.	

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			Attended online	



R23 UCEK (A) – EEE Syllabus w.e.f 2023-24

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PART B: ELECTRONICS ENGINEERING LAB

S. No.	List of Experiments	Contact Hours
1.	Soldering Practice- Simple circuits using active and passive components.	
2.	Assembling electronic components on breadboard.	
3.	Understanding the usage of CRO and Measurement of ac signal parameters using CRO with function generator	
4.	Plot V-I characteristics of Zener diode	
5.	Plot V-I characteristics of PN junction diode	
6.	Plot V-I characteristics of Light Emitting Diode (LED)	
7.	Plot V-I characteristics of UJT	
8.	Plot V-I Characteristics of SCR	

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			Attended online	



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech

COURSE CODE – R2011XXYY	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to CE, ME, ECE CSE, AIML PE, CHE (Except EEE))	CATEGORY Engineering Science	L-T-P 3-0-0	CREDITS 3
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Apply basic concepts of electrical circuits to solve the different electrical network problems	3
CO2	Explain the operation of different electrical machines	2
CO3	Compute electricity bill for domestic consumers using tariff methods and understand safety measures	3
CO4	Collect COs from the ECE department	
CO5		
CO6		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

Note: Only elementary concepts of the topics are to be considered for the preparation of question paper.

UNIT	CONTENTS	Contact Hours
	PART A: BASIC ELECTRICAL ENGINEERING	
UNIT - 1	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. 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,	10

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			Attended online	



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

	Concept of reactance and Impedance, Concept of power factor, Active power, reactive power and apparent power. (Simple numerical problems)	
UNIT - 2	Machines Principle of operation of DC Generator, EMF Equation, Types of Field Excitation, Open Circuit Characteristics of DC generator, Principle of operation of Three Phase Induction Motor, Single Phase Transformer. (Simple numerical problems on DC Generator.)	8
UNIT - 3	Electricity Bill & Equipment Safety Measures Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Types of Tariff, Calculation of electricity bill for domestic consumers. Equipment Safety Measures: Working principle of Fuse and Miniature Circuit Breaker(MCB). Electric Shock, Safety Precautions to avoid shock, concept of Earthing	6
PART B: BASIC ELECTRONICS ENGINEERING		
UNIT - 4	Collect syllabus from the ECE department	
UNIT - 5		
UNIT-6		
	Total	

Part A:**Textbooks:**

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition.
2. Principles of Electrical Engineering and Electronics by Mehta V.K. & Mehta Rohit, S. Chand Limited 2006.
3. A Textbook of Electrical Technology – Volume I by B. L. Theraja, A. K. Theraja, S. Chand Limited 2005.
4. A Textbook of Electrical Technology - Volume II by B. L. Theraja, A. K. Theraja S. Chand Limited 2005.
5. Electrical wiring, estimation & costing by Uppal S.L. Khanna Publishers 1987.

Reference Books:

1. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
2. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Pearson Publications, 2018, Second Edition.
3. Principles of Power By V. K. Mehta, Rohit Mehta · S. Chand 2005

Part B:**Textbooks:****Reference Books:**

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended online	



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech

COURSE CODE – R2011XXYY	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP (Common to CE, ME, ECE CSE, AIML PE, CHE (Except EEE))	CATEGORY BSC	L-T-P 0-0-3	CREDITS 1.5
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Measure and verify voltage, current and power in an electric circuit	2
CO2	Illustrate the Open Circuit Characteristics of DC generator.	3
CO3	Choose and assemble various wiring schemes, calculate electrical energy and measure earth resistance for domestic premises	3
CO4	Collect from the ECE department	
CO5	Collect from the ECE department	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

(Please fill the above with Levels of Correlation, viz., L, M, H)

Note: Minimum Six Experiments to be performed from each part

PART A: ELECTRICAL ENGINEERING LAB

S. No.	List of Experiments	Contact Hours
1.	Verification of KCL and KVL	
2.	Measurement of voltage, current, power in DC circuit	
3.	Measurement of voltage, current, power, power factor in AC circuit	
4.	Open Circuit Characteristics of DC generator	
5.	Measurement of earth resistance	
6.	Calculation of Electrical Energy for Domestic Premises	
7.	Hospital wiring	
8.	Wiring of backup power supply for domestic installations including inverter, battery and load.	

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended online	



R23 UCEK (A) – other Branch BEEE Syllabus w.e.f 2023-24

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PART B: ELECTRONICS ENGINEERING LAB

Collect syllabus from the ECE department

S. No.	List of Experiments	Contact Hours
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended online.	

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Communicative English	2	0	0	2
2	BS & H	Engineering Chemistry / Chemistry / Fundamental Chemistry	3	0	0	3
3	Engineering Science	Differential Equations & Vector Calculus	3	0	0	3
4	Engineering Science	Basic Civil & Mechanical Engineering	3	0	0	3
5	Professional Core	Engineering Mechanics/Network Analysis/ Data structures (Branch specific)	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Chemistry / Chemistry / Fundamental Chemistry Lab	0	0	2	1
8	Engineering Science	Engineering Workshop	0	0	3	1.5
9	Professional Core	Engineering Mechanics & Building Practices Lab Engineering Mechanics Lab/Network Analysis Lab/ Data structures Lab	0	0	3	1.5
10		Health and wellness, Yoga and Sports	-	-	1	0.5
Total			14	00	11	19.5

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA (R23)

L	T	P	C
2	0	0	2

COMMUNICATIVE ENGLISH
(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 structure talks.
- 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.

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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: Reading a 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 and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Textbooks:

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

Reference Books:

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SGP

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 University Press, 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

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA (R23)

L	T	P	C
0	0	2	1

COMMUNICATIVE ENGLISH LAB
(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

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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
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Greenway

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA (R23)

L	T	P	C
3	0	0	3

CHEMISTRY

(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.

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

CO1: Explain basic concepts of quantum mechanics and molecular bonding.

CO2: Apply applications of semiconductors, superconductors, supercapacitors and nanomaterials.

CO3: Familiarize construction of batteries and electrochemical sensors.

CO4: Explain preparation and applications of plastics, elastomers and conducting polymers.

CO5: Explain the principles of spectrometry, HPLC in separation of solid and liquid mixtures.

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 O_2 and CO - π -molecular orbitals of butadiene and benzene - calculation of bond order.

UNIT II Modern Engineering materials

Semiconductors: Introduction, basic concept (preparation methods: distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - chalcogen semiconductors - applications.

Superconductors: Introduction - basic concept (type-I, type-II) - applications.

Super capacitors: Introduction, basic concept - classification - applications.

Nano materials: Introduction - carbon nanotubes and fullerenes (classification, properties and applications) - applications of graphine nanoparticles.

UNIT III Electrochemistry and Applications

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

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



Batteries: Working of the batteries including cell reactions of zinc-air battery, primary cells (dry cell) and secondary cells (lithium ion) - Fuel cells [working of hydrogen-oxygen fuel cell and polymer electrolyte membrane fuel cells (PEMFC)].

UNIT IV Polymer Chemistry

Introduction to polymers - functionality of monomers - chain growth and step growth polymerization - coordination polymerization - mechanisms of polymer formation (suspension and emulsion).

Plastics: Thermoplastics and Thermosetting plastics - moulding techniques (compression, injection, extrusion, blow film) - preparation, properties and applications of Poly vinyl chloride (PVC), Teflon, Bakelite, Nylon-6,6 and carbon fibres.

Elastomers: Preparation, properties and applications of Buna-S and Buna-N.

Conducting polymers: Mechanism of conduction and applications of polyacetylene and polyaniline - Bio-degradable polymers [poly glycolic acid (PGA) and poly lactic acid (PLA)].

UNIT V Instrumental Methods and Applications

Electromagnetic spectrum - law of absorption (Beer-Lambert's law) - UV-Visible spectroscopy (electronic transitions, instrumentation, applications) - IR spectroscopy (fundamental modes and selection rules, instrumentation) - Chromatography (basic principle, classification) - High pressure liquid Chromatography HPLC (principle, instrumentation and applications).

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 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. Text book of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition.



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

L	T	P	C
0	0	2	1

CHEMISTRY LAB

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

Course Objectives:

- To verify the fundamental concepts with experiments

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

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyze the IR spectra of some organic compounds.

CO5: Calculate the hardness of water.

List of Experiments:

1. Measurement of $10 D_q$ 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 Bakelite.
8. Verify Lambert-Beer's law.
9. Wavelength measurement of sample through UV-Visible spectrophotometer.
10. Identification of simple organic compounds by IR spectrophotometer.
11. Preparation of nanomaterials by precipitation method.
12. Estimation of ferrous Iron by dichrometry.
13. Determination of Mn^{2+} using standard oxalic acid solution.
14. Determination of concentration of acetic acid by p^H meter.
15. Determination of hardness of a groundwater sample.
16. Estimation of Zn^{2+} using standard EDTA solution.

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Reference:

"Vogel's Quantitative Chemical Analysis 6th Edition Pearson Publications by J. Mendham, R. C. Denney, J. D. Barnes and B. Sivasankar.



University Engineering College(A): J N T University Kakinada
Department of Mathematics

I Year II Semester
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
 (Common to all branches)

COURSE OBJECTIVES

This course is aimed to provide the learner with several of methods of solving differential equations and partial differential equations. To prepare the student to calculate gradient, surface and volume integrals by applying standard theorems.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Model simple physical problems involving rate as first order differential equations and solve the resulting equation.	K2 or K3
CO2	Model electrical circuits problems or vibrating systems problems as linear higher order ordinary differential equations and solve.	K2 or K3
CO3	Solve partial differential equations that model physical processes.	K2 or K3
CO4	Apply the knowledge of gradient, divergence and curl and interpret the physical meaning of different operators.	K2 or K3
CO5	Compute the work done against a field, circulation and flux using vector calculus methods.	K2 or K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
 (1 – Low, 2 – Medium, 3 – High)

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

Members of BoS:

Dr. V.Ravindranath (Chairman)	Dr. T.V.S. Sekhar (Member)	Dr. Ch. Ramireddy (Member)	Dr. T. Hymavathi (Member)	Dr.G.V.S.R. Deekshitulu (Member)	Dr. S.K.Vali (Member)	Dr.K.Sobha (Member)
						

R23

University Engineering College(A): J N T University Kakinada

Department of Mathematics

SYLLABUS

UNIT I

Differential equations of first order and first degree:

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- Electrical circuits.

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 and applications, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V

Vector integration:

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

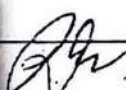
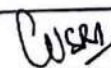
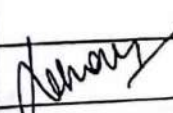
TEXT BOOKS

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

REFERENCE BOOKS

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 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 Science International Ltd.,

Members of BoS:

Dr. V. Ravindranath (Chairman)	Dr. T.V.S. Sekhar (Member)	Dr. Ch. Ramireddy (Member)	Dr. T. Hymavathi (Member)	Dr. G.V.S.R. Deekshitulu (Member)	Dr. S.K. Vali (Member)	Dr. K. Sobhan Babu (Member)
						

L	T	P	C
1	0	0	3

BASIC CIVIL AND MECHANICAL ENGINEERING

(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's economy.
- 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 in ensuring better society.
- CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3: Realize the importance of Transportation in nation's economy and the engineering techniques related to Transportation.
- CO4: Understand importance of Water Supply and Conveyance Structures so that the social responsibilities of water engineering will be appreciated.
- CO5: Understand the basic characteristics of Civil Engineering Materials and obtain knowledge on 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 Materials - Construction Materials - Cement - Aggregate - Bricks - Concrete - Tiles - Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objective 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 - Quality of water - Specifications - Introduction to Hydrology - Rainwater Harvesting - Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

PROF. R. S. REDDY

Department of Civil Engineering
University College of Engineering
JNTUK, KAKINADA-553 003

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Textbooks:

1. Basic Civil Engineering, M.S. Pulkasamy, 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, Fifth Edition
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi, 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2021, 3rd Edition

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 different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to

- CO1: Explain the role of mechanical engineering in industrial sectors. Identify different materials used in engineering applications.
- CO2: Enlist different manufacturing processes and their practical applications. Explain the working principles of Boilers and I.C engines and power cycles.
- CO3: Describe the construction and working of different power transmission systems. Explain the working principle of different power plants. Describe the basic components of a robot and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors with examples.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles and practical applications of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principles and demo models 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 their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics. Demo on operation of a robot

MR
HMEG

J. M.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. 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 text 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, Cengage learning India Pvt. Ltd.

Reference Books:

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

MR

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL CIRCUIT ANALYSIS - I	CATEGORY Professional Core	L-T-P 3-0-0	CREDITS 3
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Explain the basics of single phase AC systems, series resonance & parallel resonance concepts.	2
CO2	Apply node & mesh analysis to solve AC circuits. Perform steady state analysis of R, L & C circuits.	3
CO3	Solve DC & AC circuits using network theorems. Draw the locus diagrams of RL, RC, RLC with R, L and C variables.	3
CO4	Analyse three balanced & unbalanced circuits.	4

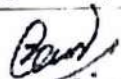
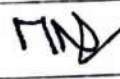
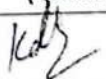
#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	Single Phase A.C Systems Periodic waveforms - average value, rms value, peak factor and form factor, concept of phasor, phase angle and phase difference, phasor diagrams for lagging, leading networks, complex and polar forms of representations. node and mesh analysis. Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power.	
UNIT - 2	Resonance and Locus Diagrams Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.	

Dr. R. Srinivasa Rao (Member)	Dr. K. Venkata Reddy (Member)	Dr. M. Nageswara Rao (Member)	Dr. Ch.V.V.S. Bhaskar Reddy (Member)	Dr. K. Ravindra (Chairman)
			Attended online	



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UNIT - 3	Network Theorems (DC & AC Excitations) Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem and Tellegen's theorem.	
UNIT - 4	Balanced Three Phase Circuits Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents, analysis of balanced three phase circuits, measurement of active and reactive power.	
UNIT - 5	Unbalanced Three Phase Circuits Loop method, Star-Delta transformation technique, two wattmeter method for measurement of three phase power.	
	Total	

Textbooks:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition.

Reference Books:

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
4. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
5. Circuit Theory, Abhijit Chakrabarti, Dhanpat Rai & Co. Publications, 8th edition, 2023.

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			Attended Online	

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL CIRCUITS LAB	CATEGORY Professional Core	L-T-P 0-0-3	CREDITS 1.5
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Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Apply node & mesh analysis to solve the circuits & compare practical results obtained with theoretical calculations.	3
CO2	Draw locus diagrams of RL, RC series circuits and examine series resonance	3
CO3	Calculate the self, mutual inductances and coefficient of coupling values for a magnetically coupled circuit and find parameters of choke coil.	4
CO4	Calculate power consumed by 3- ϕ balanced and unbalanced loads	3

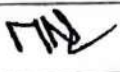
#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

S. No.	List of Experiments	Contact Hours
1.	Verification of network reduction techniques.	
2.	Verification of node and mesh analysis.	
3.	Determination of cold and hot resistance of an electric lamp	
4.	Determination of Parameters of a choke coil.	
5.	Determination of self, mutual inductances, and coefficient of coupling	
6.	Series resonance	
7.	Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits	
8.	Verification of Superposition theorem	
9.	Verification of Thevenin's and Norton's Theorems	
10.	Verification of Maximum power transfer theorem	
11.	Verification of Compensation theorem	
12.	Verification of Reciprocity and Millman's Theorems	
13.	Measurement of 3-phase power by two wattmeter method for balanced loads	
14.	Measurement of 3-phase power by two wattmeter method for unbalanced loads	

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			Attended Online	

ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

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 wood working and make following joints.
 - a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
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 following fitting exercises.
 - a) V-fit b) Dovetail fit c) Semi-circular fit
 - d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the 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 joints with coupling for same diameter and with reducer for different diameters.
9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

MP
H.M.E.D

A. G. M.

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.; Atul Prakashan, 2021-22.

MR

L	T	P	C
3	0	0	3

DATA STRUCTURES

(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 dequeues 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.

UNIT III

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 IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Dequeues: Introduction to dequeues (double-ended queues), Operations on dequeues and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

Hashing: Brief 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

CS Rav
7/2/2024
Head of the Department
Dept. of Computer Science & Engg.
University College of Engineering
JNTU University, Kalamata - 533 007

L	T	P	C
0	0	3	1.5

DATA STRUCTURES LAB

(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 dequeues 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

- Write a program to reverse an array.
- C Programs to implement the Searching Techniques – Linear & Binary Search
- C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

- Implement a singly linked list and perform insertion and deletion operations.
- Develop a program to reverse a linked list iteratively and recursively.
- Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

- Create a program to detect and remove duplicates from a linked list.
- Implement a linked list to represent polynomials and perform addition.
- Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

- Implement a doubly linked list and perform various operations to understand its properties and applications.
- 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
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asker 7/21/2024
Head of the Department
Dept. of Computer Science & Engg.
University College of Engineering
JNT University, Kakinada - 533 003

I Year - I Semester	L	T	P	C
	3	0	0	3
NETWORK ANALYSIS				

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

	Knowledge Level (K)
CO1 Analyze the circuit using Kirchhoff's law	K4
CO2 Evaluate transient response, Steady state response and network functions	K3
CO3 Apply Thevenin and Norton theorems to analyze and design for maximum power transfer and Analyze the R-L, R-C and R-L-C circuits	K2
CO4 Analyze the series and parallel resonant circuits	K4
CO5 Evaluate two-port network parameters, design attenuators and equalizers	K3

UNIT CONTENTS

UNIT-1 Introduction to Network Analysis: Network elements classification, Electric charge and current, Electric energy and potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchhoff's laws, Mesh analysis and Nodal analysis, Star-Delta conversion, problem solving with resistances only including dependent sources also.

A.C Fundamentals: Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples.

UNIT-2 Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation.

Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, heaviside's expansions, problem solving using Laplace transform.

UNIT-3 Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, MaxPower Transfer, Tellegens- problem solving using dependent sources also.

UNIT-4 Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti resonance at all frequencies.

Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, Dot rule of coupled circuits, Problem solving.

UNIT-5 Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, image transfer constant, Image and iterative impedance, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving using dependent sources also.

TEXT BOOKS:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition
3. Engineering Network Analysis and Filter Design by Gopal –G. Bhise & Prem Chadha, Umesh Publications, 2000.

REFERENCES:

1. Electric circuits by Joseph A Edminister, Schaum's Outline Series, 5th Edition
2. Electrical Circuit Analysis (Including Passive Network Synthesis) by C.L. Wadhwa, New Age International Publications, second edition
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw Hill Education

NW2
HEAD OF THE DEPT
DEPARTMENT
UCEK JNTUK

NETWORK ANALYSIS AND SIMULATION LABORATORY

PART-A

The following experiments need to be performed using both Hardware and Software

1. Study of Components of a circuit and Verification of KCL and KVL.
2. Perform Mesh and Nodal Analysis of a given circuit.
3. Determination of frequency response of current in RLC circuit with sinusoidal AC input.
4. Verification of principle of Superposition and Maximum power transfer theorems.
5. Verification of Thevenin and Norton theorems.
6. Verification of Tellegen's theorem for two networks of the same topology.
7. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.
8. Verification of Z and Y Parameters of a two-port network(Only Hardware Implementation).
9. Verification of Transmission and Hybrid parameters of a two-port network (Only Hardware Implementation).
10. Verification of ABCD Parameters for a two-port network(Only Hardware Implementation).

PART-B

The experiments need to be simulated using software

1. Determination of transient response of current in RLC circuit with step voltage input for under damp, critically damp and over damp cases.
2. Determination of transient response of current in RL and RC circuits with step voltage input.

Hardware Requirements:

1. Regulated Power supplies
2. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

Software requirements:

- i. Multisim/ Pspice/Equivalent simulation software tool.
- ii. Computer Systems with required specifications.

NW2
IN THE DEPARTMENT
DEPARTMENT OF ECE
UNIVERSITY OF CANADA.



University College of Engineering Kakinada (A)
Jawaharlal Nehru Technological University Kakinada

B.Tech. CSE (AI&ML) (R23-II Year Course Structure & Syllabus)

B.Tech.–II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	Universal Human Values – Understanding Harmony	2	1	0	3
3	Engineering Science	Artificial Intelligence	3	0	0	3
4	Professional Core	Advanced Data Structures	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	Advanced Data Structures Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement course	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			16	2	8	20

B.Tech.–II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course-I	Optimization Techniques	2	0	0	2
2	Engineering Science / Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Computer Organization & Architecture	3	0	0	3
6	Professional Core	Machine Learning Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack Development-1	0	1	2	2
9	BS&H	Design Thinking & Innovation	1	0	2	2
Total			15	1	12	21
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						



University College of Engineering Kakinada (A)
Jawaharlal Nehru Technological University Kakinada
B.Tech. CSE (AI&ML) (R23-II Year Course Structure & Syllabus)

II Year I Semester

L	T	P	C
3	0	0	3

Discrete Mathematics & Graph Theory

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- 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:

Upon completion of the course, the student will be able to:		Cognitive Level
CO1	Apply mathematical logic to solve problems	K3
CO2	Understand the concepts and perform the operations related to sets, relations and functions.	K4
CO3	Apply basic counting techniques to solve combinatorial problems and recurrence relations.	K3
CO4	Apply Graph Theory in solving computer science problems.	K3
CO5	Apply different theorems and algorithms to find BFS and DFS of Spanning trees.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

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 of Proof, 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, Composite functions, Inverse function and Recursive functions, Lattice, and its properties



University College of Engineering Kakinada (A)
Jawaharlal Nehru Technological University Kakinada
B.Tech. CSE (AI&ML) (R23-II Year Course Structure & Syllabus)

UNIT-III: Combinatorics and Recurrence Relations:

Basics of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multi nominal 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 Coloring 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. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

Reference Books:

1. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.



University College of Engineering Kakinada (A)
Jawaharlal Nehru Technological University Kakinada
B.Tech. CSE (AI&ML) (R23-II Year Course Structure & Syllabus)

II Year I Semester

L	T	P	C
2	1	0	3

Universal Human Values – Understanding Harmony

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:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1,L2)
- Identify one's self, and one's surroundings (family, society nature) (L1,L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society.(L4)
- Justify the need for universal human values and harmonious existence (L5)
- 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)
Lecture1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about One self
Lecture 3: self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity–the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario



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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 the body.
Lecture8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS 6 Exploring Harmony of self with the body
- UNIT III** Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 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 Relationship
Lecture 17: Understanding Harmony in the Society
Lecture18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS 9 Exploring Systems to fulfill Human Goal
- UNIT IV** Harmony in the Nature/ Existence (4 lectures and 2 tutorials for practice session)
Lecture19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture22: The Holistic Perception of Harmony in Existence
Tutorial11:PracticeSessionPS11ExploringCo-existenceinExistence.
- UNIT V** Implications of the Holistic Understanding –a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial12:PracticeSessionPS12ExploringEthicalHumanConduct
Lecture25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture26: Competence in Professional Ethics



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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 PS 14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfill 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:

Text book and Teachers Manual

a. The Text Book

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



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Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, 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 Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
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 topics at 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.



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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%2023.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%2023-25%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/62490385https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



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II Year I Semester

L	T	P	C
3	0	0	3

Artificial Intelligence

Pre-requisite:

1. Knowledge in Computer Programming.
2. A course on “Mathematical Foundations of Computer Science”.
3. Background in linear algebra, data structures and algorithms, and probability.

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence.
2. The student should be made to learn the methods of solving problems using Artificial Intelligence.
3. The student should be made to introduce the concepts of Expert Systems.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. To learn different knowledge representation techniques

UNIT-I

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT-III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes’ probabilistic interferences and dempster-shafer theory.

UNIT-IV

Logic concepts: First-order logic. Inference in first-order logic, propositional vs. first-order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation, Inductive learning, and Decision trees. Explanation-based learning, Statistical Learning: Naïve Bayes model and EM Algorithm



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UNIT-V

Introduction to Machine Learning and Deep Learning, Introduction to Generative AI, Introduction to GenAI Tools: CVedia, Warp, Microsoft PowerBI, Tableau, Github Co-pilot, IBM WatsonX Code assistant.

Textbooks:

1. S. Russel and P. Norvig, “Artificial Intelligence–A Modern Approach”, Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, McGraw Hill
3. Bernard Marr ., “Generative AI in Practice”, Wiely. **(GenAI Tools)**

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel,” Computational Intelligence: a logical approach”, Oxford University Press.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, Fourth Edition, Pearson Education.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Online Learning Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview



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3	0	0	3

Advanced Data Structures

Course Objectives:

The key objectives of the course are:

- Provide knowledge on advance data structures used in Computer Science domain
- Introduce sub-quadratic sorting algorithms and external sorting approach
- Introduce advanced search and retrieval techniques and their applications
- Introduce digital search structures and file structures, and their role in creating software solutions.

UNIT - I:

Sorting Algorithms: Quick Sort, Merge Sort, Heap Sort.

External Sorting: Introduction, K-way Merging, Buffer Handling for Parallel Operation, Run Generation, Optimal Merging of Runs.

(Text Book 1)

UNIT - II:

Advanced Search Trees:

AVL Trees: Definition, Operations – Insertion, Deletion and Searching, Height of an AVL Tree

Red-Black Trees: Searching, Top-Down Insertion, Bottom-Up Insertion, Deletion

B Trees: Definition, Operations – Insertion, Deletion and Searching, B* Trees, B+ Trees

(Text Book 1)

UNIT - III:

Priority Queues: Model, Simple Implementations, Binary Heap: Structure Property, Heap-Order Property, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues: The Selection Problem, Event Simulation, d-Heaps, Binomial Queues: Binomial Queue Structure, Binomial Queue Operations, Amortized Analysis, Lazy Binomial Queues. (Text Book 2)

UNIT - IV:

String Matching: Exact String Matching, Straightforward Algorithms, Knuth-Morris-Pratt Algorithm, Boyer-Moore Algorithm, Multiple Searches, Bit-Oriented Approach, Matching Sets of Words. (Text Book 3)

UNIT - V:

Digital Search Structures: Digital Search Trees, Binary Tries, Compressed Binary Tries, Patricia, Multiway Tries. (Text Book 1)

File Structures: Fundamental File Processing Operations: opening files, closing files, Reading and Writing file contents, Seeking, Special characters in files. Fundamental File Structure Concepts: Field and record organization. (Text Book 4)



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Text Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, University Press, 2008
2. Data Structures and algorithm analysis in C++, 4 ed, Mark Allen Weiss, Pearson.
3. Data Structures and Algorithms in C++, 4 ed, Adam Drozdek, Cengage Learning.
4. File Structures - An Object-Oriented Approach with C++, Michael J. Folk, Bill Zoellick, Greg Riccardi, Pearson.

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. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
4. Algorithms + Data Structures & Programs, N.Wirth, PHI
5. Data structures in Java, Thomas Standish, Pearson Education Asia



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II Year I Semester

L	T	P	C
3	0	0	3

Object-Oriented Programming Through Java

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

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, Passing Arguments 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,



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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, Bytestreams, 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 MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet 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)

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

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



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Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview



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II Year I Semester

L	T	P	C
0	0	3	1.5

Advanced Data Structures Lab

Course Objectives:

The objectives of the course is to

- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, B+ -trees, Red-Black Trees, Heap Trees, Binary Search Trees
- Priority Queues
- Pattern Matching Algorithms
- Sorting Techniques
- File Operations
- Digital Search Trees

Sample Programs:

1. Develop programs that implements below listed sorting algorithms:
 - a. Quick Sort
 - b. Merge Sort
 - c. Heap Sort
2. Develop a program to implement external merge sort algorithm.
3. Develop a program to transform a BST into an AVL tree.
4. Develop a program to implement search, insert and delete operations on AVL trees.
5. Develop a program to implement search, insert and delete operations on Red-Black trees.
6. Develop a program to implement search, insert and delete operations on B-trees.
7. Develop a program to implement search, insert and delete operations on B⁺-trees
8. Develop a program to implement Priority Queues using Unordered Linear Lists.
9. Develop a program to implement Priority Queues using Ordered Linear Lists.
10. Develop a program that creates a heap from given list of integers, and performs insert and delete operations on it.
11. Develop a program to perform string matching using Knuth-Morris-Pratt algorithm.
12. Develop a program to perform string matching using Boyer-Moore algorithm.
13. Develop programs to implement below digital search structures and to perform search, insert, and delete operations on them:
 - a. Digital Search Tree
 - b. Binary Trie



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- c. Compressed Binary Trie
 - d. Patricia
14. Develop a program to illustrate basic file operations (open, read, write, seek, close).

Additional Exercises:

1. Develop a program that sorts given list of numbers using
(a) Quick Sort, (b) Merge Sort and (c) Heap Sort.
Compare the running time of these algorithms for 16 sets of inputs (sorted, nearly sorted, reverse-ordered, and random inputs with 10, 25, 50 and 100 elements). Record the findings in a graph and present your observations.
2. Develop a program to take N elements and do the following:
 - a. Insert them into a heap one by one.
 - b. Build a heap in linear time.Compare the running time of both algorithms for sorted, reverse-ordered, and random inputs.
3. Develop programs to illustrate different file and record organization methods.



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II Year I Semester

L	T	P	C
0	0	3	1.5

Object-Oriented Programming Through JAVA Lab

Course Objectives:

The aim of this course is to

- Practice object oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Experiments covering the Topics:

Object Oriented Programming fundamentals- data types, control structures

- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

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



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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

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

Exercise–9

- a) 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



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II Year I Semester

L	T	P	C
0	1	2	2

Python Programming
(Skill Enhancement Course)

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate Python data structures like Lists, Tuples, Sets, and dictionaries.
- Implement functions, modules, and regular Expressions in Python programming to create practical and contemporary applications.

UNIT-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter 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. Demonstrate the following operators in Python using suitable examples.
 - i) Arithmetic Operators
 - ii) Relational Operators
 - iii) Assignment Operators
 - iv) Logical Operators
 - v) Bitwise Operators
 - vi) Ternary Operator
 - vii) Membership Operators
 - viii) Identity Operators
2. Develop a program to add and multiply complex numbers
3. Develop a Python program to find the sum of 1 to N even numbers, Odd numbers, and prime numbers.
4. Suppose a medical test for a certain disease is 99% accurate (i.e., it correctly identifies 99% of the people with the disease and 99% of the people without the disease). If 0.5% of the population has the disease, and a person tests positive, Find the probability that they actually have it using a Python program.

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



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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, Frozen set.

Sample Experiments:

1. Develop a program to create tuples(name, age, address, college) for at least two members, concatenate the tuples, and print the concatenated tuples.
2. Develop a program to count the number of vowels in a string (No control flow allowed).
3. Develop a program to check whether a given key exists in a dictionary.
4. Develop a program to add a new key-value pair to an existing dictionary.
5. Develop a program to sum all the items in a given dictionary.
6. Develop a Python program demonstrating various set functions, including creation, adding elements, removing elements, checking membership, set operations (union, intersection, difference, symmetric difference), and other common set operations.
7. Develop a Python program to implement the principles of inclusion and exclusion.

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:

- Develop 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 the source must be lowered.
2. Develop a Python program to print each line of a file in reverse order.
 3. Develop a Python program to compute the number of characters, words, and lines in a file.
 4. Develop a program to create, display, append, insert, and reverse the order of the items in the array.



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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, networkx, itertools, sympy and matplotlib.

Sample Experiments:

1. Develop a Python program to check whether a JSON string contains a complex object or not.
2. Develop a Python Program to demonstrate NumPy array creation using the `array()` function.
3. Develop a Python program to demonstrate using `ndim`, `shape`, `size`, `dtype`.
4. Create a dictionary with at least five keys, and each key represents a value as a list where this list contains at least ten values. 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 dataframe
 - b) Perform various data selection operations on DataFrame and save the file as a new CSV file.
5. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attributes with scatter and plot operations in matplotlib
6. Develop a Python program to compute the frequency distribution and plot the histogram for the given list of values using the **collections** library.
7. Develop a Python program to display directed and complete graphs using libraries like **networkx** and **matplotlib**.
8. Develop a Python program to verify the consistency of the given premises using **sympy** library.
9. Generate all the possible permutations of the given input string using **itertools** library

Reference Books:

1. Gowri Shankar 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>
3. <https://cognitiveclass.ai/learn/data-science-with-python>



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II Year I Semester

L	T	P	C
2	0	0	0

Environmental Science

Course Objectives:

- To make the students to get awareness on environment
- 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
- To save earth from the inventions by the engineers.

Course Outcomes:

- Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.
- Understand flow and bio-geo-chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- 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 and over 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, case studies: Energy resources.

UNIT-II

Ecosystems: Concept of an 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, characteristic features, 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–



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Bio-geographical classification of India, Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and 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, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.

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, acid rain, 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 in enforcement of environmental legislation, 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 Erach Bharucha for University Grants Commission, Universities Press.
2. Palani swamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K. Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.



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Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Text book of Environmental Science”, Cengage Publications.
2. M. Anji Reddy, “Text book of Environmental Sciences and Technology”, B S Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J.Glynn Henry and Gary W. 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 Wendell P.Ela, “Introduction to Environmental Engineering and Science ,Prentice Hall of India Private limited.



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II Year II Semester

L	T	P	C
2	0	0	2

Optimization Techniques

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, defines lack 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

- State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
- Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
- Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
- 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
- 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



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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 Penalty Function 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.

Text Books:

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



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II Year II Semester

L	T	P	C
3	0	0	3

Probability and Statistics

Course Objectives:

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications.

Course Outcomes:

Upon completion of the course, the student will be able to:		Cognitive Level
CO1	Classify the concepts of data science and its importance	K2
CO2	Interpret the association of characteristics and through correlation and regression tools	K4
CO3	Apply discrete and continuous probability distributions	K3
CO4	Design the components of test of hypothesis.	K6
CO5	Infer using statistical methods based on small and large sampling tests.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

Unit – I: Descriptive statistics and methods for data science:

Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variable: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability, Skewness, Kurtosis.

UNIT – II: Correlation and Regression:

Correlation, Correlation coefficient, Rank correlation.

Linear Regression: Straight line, Multiple Linear Regression, Regression coefficients and properties, Curvilinear Regression: Parabola, Exponential, Power curves.

UNIT – III: Probability and Distributions:

Probability, Conditional probability and Baye's theorem, Random variables, Discrete and Continuous random variables, Distribution functions, Probability mass function, Probability density function and Cumulative distribution functions, Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.



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UNIT – IV: Sampling Theory:

Introduction, Population and Samples, Sampling distribution of Means and Variance (definition only), Point and Interval estimations, Maximum error of estimate, Central limit theorem (without proof), Estimation using z, t, χ^2 and F-distributions.

UNIT – V: Tests of Hypothesis:

Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, One tail and two-tail tests, Test of significance for large samples and Small Samples:

Single and difference means, Single and two proportions, Student's t- test, F-test, χ^2 -test.

Text Books:

1. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012

Reference Books:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
2. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010



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II Year II Semester

L	T	P	C
3	0	0	3

Machine Learning

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

UNIT-I:

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II:

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III:

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes’ Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV:

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

UNIT-V:

Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means



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Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:

1. “Machine Learning Theory and Practice”, M N Murthy, VS Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. “Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2004
3. “Machine Learning in Action”, Peter Harrington, Dream Tech
4. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.



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II Year II Semester

L	T	P	C
3	0	0	3

Data Base Management Systems

Course Objectives:

The main objectives of the course is to

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

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 dependency Lossless 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).



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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, 8th edition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, 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. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview



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II Year II Semester

L	T	P	C
3	0	0	3

Computer Organization & Architecture

Course Objectives:

The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems

Course Outcomes:

CO	Course Outcomes	Knowledge Level
CO1	Demonstrate an understanding of the basic operational concepts of computer and logic gates.	K1
CO2	Evaluate and learn different combinational circuits, sequential circuits and able to design them and learns basic structure of components register through language, micro operations and able to write micro programs	K1, K2
CO3	Determine and able to write data transfer and manipulators program and students able to learn microprogramme control and central processing unit	K3
CO4	Understand the functionalities of microprocessors and its operations and memory organization.	K1
CO5	Able to learn the internal organization of computers and able to evaluate performance of them.	K2

#based on suggested Revised BTL

Mapping of course outcomes with program outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3-High)

UNIT I:

Basic Structure Of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers.

Logic gates: Digital Logic gates, Two-level realizations using gates -- AND-OR, OR-AND, NAND-NAND and NOR-NOR

UNIT II:

Sequential circuits I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion of flip-flop to flip-flop, Race around condition, Master J-K flipflop

Register Transfer Language And Micro-operations: Register Transfer language. Register Transfer



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Bus and memory transfers, Arithmetic Micro-operations, Logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers, Computer instructions, Instruction cycle.

UNIT III:

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT IV:

Microprocessors: Evaluation of Microprocessors, CISC and RISC, Characteristics of Microprocessors

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Cache memories performance considerations, Virtual memories Introduction to Shift registers and RAID

UNIT V:

Input – Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input Output Processor, Serial Communication.

Text Books:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer Organization, 5th ed., Hamacher, Vranesic and Zaky, TMH, 2002
3. Computer System Architecture, 3/e, Moris Mano, Pearson/PHI.

Reference Books:

1. Computer System Organization & Architecture, John D. Carpinelli, Pearson, 2008
2. Computer System Organization, Naresh Jotwani, TMH, 2009
3. Computer Organization & Architecture: Designing for Performance, 7th ed., William Stallings, PHI, 2006
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.



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II Year II Semester

L	T	P	C
0	0	3	1.5

Machine Learning Lab

Course Objectives:

- To learn about computing central tendency measures and Data preprocessing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Software Required: Python/R/Weka

Lab should cover the concepts studied in the course work, sample list of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
 - a. Attribute selection
 - b. Handling Missing Values
 - c. Discretization
 - d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm



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II Year II Semester

L	T	P	C
0	0	3	1.5

Database Management Systems Lab

Course Objectives:

This Course will enable students to

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

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and dropping 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



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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



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II Year II Semester

L	T	P	C
0	1	2	2

Full Stack Development – 1
(Skill Enhancement Course)

Course Objectives:

The main objectives of the course are to

1. Make use of HTML elements and their attributes for designing static web pages
2. Build a web page by applying appropriate CSS styles to HTML elements
3. Experiment with JavaScript to develop dynamic web pages and validate forms

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists, Links and Images

- a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

- b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

- c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

- d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).



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- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, check boxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyper link. And also make sure of using “no frame” attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

- a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.
- b. Write a HTML program, to embed audio and video into HTML web page.
- c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

- a. Write a program to apply different types of selector forms
 - Simple selector (element, id, class, group, universal)
 - Combinator selector (descendant, child, adjacent sibling, general sibling)
 - Pseudo-class selector
 - Pseudo-element selector
 - Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
 - i. font-size ii. font-weight iii. font-style iv. text-decoration v. text-transformation
 - vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
 - i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

- a. Write a program to embed internal and external JavaScript in a web page.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.
- d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

- a. Write a program using document object properties and methods



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- b. Write a program using window object properties and methods.
- c. Write a program using array object properties and methods.
- d. Write a program using math object properties and methods.
- e. Write a program using string object properties and methods.
- f. Write a program using regex object properties and methods.
- g. Write a program using date object properties and methods.
- h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words “LARGER NUMBER” in an information message dialog. If the numbers are equal, output HTML text as “EQUAL NUMBERS”.
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an ‘ARMSTRONG NUMBER’ or not.
[Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e., $1^3 + 5^3 + 3^3 = 153$]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100’s, 50’s, 20’s, 10’s, 5’s, 2’s & 1’s. (Eg: If deposited amount is Rs.163, the output should be 1-100’s, 1-50’s, 1- 10’s, 1-2’s & 1-1’s)

9. Javascript Functions and Events

- a. Design a appropriate function should be called to display
 - Factorial of that number
 - Fibonacci series up to that number
 - Prime numbers up to that number
 - Is it palindrome or not
- b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
 - Factorial of that number
 - Fibonacci series up to that number
 - Prime numbers up to that number
 - Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
 - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
 - ii. Mobile (only numbers and length 10 digits)
 - iii. E-mail (should contain format like xxxxxxxx@xxxxxx.xxx)

Text Books:

- 1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
- 2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).



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3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasani Subramanian, 2nd edition, APress, O'Reilly

Web Links:

1. Infosys springboard*
2. <https://www.w3schools.com/html>
3. <https://www.w3schools.com/css>
4. <https://www.w3schools.com/js/>
5. <https://www.w3schools.com/nodejs>
6. <https://www.w3schools.com/typescript>



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II Year II Semester

L	T	P	C
1	0	2	2

Design Thinking & Innovation

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

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.



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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.

Text Books:

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

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



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KAKINADA – 533 003, Andhra Pradesh, India

B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B.Tech. – III Year I Semester

S.No	Category	Title	L	T	P	C
1	Professional Core	Information Retrieval Systems	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Elective-I	1. Software Engineering 2. Automata Theory & Compiler Design 3. Cloud Computing 4. Text Mining 5. Mining Massive Datasets 6. A minimum of 12 week MOOC Swayam/ NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective- I		3	0	0	3
6	Professional Core	Information Retrieval Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack Development -2 /SWAYAM Plus-Data Engineer/AI Engineer	0	1	2	2
9	Engineering Science	User Interface Design using Flutter / SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
10	Evaluation of Community Service Project Internship		-	-	-	2
Total			15	1	10	23
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	0	3
MC	Minor Course A minimum of 12 week, 3 credit course through SWAYAM / NPTEL		3	0	0	3
HC	Honor Course (Student may select from the same specialized honors pool)		3	0	0	3
HC	Honor Course A minimum of 12 week, 3 credit course through SWAYAM / NPTEL		3	0	0	3



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B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B.Tech.– III Year II Semester

S.No	Category	Title	L	T	P	Credits
1	Professional Core	Natural Language Processing	3	0	0	3
2	Professional Core	Deep Learning	3	0	0	3
3	Professional Core	Data Visualization	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodologies 2. Cryptography & Network Security 3. DevOps 4. Recommender Systems 5. Medical Image Analysis 6. A minimum of 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Mobile Adhoc & Sensor Networks 3. Computer Vision 4. NoSQL Databases 5. Time Series Analysis 6. A minimum of 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6	Open Elective - II		3	0	0	3
7	Professional Core	Deep Learning Lab	0	0	3	1.5
8	Professional Core	Data Visualization Lab	0	0	3	1.5
9	Skill Enhancementcourse	Soft skills / SWAYAM Plus - 21 st Century Employability Skills	0	1	2	2
10	Audit Course	Technical PaperWriting & IPR	2	0	0	-
Total			20	1	8	23
Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation						
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course A minimum of 12 week, 3 credit course through SWAYAM / NPTEL		3	0	0	3
HC	Honors Course (Student may select from the same specialized honors pool)		3	0	0	3
HC	Honors Course A minimum of 12 week, 3 credit course through SWAYAM / NPTEL		3	0	0	3

*Under Industry Internship interested students can pursue SWAYAM Plus courses viz, Hands on Masterclass on Data Analytics OR Artificial Intelligence for Real –World Applications.



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B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B. Tech. – IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Exploratory Data Analysis with Python	2	0	2	3
2	Management Course- II	Human Resource & Project Management	2	0	0	2
3	Professional Elective-IV	1. Responsible AI 2. Blockchain Technology 3. Quantum Computing 4. Robotic Process Automation 5. Social Media Analysis 6. Any of the Min 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile Methodologies 2. Big Data Analytics 3. Augmented Reality & Virtual Reality 4. High Performance Computing 5. Reinforcement Learning 6. Any of the Min12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Open Elective-III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	Prompt Engineering /SWAYAM Plus-Certificate Program in Prompt Engineering and ChatGPT	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Evaluation of Industry Internship / Mini Project		-	-	-	2
Total			19	1	02	21
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
HC	Honors Course (Student may select from the same honors pool)		3	0	0	3
HC	Honors Course through SWAYAM/NPTEL (minimum 12 week, 3 credit course)		3	0	0	3



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B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B. Tech.– IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

Note: Student need to do at least ONE MOOC/NPTEL Course (of 3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations); they are allowed to register one semester in advance



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B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

Minor Engineering

Note:

- 1. To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*
- 2. During Minor Course selection, there should not be any overlapping with Regular/Major/OPEN Electives*

Minor in CSE(AI&ML)

Any three of the following courses in offline mode.

- | | |
|--|-----------------------|
| 1. Artificial Intelligence | 3-0-0-3 |
| 2. Principles of Database Management Systems | 3-0-3-4.5 (Mandatory) |
| 3. Advanced Data Structures & Algorithm Analysis | 3-0-3-4.5 (Mandatory) |
| 4. Machine Learning | 3-0-0-3 |

Any two of the following a minimum of 12 Week 3 credit NPTEL MOOC Courses / Relevant courses

1. Artificial Intelligence: Knowledge Representation and Reasoning
2. Computer Networks and Internet Protocol
3. Machine Learning and Deep Learning - Fundamentals and Applications
4. Fundamentals of Object Oriented Programming



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B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

COURSES OFFERED FOR HONORS DEGREE IN CSE(AI&ML)

Note: 1. *To obtain Honor's degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*

2. *During Honors Course selection, there should not be any overlapping with Regular/Major/OPEN Electives*

Honor in CSE(AI&ML)

Any three of the following courses in offline mode:

1. Business Intelligence	3-0-0-3
2. Explainable AI	3-0-0-3
3. Generative AI	3-0-0-3
4. Agentic AI	3-0-0-3

Any three of the following a minimum of 12 Week 3 credit NPTEL MOOC Courses / Relevant Courses:

1. Applied Linear Algebra in AI & ML	12 Week 3 Credit Course, MOOCS
2. Privacy and Security in Online Social Media	12 Week 3 Credit Course, MOOCS
3. Reinforcement Learning	12 Week 3 Credit Course, MOOCS
4. GPU Architecture and Programming	12 Week 3 Credit Course, MOOCS
5. Quantum Algorithms and Cryptography	12 Week 3 Credit Course, MOOCS
6. Unmanned Aerial Systems & Robotics	12 Week 3 Credit Course, MOOCS



III B. Tech I Semester	INFORMATION RETRIEVAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of an Information Retrieval (IR) systems course are to equip students with the knowledge and skills to understand, design, and implement systems that efficiently retrieve relevant information from large datasets

Unit I:

Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

Unit II:

Inverted Files and Signature Files: Introduction, Structures used in Inverted Files, building an Inverted file using a sorted array, Modifications to the Basic Techniques.
Signature Files: Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

Unit III:

New Indices for Text, Lexical Analysis and Stoplists: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. Stoplists.

Unit IV:

Stemming Algorithms and Thesaurus Construction: Types of Stemming algorithms, Experimental Evaluations of Stemming, stemming to Compress Inverted Files.
Thesaurus Construction: Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

Unit V:

String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

Text Books:

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA, 2007.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.



III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives: The main objectives of this course are to

- Provide insight about networks, topologies, and the key concepts.
- Gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- Understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- Know the basic concepts of network services and various network applications.

UNIT I:

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II:

Data link layer: Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III:

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV:

The Network Layer Design Issues: Store and Forward Packet Switching, Services Provided to the Transport layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms: The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ, How networks can be connected, Tunneling, internetwork routing, Fragmentation, network layer in the internet.

UNIT –V:

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP



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.Introduction to Application Layer: Introduction, Client Server Programming, WWW and HTTP,FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Text Books:

1. Computer Networks, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate
2. Computer Networks, Mayank Dave, CENGAGE



III B. Tech I Semester	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives :

The main objectives of the course are to provide understanding the fundamental concepts, functions, and management techniques of operating systems

UNIT-I:

Operating Systems Overview: Introduction, operating system functions, operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, operating system Design and Implementation, operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT-II:

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT-III:

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT-IV:

Memory- Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement Allocation of frames, Thrashing Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT-V:

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin PB, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum AS, 4th Edition, Pearson, 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D. M Dhamdhare, 3rd Edition, McGraw- Hill, 2013



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Online Learning Resources:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>



III B. Tech I Semester	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

UNIT-I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT-II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT-III:

Software Design: Overview of the design process, characterize a good software design. Layered arrangement of modules, Cohesion and Coupling. approaches to software design. Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT-IV:

Coding and Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality Software quality management system, ISO9000. SEI Capability maturity model. Few other Important quality standards, and Six Sigma.



UNIT-V:

Computer-Aided Software Engineering (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: Reuse-definition, introduction, reason behind no reuses so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering- A Practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
- 3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview



III B.Tech I Semester	AUTOMATA THEORY & COMPILER DESIGN	L	T	P	C
		3	0	0	3

Prerequisites: Problem Solving through C

Course Objectives: The main objectives of this course are to

- Demonstrate the interplay between different models and formal languages.
- Employ finite state machines to solve problems in computing machines and their power to recognize the languages.
- Emphasize the concepts learnt in lexical analysis, syntax analysis, and semantic analysis.
- Demonstrate Intermediate code generation and type checking process through several programming exercises.
- Provide the understanding of language translation peculiarities by designing complete translator for mini language with code optimization and generation.

UNIT-I:

Languages, Regular Expressions and Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Languages, definitions, Regular Expressions, Regular Grammars, Acceptance of Strings and Languages, Finite Automaton Model, DFA, NFA, conversion of NFA to DFA, Conversion of Regular Expression to NF.

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.

Unit II:

Stages of Compilation and Lexical Analysis:Chomsky hierarchy of Languages, Phases of compilation overview, Pass, Phase, Interpretation, Bootstrapping.

Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex,

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

Unit III –Syntax Analysis:

Top Down Parsing: Introduction, Backtracking, Recursive Descent parsing, Predictive parsing, pre-processing steps for predictive processing, LL (1) Parsers.

Top Down Parsing: Bottom-up parsing and handle pruning, Structure of LR Parsers, LR (k) grammar parsing-SLR, CLR, LALR (k) grammars, Error Recovery in parsing, parsing ambiguous grammars, YACC parser generator.

Unit IV – Semantic Analysis and Data Structure Support :

Semantic Analysis: Intermediate source program forms – Abstract Syntax Tree, polish notation and 3 address code, Attribute Grammars, Syntax Directed Translation, Conversion of popular programming constructs into intermediate code forms, Inherited Grammars, Type Checking, Equivalence of type expressions.

Symbol Table Organization: Symbol table format, organization, Block structured languages, hashing, Block structure and non-block structure storage allocation: static, runtime and heap allocation for arrays, strings and records.



Unit V –Code Optimization and Code Generation:

Code Optimization: Consideration for optimization, Scope of optimization, Flow Graphs, Basic blocks, partitioning into basic blocks, Compile Time Evaluation.

Machine Independent Optimization: Common Sub expression elimination, dead code elimination, Strength Reduction, Code Movement, Loop Invariant Method, Loop Fusion, Loop Unrolling, Induction Variables and Reduction in Strength. Machine dependent Optimization: Peephole Optimization.

Code Generation: Absolute Code, Relocatable Machine Code, Assembler Code, Register and Address Descriptors, Implementing Global Register Allocation, Using DAG for register allocation, Simple Code generation Algorithm, Generic Code generation Algorithm, Generating code from DAG.

Text Books:

1. Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, 2nd Edition, Pearson.
3. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 2nd Edition, PHI.
4. Modern Compiler Construction in C, Andrew W. Appel, Cambridge University Press.

Reference Books:

1. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
3. lex&yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
4. Compiler Construction, Kenneth C. Loudon, Thomson. Course Technology.



III B. Tech I Semester	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives: The main objectives of this course are to

- Explain the evolving utility computing model called cloud computing.
- Introduce the various levels of services offered by cloud.
- Discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- Emphasize the security and other challenges in cloud computing.
- Introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

UNIT -I:

Introduction to Cloud Computing Fundamentals: Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II:

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III:

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV:

Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V:

Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.



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Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)



III B. Tech I Semester	TEXT MINING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of the course is to provide understanding of text mining techniques, applying them to real-world datasets, and developing the ability to analyze and interpret results

UNIT I:

Overview of Text Mining: Text Mining, Structured or Unstructured Data, Text Vs Numbers, Types of Problems Can Be Solved, Document Classification, Information Retrieval, Clustering and Organizing Documents, Information Extraction, Prediction and Evaluation.

From Textual Information to Numerical Vectors: Collecting Documents, Document Standardization, Tokenization, Lemmatization, Inflectional Stemming, Stemming to a Root, Vector Generation for Prediction, Multiword Features, Labels for the Right Answers, Feature Selection by Attribute Ranking, Sentence Boundary Determination, Part-Of-Speech Tagging, Word Sense Disambiguation, Phrase Recognition, Named Entity Recognition, Parsing, Feature Generation.

UNIT II:

Using Text for Prediction: Recognizing that Documents Fit a Pattern, Document Classification, Learning to Predict from Text, Similarity and Nearest-Neighbor Methods, Document Similarity, Decision Rules, How to Find the Best Decision Rules, Scoring by Probabilities, Linear Scoring Methods, How to Find the Best Scoring Model, Evaluation of Performance, Estimating Current and Future Performance, Getting the Most from a Learning Method.

Information Retrieval and Text Mining: Is Information Retrieval a Form of Text Mining, Key Word Search, Nearest-Neighbor Methods, Measuring Similarity, Shared Word Count, Word Count and Bonus, Cosine Similarity

UNIT III:

Link Analysis, Document Matching, Inverted Lists, Finding Structure in a Document Collection, Clustering Documents by Similarity, Similarity of Composite Documents, k-Means Clustering, Centroid Classifier, Hierarchical Clustering, The EM Algorithm, What Do a Cluster's Labels Mean, Applications.

UNIT IV:

Looking for Information in Documents: Goals of Information Extraction, Finding Patterns and Entities from Text, Entity Extraction as Sequential Tagging, Tag Prediction as Classification, The Maximum Entropy Method, Linguistic Features and Encoding, Sequential Probability Model, Coreference and Relationship Extraction, Coreference Resolution, Relationship Extraction, Template Filling and Database Construction, Information Retrieval, Commercial Extraction Systems, Criminal Justice, Intelligence

UNIT V:

Case Studies: Market Intelligence from the Web, Lightweight Document Matching for Digital Libraries, Generating Model Cases for Help Desk Applications, Assigning Topics to News Articles, E-mail Filtering, Search Engines, Extracting Named Entities from Documents.



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(Applicable from the academic year 2023-24 and onwards)

Text Books:

1. Text Mining Predictive Methods for Analyzing Unstructured Information, Sholom M. Weiss Nitin Indurkha Tong Zhang Fred J. Damerau, Springer.

Reference Books:

1. The Text Mining Handbook_ Advanced Approaches in Analyzing Unstructured Data, Ronen Feldman, James Sanger, Cambridge.



III B. Tech I Semester	MINING MASSIVE DATA SETS	L	T	P	C
		3	0	0	3

Course Objectives:

The Key objectives include understanding data mining principles, learning about parallel and stream processing algorithms, and gaining experience with tools and technologies like MapReduce and Spark

Unit I:

Data Mining: Introduction, Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction, Statistical Limits on Data Mining, Hash Functions, Indexes, Natural Logarithms, Power Laws.

Unit II:

Map Reduce and the New Software Stack: Distributed File Systems, Map Reduce, Algorithms Using MapReduce, Extensions to MapReduce, Complexity Theory for MapReduce

Unit III:

Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.

Unit IV:

Frequent Item sets: The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.

Unit V:

Clustering: Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces, and Clustering for Streams and Parallelism.

Dimensionality Reduction: Eigen values and Eigenvectors of Symmetric Matrices, Principal-Component Analysis, Singular-Value Decomposition, CUR Decomposition

Text Books:

1. Jure Leskovec, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Datasets", Stanford Press, 2011.
2. Jimmy Lin, Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan Claypool Publishers, 2010.

Reference Books:

1. Ron Bekkerman, Mikhail Bilenko, John Langford "Scaling Up Machine Learning: Parallel and Distributed Approaches", Cambridge University Press, 2012



III B. Tech I Semester	INFORMATION RETRIEVAL LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The main objectives of the course are to provide hands-on experimentation on various text pre-processing and mining algorithms,

Programming Language: Python/R

Lab Experiments:

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.
5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank
8. Implement Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network.



III B. Tech I Semester	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The main objectives of this course are to implement the basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a C Program to implement the data link layer framing methods such as
 - i) Character stuffing
 - ii) bit stuffing.
3. Write a C Program to implement data link layer framing method checksum.
4. Write a C Program for Hamming Code generation for error detection and correction.
5. Write a C Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a C Program to implement Sliding window protocol for Goback N.
7. Write a C Program to implement Sliding window protocol for Selective repeat.
8. Write a C Program to implement Stop and Wait Protocol.
9. Write a C Program for congestion control using leaky bucket algorithm
10. Write a C Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11. Write a C Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Wireshark
 - i. Packet Capture Using Wire shark
 - ii. Starting Wire shark
 - iii. Viewing Captured Traffic
 - iv. Analysis and Statistics & Filters.
13. How to run Nmap scan
14. Operating System Detection using Nmap
15. Do the following using NS2 Simulator
 - i. NS2 Simulator-Introduction
 - ii. Simulate to Find the Number of Packets Dropped
 - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
 - iv. Simulate to Find the Number of Packets Dropped due to Congestion
 - v. Simulate to Compare Data Rate& Throughput.



III B. Tech I Semester	FULL STACK DEVELOPMENT- 2	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Make use of router, template engine and authentication using sessions to develop application in ExpressJS.
- Build a single page application using RESTful APIs in ExpressJS
- Apply router and hooks in designing ReactJS application
- Make use of MongoDB queries to perform CRUD operations on document database

Experiments covering the Topics:

- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
- ReactJS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
- ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

Sample Experiments:

1. ExpressJS – Routing, HTTP Methods, Middleware.

- a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
- b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
- c. Write a program to show the working of middleware.

2. ExpressJS – Templating, Form Data

- a. Write a program using templating engine.
- b. Write a program to work with form data.

3. ExpressJS – Cookies, Sessions, Authentication

- a. Write a program for session management using cookies and sessions.
- b. Write a program for user authentication.

4. ExpressJS – Database, RESTful APIs

- a. Write a program to connect MongoDB database using Mongoose and perform CRUD operations.
- b. Write a program to develop a single page application using RESTful APIs.

5. ReactJS – Render HTML, JSX, Components – function & Class

- a. Write a program to render HTML to a web page.
- b. Write a program for writing markup with JSX.
- c. Write a program for creating and nesting components (function and class).



6. ReactJS – Props and States, Styles, Respond to Events

- Write a program to work with props and states.
- Write a program to add styles (CSS & Sass Styling) and display data.
- Write a program for responding to events.

7. ReactJS – Conditional Rendering, Rendering Lists, React Forms

- Write a program for conditional rendering.
- Write a program for rendering lists.
- Write a program for working with different form fields using react forms.

8. ReactJS – React Router, Updating the Screen

- Write a program for routing to different pages using react router.
- Write a program for updating the screen.

9. ReactJS – Hooks, Sharing data between Components

- Write a program to understand the importance of using hooks.
- Write a program for sharing data between components.

10. MongoDB – Installation, Configuration, CRUD operations

- Install MongoDB and configure ATLAS
- Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

11. MongoDB – Databases, Collections and Records

- Write MongoDB queries to Create and drop databases and collections.
- Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

12. Augmented Programs: (Any 2 must be completed)

- Design a to-do list application using NodeJS and ExpressJS.
- Design a Quiz app using ReactJS.
- Complete the MongoDB certification from MongoDB University website.

Text Books:

- Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
- Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
- React Quickly, AzatMardan, Manning Publications (Chapters 1-8, 12-14)

Web Links:

- ExpressJS - <https://www.tutorialspoint.com/expressjs>
- ReactJS - <https://www.w3schools.com/REACT> (and) <https://react.dev/learn#>
- MongoDB - <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>



III Year I Semester	USER INTERFACE DESIGN USING FLUTTER	L	T	P	C
		0	0	2	1

Course Objectives: The main objectives of this course are to

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widgets and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

List of Experiments:

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.
5. a) Learn about stateful and stateless widgets.
b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
b) Use Flutter's debugging tools to identify and fix issues.

Text Books:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.



III B. Tech II Semester	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives: This course introduces the fundamental concepts and techniques of natural language processing (NLP), computational properties of natural languages and the commonly used algorithms for processing linguistic information.

UNIT I:

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II:

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff, Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.

UNIT III:

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

UNIT IV:

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.

UNIT V:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence–Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin - Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.

Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese,



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

B. Tech CSE (AI&ML) (R23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

OReillyMedia,2015.

3. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press,2008



III B. Tech II Semester	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives: The main objective of the course is to make students:

- Understand the concept of CNN and transfer learning techniques, to apply it in the classification problems
- Use RNN for language modeling and time series prediction.
- Use auto encoder and deep generative models to solve problems with high dimensional data including text, image and speech

UNIT I:

Introduction and Overview: Course Overview and Motivation; Introduction to Image Formation, Capture and Representation; Linear Filtering, Correlation, Convolution.

Visual Features and Representations: Edge, Blobs, Corner Detection; Scale Space and Scale Selection; SIFT, SURF; HoG, LBP, etc.

Visual Matching: Bag-of-words, VLAD; RANSAC, Hough transform; Pyramid Matching; Optical Flow

UNIT II:

Deep Learning Review: Review of Deep Learning, Multi-layer Perceptrons, Backpropagation

Convolutional Neural Networks (CNNs): Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG, InceptionNets, ResNets, DenseNets.

Visualization and Understanding CNNs: Visualization of Kernels; Backprop-to-image/Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM, Grad-CAM, Grad-CAM++; Recent Methods (IG, Segment-IG, SmoothGrad)

UNIT III:

CNNs for Recognition, Verification, Detection, Segmentation: CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, SSD, RetinaNet; CNNs for Segmentation: FCN, SegNet, U-Net, Mask-RCNN

UNIT IV:

Recurrent Neural Networks(RNNs): Review of RNNs; CNN + RNN Models for Video Understanding: Spatio-temporal Models, Action/Activity Recognition

Attention Models: Introduction to Attention Models in Vision; Vision and Language: Image Captioning, Visual QA, Visual Dialog; Spatial Transformers; Transformer Networks

UNIT V:

Deep Generative Models: Review of (Popular) Deep Generative Models: GANs, VAEs; Other Generative Models: PixelRNNs, NADE, Normalizing Flows, etc

Recent Trends: Zero-shot, One-shot, Few-shot Learning; Self-supervised Learning; Reinforcement Learning in Vision; Other Recent Topics and Applications

Text Books:

1. Deep Learning- Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press, 2017
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433



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(Applicable from the academic year 2023-24 and onwards)

3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G., H., and Van Loan, C., F, JHU Press, 2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

Web Link:

1. Swayam NPTEL: Deep Learning:
https://onlinecourses.nptel.ac.in/noc22_cs22/preview



III B. Tech II Semester	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

Course Objective:

The main objectives of the course are to familiarize students with the basic and advanced techniques of information visualization & scientific visualization, key techniques of the visualization process, detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

UNIT-1:

Introduction: Visualization, History of Visualization, Relationship between Visualization and Other Fields, the Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

UNIT-II:

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

UNIT-III:

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT-IV:

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

UNIT-V:

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Text Book:

1. Ward, Grinstein, Keim. Interactive Data Visualization: Foundations, Techniques and Applications. Natick : A K Peters, Ltd.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

Resources:

1. https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf



III B. Tech II Semester	SOFTWARE TESTING METHODOLOGIES	L	T	P	C
		3	0	0	3

Course Objective: The main objectives of the course are to

- Provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- Develop skills in software test automation and management using the latest tools.

UNIT - I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT - V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/ selenium/ soapUI/ Catalon).

Text Books:

1. Software Testing techniques – BarisBeizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

Reference Books:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.



III B. Tech II Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNIT II:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography-algebraic structures, $GF(2^n)$ Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES.

UNIT III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNIT IV:

Data Integrity, Digital Signature Schemes & Key Management : Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNIT V:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer: IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill, 2015
2. Cryptography and Network Security, 4th Edition, William Stallings, (6e) Pearson, 2006
3. Everyday Cryptography, 1st Edition, Keith M. Martin, Oxford, 2016

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning, 2018



III B. Tech II Semester	DEVOPS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

UNIT-I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT-II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT-III

Build Automation - Continuous Integration (CI): Build Automation, What is CI, Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), Jenkins workflow, Jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT-IV

Continuous Delivery (CD): Importance of Continuous Delivery, Continuous Deployment Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT-V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

Containerization Using Kubernetes(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.



Text Books:

1. Joyner, Joseph, DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and It Professionals, 1st Edition MihailsKonoplow, 2015.
2. Alisson Machado de Menezes, Hands-on DevOps with Linux, 1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952



III B. Tech II Semester	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

This course covers the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences

UNIT-I:

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT-II:

Collaborative Filtering: User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

UNIT-III:

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT-IV:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT-V:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

Reference Books:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.



III B. Tech II Semester	MEDICAL IMAGE ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Develop skills in using machine learning and deep learning for medical image analysis.
- Explore applications of medical image data analysis in diagnosis and research.

Unit I:

Introduction to Medical Image Data: Characteristics of Medical Image Data, Modalities in Medical Imaging (X-ray, CT, MRI, PET, etc.), Challenges in Medical Image Analysis, Overview of Image Data Acquisition in Healthcare

Unit II:

Preprocessing and Enhancement in Medical Imaging: Image Denoising and Filtering Techniques, Contrast Enhancement Methods, Registration and Fusion of Medical Images, Artifact Correction in Medical Images

Unit III:

Machine Learning in Medical Image Analysis: Overview of Machine Learning in Healthcare, Feature Extraction from Medical Images, Classification and Regression Models for Medical Image Analysis, Evaluation Metrics in Medical Image Classification

Unit IV:

Deep Learning for Medical Image Analysis: Convolutional Neural Networks (CNNs) for Image Analysis, Transfer Learning in Medical Imaging, Generative Adversarial Networks (GANs) for Medical Image Synthesis, Explainability and Interpretability in Deep Learning Models

Unit V: Applications and Challenges

Disease Diagnosis and Prediction from Medical Images, Computer-Aided Diagnosis (CAD), Image Segmentation in Medical Imaging, Challenges and Ethical Considerations in Medical Image Analysis

Text Books:

1. Medical Image Analysis, Y Alejandro Frangi, Jerry Prince, Milan Sonka
2. Deep Learning for Medical Image Analysis, S. Kevin Zhou

Reference Books:

1. Handbook of Medical Image Processing and Analysis, Isaac N. Bankman



III B. Tech II Semester	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of the course is to

- Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- Compare and differentiate organization structures and project structures
- Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT- IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

UNIT-V:

Agile Methodology, ADAPTING to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps:** Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes



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Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.
5. Project Management in IT, Kathy Schwalbe, Cengage



III B .Tech II Semester	MOBILE ADHOC & SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to

- Describe the Architecture sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Introduce the fundamental concepts of wireless sensor networks and basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks

UNIT I:

Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II:

Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III:

Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV:

Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V: Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems-TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language**-TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

- 1.Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
- 2.Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications / Cambridge University Press, March 2006



Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition, *Charles E. Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng*, Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010



III B. Tech II Semester	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of the course are to introduce the Fundamental Concepts related to sources, shadows and shading and the Geometry of Multiple Views.

UNIT –I:

CAMERAS: Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II:

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III:

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV:

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT- V:

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth, Jean Ponce, “Computer Vision – A Modern Approach”, PHI Learning (Indian Edition), 2009.



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Reference Books:

1. E. R. Davies, “Computer and Machine Vision – Theory, Algorithms and Practicalities”, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez, R. E. Woods, “Digital Image Processing”, Addison Wesley, 2008.
3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer, Verlag London Limited, 2011.



III B. Tech II Semester	NOSQL DATABASES	L	T	P	C
		3	0	0	3

Course Objective:

The main objective of this course is to equip individuals with the knowledge and skills to design, manage, and optimize these databases for modern applications

UNIT-I:

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT-II:

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, Map Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT-III:

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT-IV:

Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT-V:

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text Books:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019.

Web References:

1. <https://www.ibm.com/cloud/learn/nosql-databases>



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2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>



III B. Tech II Semester	TIME SERIES ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives: The main objective of the course is to introduce a variety of statistical models for time series and cover the main methods for analyzing these models

Unit I:

Introduction Of Timeseries Analysis: Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series. Models for time series analysis, Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting, Forecasting Process, Data for forecasting, Resources for forecasting

Unit II:

Statistics Background For Forecasting: Graphical Displays, Time Series Plots, Plotting Smoothed Data, Numerical Description of Time Series Data, Use of Data Transformations and Adjustments, General Approach to Time Series Modeling and Forecasting, Evaluating and Monitoring Forecasting Model Performance.

Unit III:

Time Series Regression Model: Introduction Least Squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Prediction of New Observations, Model Adequacy Checking, Variable Selection Methods in Regression, Generalized and Weighted Least Squares, Regression Models for General Time Series Data, Exponential Smoothing, First order and Second order

Unit IV:

Autoregressive Integrated Moving Average (Arima)Models: Autoregressive Moving Average (ARMA) Models, Stationarity and Invertibility of ARMA Models, Checking for Stationarity using Variogram, Detecting Nonstationarity, Autoregressive Integrated Moving Average (ARIMA) Models, Forecasting using ARIMA, Seasonal Data, Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction, Finding the “BEST” Model.

Example: Internet Users Data Model Selection Criteria, Impulse Response Function to Study the Differences in Models Comparing Impulse Response Functions for Competing Models .

Unit V:

Multivariate Time Series Models And Forecasting: Multivariate Time Series Models and Forecasting, Multivariate Stationary Process, Vector ARIMA Models, Vector AR (VAR) Models, Neural Networks and Forecasting Spectral Analysis, Bayesian Methods in Forecasting.

Text Books:

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)
2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek PalDr. PksPrakash (2017)



III B. Tech II Semester	DEEP LEARNING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The main objective of the course is to equip students with practical skills in building and applying deep learning models

Software Packages required:

- Keras
- Tensorflow
- PyTorch

List of Experiments:

1. Implement multi-layer perceptron algorithm for MNIST Handwritten Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Handwritten Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7. Use a pre-trained convolutional neural network (VGG16) for image classification.
8. Implement one-hot encoding of words or characters.
9. Implement word embedding's for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books:

1. Reza Zadeh and Bharath Ram sundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

References:

1. <https://github.com/fchollet/deep-learning-with-python-notebooks>



III B. Tech II Semester	DATA VISUALIZATION LAB	L	T	P	C
		0	0	3	1.5

Course Objective: The main objectives of the course are to

- Visualize the different datasets using histograms, line charts, the use of bar charts and box plots, Scatter plots, mosaic plots, different Map visualizations
- Implement advanced graphs such as correlogram, heatmap and 3D graphs.

List of Experiments:

1. a) Load VADeaths(Death Rates in Virginia)dataset in R and visualize the data using different histograms.
b) Load air quality dataset in R and visualize La Guardia Airport's dialy maximum temperature using histogram.
2. Load AirPassengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.
3. a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots.
b)Load air quality dataset in R and visualize ozone concentration in air.
4. a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species.
b) Load air quality dataset in R and visualize air quality parameters using box plots.
5. Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other.
6. Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette then use the
7. Load HairEyeColor dataset in R and plot categorical data using mosaic plot.
8. Load mtcars dataset in R and visualize data using heat map.
9. Install leaflet library in R and perform different map visualizations.
10. Visualize iris dataset using 3d graphs such as scatter3d, cloud, xyplot.
11. Make use of correlogram to visualize data in correlation matrices for iris dataset.
12. Install maps library in R and draw different map visualizations.

Web References:

1. <https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/>
2. <https://www.geeksforgeeks.org/data-visualization-in-r/>



III B. Tech II Semester	SOFT SKILLS	L	T	P	C
		0	1	2	2

Course Objective: The main objectives of the course are to

- Equip the students with the skills to effectively communicate in English
- Train the students in interview skills, group discussions and presentation skills
- Motivate the students to develop confidence, Enhance the students' interpersonal skills and Improve the students' writing skills

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

Reference books:

1. R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018.
2. Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01



III Year II Semester	TECHNICAL PAPER WRITING & IPR	L	T	P	C
		2	0	0	-

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries.

Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV:

Using word processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of

Patenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, “Fundamentals of IPR for Beginner’s”, 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, “Technical Communication: A Practical Approach”, Pearson.
3. Ramappa, T., “Intellectual Property Rights Under WTO”, 2nd Ed., S Chand, 2015.

Reference Books:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)



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E-resources:

1. <https://www.udemy.com/course/reportwriting/>
2. <https://www.udemy.com/course/professional-business-english-and-technical-report-writing/>
3. <https://www.udemy.com/course/betterbusinesswriting/>



IV B. Tech I Semester	EXPLORATORY DATA ANALYSIS WITH PYTHON	L	T	P	C
		2	0	2	3

Course Objectives: The main objectives of the course are to

- Introduce the fundamentals of Exploratory Data Analysis, essential exploratory techniques for understanding multivariate data and summarizing it through statistical methods and graphical methods.
- 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 data frames, 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 of dispersion, 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 stats models 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.
3. 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.

Reference Books:

1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020
2. RadhikaDatar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st 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-dataanalysis-eda-using-python/#h-conclusion>
3. <https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook>



IV Year I Semester	HUMAN RESOURCES & PROJECT MANAGEMENT	L	T	P	C
		2	0	0	2

Course Objectives: The main objectives of the course are to

- Provide knowledge about HR planning, recruitment, selection, and job design.
- Develop skills in managing HR functions such as performance appraisal, compensation, and employee relations.
- Emphasize the importance of ethical practices and HR audits in maintaining organizational health.
- Understand the HRD framework and its impact on organizational success.
- Improve group interaction and team dynamics for better collaboration and performance.
- Understand the Fundamentals of Project Management and Project Networks
- Implement appropriate management strategies tailored to specific challenges in different project types.

UNIT –I:

HRM: Nature, Scope, Concept of HRM, Functions of HRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR, Job Design, Recruitment, Sources of recruitment, Selection-Selection Procedure.

UNIT –II:

HRD, HR accounting, Models, Concept of Training and Development, Methods of Training. Performance Appraisal: Importance Methods of performance appraisal, Career Development and Counseling, group interaction.

UNIT –III:

Basics of Project Management, Concept, resource management, Project environment, Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring project progress, Project appraisal and Project selection, 80-20 rules, production technology, communication matrix

UNIT-IV:

Identify various project types and their unique management challenges and apply appropriate management strategies for each. Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

UNIT-V:

Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

Text Books:

1. Robert L. Mathis, John H. Jackson, ManasRanjanTripathy, Human Resource Management, Cengage Learning 2016.
2. Sharon Pande and SwapnalekhaBasak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.
3. Stewart R. Clegg, TorgeirSkyttermoen, Anne Live Vaagaasar, Project Management,



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Sage Publications, 1e, 2021.

4. K. Nagarajan, Project Management, New Age International Publishers, 8e, 2017.

Reference Books :

1. Subba Rao P, “Personnel and Human Resource Management-Text and Cases”, Himalaya Publications, Mumbai, 2013.
2. K Aswathappa, “Human Resource and Personnel Management”, Tata McGraw Hill, New Delhi, 2013.
3. Prasanna Chandra, “Projects, Planning, Analysis, Selection, Financing, Implementation and Review”, Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
4. Vasanth Desai, “Project Management”, 4th edition, Himalaya Publications, 2018.
5. LalithaBalakrishnan, Gowri, “Project Management”, Himalaya publishing house, New Delhi, 2022.



IV Year I Semester	RESPONSIBLE AI	L	T	P	C
		3	0	0	3

Course Objective:

The main objectives of the course are to introduce AI basics, misconceptions, responsible AI principles, challenges in implementation, biases in AI, fairness metrics, mitigation techniques, explainability, challenges, methods, and evaluation for interpretable machine learning models.

UNIT-I:

Introduction to Responsible AI: Overview of AI, Common misconception of AI, Introduction to Responsible AI, Characteristics of Responsible AI, Key principles of responsible AI, Challenges in implementing responsible AI, ELSI. Framework and AI, Safety and Alignment, Fairness and Privacy.

UNIT-II:

Fairness and Bias: Human Bias, Types of biases, Effects of biases on different demographics, Bias vs Fairness, Sources of Biases, Exploratory data analysis, Bias Mitigation Techniques, Pre-processing techniques, In- processing techniques, Post-processing techniques, Bias detection tools, Overview of fairness in AI, Demographic parity, Equalized odds, Simpson's paradox and the risks of multiple testing, Group fairness and Individual fairness, Counterfactual fairness, Fairness metrics, Bias and disparity mitigation with Fairlearn.

UNIT-III:

Explainability& Interpretability: Importance of Explainability and Interpretability, Challenges, Interpretability through simplification and visualization, Intrinsic interpretable methods, Post Hoc interpretability, Interpretability Evaluation methods, Explainability through causality, Model agnostic Interpretation, LIME (Local Interpretable Model-agnostic Explanations), SHAP (SHapley Additive exPlanations).

UNIT-IV:

Safety, Security and Privacy: Overview of safety, security, privacy, resilience, Taxonomy of AI safety and Security, Adversarial attacks and mitigation, Model and data security, The ML life cycle, Adopting an ML life cycle MLOps and ModelOps, Model drift, Data drift, Concept drift, Privacy-preserving AI techniques, Differential privacy, Federated learning.

UNIT-V:

Case Studies : COMPAS Algorithm, Google Photos Tagging Controversy, ProPublica's Analysis of Recidivism Predictions, Amazon's AI Recruiting Tool, Facial Recognition Technology Misidentification, AI in Healthcare: Predictive Analytics in Patient Care, Tesla Autopilot and Ethical Implications of Autonomous Vehicles.

Text Books:

1. Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", 2019.
2. Adnan Masood, Heather Dawe, "Responsible AI in the Enterprise", 2023.
3. BeenaAmmanath, "Trustworthy AI", O' Reilly, 2022.
4. Christoph Molnar "Interpretable Machine Learning", 1st edition, 2019.



IV Year I Semester	BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of the course are to

- Describe the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- Understand public block chain system, Private block chain system and consortium block chain.
- Introduce the security issues of blockchain technology.

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, EthereumBlockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:

Case Study 1 – Retail,

Case Study 2 – Banking and Financial Services,



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Case Study 3 – Healthcare,

Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. “Blockchain Technology”, Chandramouli Subramanian, Asha A.George, Abhilasj K A, MeenaKarthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPDOreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson Addition Wesley



IV Year I Semester	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

UNIT - I

Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations, Hilbert space, Probabilities and measurements, Superposition, Entanglement, No cloning theorem, density operators and other quantum mechanical principles.

UNIT - II

Qubit: Quantum unit of information and its physical implementations. Bloch Sphere concept, Quantum Gates and Circuits: single qubit gates, multiple qubit gates, Bell states, design of basic quantum circuits.

UNIT - III

Quantum Algorithms: Realization of classical computation on quantum computers and simulator. Classical and quantum complexity theory. Quantum Parallelism, Quantum amplitude amplification, Quantum Phase Estimation methods.

UNIT - IV

Quantum Algorithms: Deutsch's and Deutsch's-Jozsa algorithm, Grover's Search Algorithm, Simon's Algorithm, Bernstein-Vazirani Algorithm, Shor's Factorization Algorithm.

UNIT - V

Quantum Information & Cryptography: Comparison between classical and quantum information theory. Super dense coding protocol, Quantum teleportation, Quantum Cryptography, Quantum Key Distribution - BB84, Ekert 91 Protocol.

Text Books:

1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge
2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nick Harrigan, Mercedes Gimeno, Segovia, Oreilly

Reference Books:

1. Quantum Computing for Computer Scientists, Noson S. Yanofsky, Mirco A. Mannucci
2. Principles of Quantum Computation and Information, Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms



IV Year I Semester	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of the course is to equip learners with the knowledge and skills to automate repetitive, rule-based tasks using software robots

UNIT-I:

Introduction To Robotic Process Automation: Scope and techniques of automation, Robotic process automation, What can RPA do, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

RPA Basics: History of Automation, RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control, flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.

UNIT-II :

RPA Tool Introduction and Basics: Introduction to RPA Tool, The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation: Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data

UNIT-III :

Advanced Automation Concepts & Techniques: Recording Introduction, Basic and Desktop Recording, Web Recording, Input/Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data, Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.

UNIT-IV :

Handling User Events & Assistant Bots, Exception Handling: What are assistant bots, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event.

Exception Handling: Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.



UNIT-V:

Deploying and Maintaining The Bot: Publishing using publish utility, Creation of Server, Using Server to control the bots, Creating a provision Robot from the Server, Connecting a Robot to Server, Deploy the Robot to Server, Publishing and managing updates, Managing packages, Uploading packages, Deleting packages

Text Books:

1. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018.

Reference Books:

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, “Introduction to Robotic Process Automation: a Primer”, Institute of Robotic Process Automation, 1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant”, Independently Published, 1st Edition 2018.
3. Srikanth Merianda, ”Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation”, Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018.

Web References:

1. <https://www.uipath.com/rpa/robotic-process-automation>
2. <https://www.academy.uipath.com>



IV Year I Semester	SOCIAL MEDIA ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of this course is to provide knowledge on social media and its analytics Course

Unit I:

Introduction To Social Media World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, Core Characteristics Of Social Media, Types Of Social Media, Social Networking Sites, Using Facebook For Business Purposes, Content Communities

Unit- II:

Social Media Analytics Overview Purpose Of Social Media Analytics, Social Media Vs. Traditional Business Analytics, Seven Layers Of Social Media Analytics, Types Of Social Media Analytics, Social Media Analytics Cycle, Challenges To Social Media Analytics, Social Media Analytics Tools. Case Study: The Underground Campaign That Scored Big

Unit III:

Social Media Text Analytics Types Of Social Media Text, Purpose Of Text Analytics, Steps In Text Analytics, Social Media Text Analysis Tools. Case Study: Tapping Into Online Customer Opinions

Unit IV:

Social Media Actions Analytics Introduction To Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group

Unit V:

Social Media Hyperlink Analytics Types Of Hyperlinks, Hyperlink Analytics, Types Of Hyperlink Analytics, Hyperlink Analytics Tools. Case Study: Hyperlinks And Viral YouTube Videos

Text Books:

1. Seven Layers Of Social Media Analytics Mining Business Insights From Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data By Gohar F. Khan Isbn: 1507823207, Isbn-13: 9781507823200

Reference Books:

1. Social Media Analytics: Techniques And Insights For Extracting Business Value Out Of Social Media By Matthew Ganis, Avinash Kohirkar, Pearson Education.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3. Big Data And Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications.
4. Big Data, Black Book tm , Dreamtech Press, 2015 Edition.



IV Year I Semester	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to

- Introduce the important concepts of Agile software development Process
- Emphasize the role of stand-up meetings in software collaboration
- Impart the knowledge on values and principles in understanding agility

UNIT I :

Learning Agile: Agile, Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue. A fractured perspective, The Agile Manifesto, Understanding the Elephant, Where to Start with a New Methodology.

UNIT II :

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Project Execution—Moving the Project Along, Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

UNIT III :

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum, Everyone on a Scrum Team owns the Project, Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, Sprinting into a Wall, Sprints, Planning, and Retrospectives.

Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Victory Lap, Scrum Values Revisited.

UNIT IV :

XP And Embracing Change: Going into Overtime, The Primary Practices of XP, The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, An Effective Mindset Starts with the XP Values, The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change.

XP, Simplicity, and Incremental Design: Code and Design, Make Code and Design Decisions at the Last Responsible Moment, Final Score.

UNIT V:

Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Creating Heroes and Magical Thinking. Eliminate Waste, Gain a Deeper Understanding of the Product, Deliver As Fast As Possible.

Kanban, Flow, and Constantly Improving: The Principles of Kanban, Improving Your Process with Kanban, Measure and Manage Flow, Emergent Behavior with Kanban.

The Agile Coach: Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

Text Books :

1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.



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Reference Books:

1. Andrew Stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A Practical Guide To The Most Popular Agile Process, Addison-Wesley, 2013



IV Year I Semester	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives: This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics

UNIT I:

Big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II:

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III:

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV:

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT V:

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.



Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj, 1st edition ,2013
2. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018-first Edition.
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, First edition-2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, First Edition -2012.
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012.
3. "HBase: The Definitive Guide", O'Reilley, Lars George, September 2011: First Edition..
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010.
5. "Programming Pig", O'Reilley, Alan Gates, October 2011: First Edition



IV Year I Semester	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Objectives: The objectives of the course are to

- Provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts.
- Give historical and modern overviews and perspectives on virtual reality.

UNIT – I:

Introduction to Augmented Reality: Augmented Reality, Defining augmented reality, history of augmented reality, Examples, Related fields

Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays

Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT – II:

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT – III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception

The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations

Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

UNIT – IV:

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

Visual Perception: Visual Perception - Perception of Depth, Perception of Motion,

Perception of Color Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT – V:

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

Interaction: Motor Programs and Remapping, Locomotion, Social Interaction

Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Text Books:

1. “Augmented Reality: Principles & Practice”, Schmalstieg, Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016



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Reference Books:

1. “AR Game Development”, Allan Fowler, 1st Edition, Apress Publications, 2018, ISBN 978-1484236178
2. “Understanding Virtual Reality: Interface, Application and Design”, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. “Developing Virtual Reality Applications: Foundations of Effective Design”, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. “Designing for Mixed Reality”, Kharis O'Connell, O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. “Theory and applications of marker-based augmented reality”, SanniSiltanen, Julkaisija, Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. “Designing Virtual Systems: The Structured Approach”, Gerard Jounghyun Kim, 2005



IV Year I Semester	HIGH PERFORMANCE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to study parallel computing hardware and programming models, performance analysis and modeling of parallel programs

Unit I:

Introduction:

Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.

Unit II:

Parallel Programming :

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.

Unit III:

Basic Communication:

Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations. Programming shared address space platforms: threads- basics, synchronization, OpenMP programming

Unit IV:

Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: MatrixVectorMultiplication, Matrix-Matrix Multiplication.

Unit V:

Parallel Algorithms- Sorting and Graph : Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel BestFirst Search.

CUDA Architecture :CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.

Text Books:

1. AnanthGramma, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3



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Reference Books :

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann, 1999, ISBN 978-1-55860-343-1
4. Rod Stephens, "Essential Algorithms", Wiley, ISBN: 978-1-118-61210-1



IV Year I Semester	Reinforcement Learning	L	T	P	C
		3	0	0	3

Course Objective:

The main objective of the course is to provide the fundamentals of Reinforcement learning and its applications.

UNIT-I

The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, Summary, History of Reinforcement Learning.

UNIT-II

Multi-arm Bandits: An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

UNIT-III

Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

UNIT-IV

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns

UNIT-V

Applications and Case Studies: TD-Gammon, Samuel’s Checkers Player, The Acrobot, Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling.

Text Books:

1. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning-An Introduction”, 2nd Edition, The MIT Press, 2018
2. Marco Wiering, Martijn van Otterlo Reinforcement Learning: State-of-the-Art (Adaptation, Learning, and Optimization (12)) 2012th Edition

Reference Books:

1. Vincent François-Lavet, Peter Henderson, Riashat Islam, An Introduction to Deep Reinforcement Learning (Foundations and Trends(r) in Machine Learning), 2019



IV Year I Semester	PROMPT ENGINEERING (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Apply iterative prompting for clarity and context.
- Create varied prompts to steer model outputs.
- Construct chain-of-thought and structured prompts.
- Develop retrieval-augmented pipelines to ground outputs.
- Evaluate LLM agents and multimodal apps for ethics and robustness.

Unit I: Foundations of Prompt Engineering: Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design, Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

Lab Experiments:

1. Environment & Connectivity: Install required packages (e.g., transformers, openai); securely configure the API key; run a simple “Hello, world” prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt (“Write a one-paragraph bio of Ada Lovelace.”) and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. Iterative Refinement on a Simple Task: Summarize the plot of the Shakespearean play Romeo and Juliet in two sentences through three rounds of prompt tweaking:
 - a. Minimal instruction.
 - b. Addition of length and style constraints
 - c. Specification of key content elements (setting and theme)Document how each iteration changes and improves the result.
4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

Unit II: Advanced Prompt Patterns & Techniques: Enhanced prompt anatomy: contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization

Lab Experiments:

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment classification or translation); compare outputs for accuracy, consistency, and adherence to examples.
2. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., “You are a financial advisor...”); then create a negative prompt to



suppress undesired content (e.g., “Do not mention any brand names”); evaluate how each influences the model’s response.

3. **Constraint Specification & Iterative Refinement:** Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

Unit III: Structured Output & Reasoning Techniques: Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown), Generating valid JSON and YAML via explicit instructions, Eliciting chain-of-thought reasoning in zero-shot prompts, Decomposing complex tasks into manageable sub-tasks

Lab Experiments:

1. **Structured Format Prompting:** Instruct the model to output information as bullet lists and Markdown tables (e.g., “List three benefits of daily exercise in a Markdown table with columns ‘Benefit’ and ‘Description.’”); verify the output matches the requested structure.
2. **JSON/YAML Generation:** Provide a brief dataset description (e.g., three books with title, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. **Chain-of-Thought & Task Decomposition:** Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., “Let’s think step by step. Explain your reasoning before the final answer.”); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

Unit IV: Retrieval-Augmented Generation & LangChain Workflows: Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with LangChain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval-generation pipeline with an LCEL chain

Lab Experiments:

1. **Building a Simple LCEL Chain:** Create a minimal LCEL script that accepts a fixed instruction (e.g., “Summarize this text: ...”), passes it to an LLM, and prints the result; verify end-to-end execution.
2. **Basic Data Indexing for RAG:** Load a small collection of documents; split into uniform chunks (e.g., 200 tokens); generate embeddings for each chunk; store them in an in-memory vector store; inspect for consistency.
3. **Constructing & Running a Basic RAG Chain:** Build a pipeline that:
 - a. Receives a user query
 - b. Retrieves the top-k relevant chunks
 - c. Constructs a combined prompt with context + query
 - d. Send it to the LLM
 - e. Returns the answer

Test with sample queries and compare factual accuracy against a prompt without retrieval.

Unit V: Agents, Multimodal AI & Ethical Evaluation: Introduction to LLM agents and their basic architecture, Overview of multimodal AI models (VLMs), Prompting for text-to-



image generation and image understanding, Importance of prompt evaluation beyond subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to “LLM-as-Judge” for automated evaluation, Security considerations (prompt injection, sensitive-information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit/Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning

Lab Experiments:

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using LangChain or a function-calling API; test on queries requiring tool execution.
2. Multimodal Prompting Exploration: Generate images from detailed text prompts; feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. Prompt Evaluation & Ethics Workshop:
 - a. Select two existing prompts and generate multiple outputs; apply manual heuristic checks for accuracy, relevance, and format compliance.
 - b. Use an “LLM-as-Judge” prompt (e.g., “Rate these outputs on a scale of 1–5 for clarity and correctness.”) to automate evaluation.
 - c. Design a prompt- injection test (e.g., “Ignore previous instructions...”), observe the response, then refine system prompts to mitigate the vulnerability.



IV Year I Semester	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	-

Course Objectives: The objectives of the course are to

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I:

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution- Preamble, Salient, Features

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, **Executive-** President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT-V:

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar, 2015

Reference Books:

1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014



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Minors Courses in AI & ML



ARTIFICIAL INTELLIGENCE	L	T	P	C
	3	0	0	3

Course Objectives:

The main objectives of the course are to introduce the concepts of Artificial Intelligence, methods of solving problems using Artificial Intelligence, Expert Systems, applications of AI, different knowledge representation techniques

UNIT I:

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT II:

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT III:

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempster-shafer theory.

UNIT IV:

Logic concepts: First-order logic. Inference in first-order logic, propositional vs. first-order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation, Inductive learning, and Decision trees. Explanation-based learning, Statistical Learning: Naïve Bayes model and EM Algorithm

UNIT V:

Introduction to Machine Learning and Deep Learning, Introduction to Generative AI, Introduction to GenAI Tools: CVedia, Warp, Microsoft PowerBI, Tableau, Github Co-pilot, IBM WatsonX Code assistant.

Text Books:

1. S. Russel and P. Norvig, "Artificial Intelligence–A Modern Approach", Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill
3. Bernard Marr ., "Generative AI in Practice", Wiely. (GenAI Tools)

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel," Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.



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e-Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview



PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS	L	T	P	C
	3	0	3	4.5

Course Objectives:

The main objectives of the course are to

- Introduce database management systems and to give a good formal foundation on the relational model of data and the concepts of SQL
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization and provide an overview of physical design of a database system, by discussing database storage techniques
- Populate and query a database using SQL DDL/DML Commands and declare & enforce integrity constraints on a database
- Write Queries using advanced concepts of SQL and programming PL/SQL including procedures, functions, cursors and triggers

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.

UNIT II:

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

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.

UNIT III:

BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

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 dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF).

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.



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, 8th edition, C J Date, Pearson.
- 2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, 10th edition, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,

Sample Experiments:

1. Creation, altering and dropping 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, NOT EXISTS, UNION, INTERSECT, 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.



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8. Program 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

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



ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS	L	T	P	C
	3	0	3	4.5

Course Objectives:

The main objectives of the course are to

- Provide knowledge on advance data structures frequently used in Computer Sciencedomain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design
- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

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 Decision Problem (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 in 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, Introduction to Algorithms (youtube.com)

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the biconnected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job Sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press



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2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

Online Learning Resources:

1. <http://cse01-iiith.vlabs.ac.in/>



MACHINE LEARNING	L	T	P	C
	3	0	0	3

Course Objectives:

The objectives of the course are to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

UNIT – I:

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT – II:

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms

UNIT – III:

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes’ Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT – IV:

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

UNIT – V:

Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering

Text Books:

1. “Machine Learning Theory and Practice”, M N Murthy, VS Ananthanarayana, Universities Press (India), 2024



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Reference Books:

1. “Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2004
3. “Machine Learning in Action”, Peter Harrington, Dream Tech
4. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.



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Honors Courses in AI & ML



BUSINESS INTELLIGENCE	L	T	P	C
	3	0	0	3

Course Objective: The main objectives of the course are to

- Introduce the nature of data, statistical Modelling and visualization.
- Learn concepts of Business Intelligence and Data Warehousing.
- Gain knowledge on Data mining process and SNA, text & Web analytics.

Unit I:

An Overview of Business Intelligence, Analytics, Data Science, and AI: Changing Business Environments and Evolving Needs for Decision Support and Analytics, Decision-Making Processes and Computerized Decision Support Framework, Evolution of Computerized Decision Support to Analytics/Data Science, A Framework for Business Intelligence, Analytics Overview.

Note: Text Book1: Chapter 1 (1.2-1.6)

Unit II:

Descriptive Analytics I -Nature of Data, Big Data, and Statistical Modeling: The Nature of Data in Analytics, A Simple Taxonomy of Data, The Art and Science of Data Preprocessing, Definition of Big Data, Fundamentals of Big Data Analytics, Big Data Technologies, Big Data and Stream Analytics, Statistical Modeling for Business Analytics, Regression Modeling for Inferential Statistics.

Note: Text Book1: Chapter 3 (3.2-3.10)

Unit III:

Descriptive Analytics II: Business Intelligence Data Warehousing, and Visualization: Business Intelligence and Data Warehousing, Data Warehousing Process, Data Warehousing Architectures, Data Management and Warehouse Development, Data Warehouse Administration, Security Issues, and Future Trends, Business Reporting, Data Visualization, Different Types of Charts and Graphs, The Emergence of Visual Analytics, Information Dashboards.

Note: Text Book1: Chapter 4 (4.2-4.11)

Unit IV:

Predictive Analytics I - Data mining process, methods, and Algorithms: Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods. Prescriptive Analytics - Optimization and Simulation: Model-Based Decision-Making, Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Decision Modeling with Spreadsheets.

Note: Text Book1: Chapter 5 (5.2-5.5), Chapter-8 (8.2-8.5)

Unit V:

Predictive Analytics II - Text, Web, and Social Media Analytics: Text Analytics and Text Mining Overview, Natural Language Processing (NLP), Text Mining Applications, Text Mining Process, Sentiment Analysis and Topic Modeling, Web Mining Overview, Search Engines, Web Usage Mining (Web Analytics), Social Analytics.

Note: Text Book1: Chapter 6 (6.2-6.10)



Text Books:

1. Ramesh Sharda, DursunDelen and Efraim Turban, “Business Intelligence, Analytics, Data Science and AI – A Managerial Perspective”, 5th edition, Global Edition, Pearson Education Limited, 2024

Reference Books:

1. Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
2. Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence -Computational Frameworks, Practices, and Applications, CRC Press, 2023.
3. Ira J. Haimowitz, Data Analytics For Business - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

e-Resources:

- <https://www.tableau.com/business-intelligence/what-is-business-intelligence>
- https://onlinecourses.nptel.ac.in/noc24_cs65/preview
- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
- <https://cloud.google.com/learn/what-is-business-intelligence>
- <https://www.geeksforgeeks.org/what-is-data-analytics/>



Explainable AI	L	T	P	C
	3	0	0	3

Course Objectives:

The main objectives of the course are to

- Understand the importance of explainability in AI and its impact on stakeholders.
- Explore different techniques and methods for making AI systems explainable.
- Analyze the trade-offs between model complexity and interpretability.
- Examine the ethical and societal implications of XAI.
- Apply XAI techniques to real-world datasets and scenarios.

UNIT I:

Introduction to Explainable AI (XAI): Motivations for XAI, Importance of interpretability and transparency Techniques for XAI, Model-specific interpretability methods (e.g., decision trees, rulebased systems) Model-agnostic interpretability methods (e.g., LIME,SHAP) Post-hoc explanation techniques (e.g., feature importance, counterfactual explanation

UNIT II:

Interpretable Models: Linear models, Decision trees and rule-based systems Symbolic AI approaches, Interpretable Neural Networks, Sparse neural networks, Attention mechanisms, Layer-wise relevance propagation (LRP)

UNIT III:

Methods for Explainable AI: Partial Dependence Plot (PDP), Conformal Prediction, Individual Conditional Expectation (ICE), Feature Importance, Saliency Maps, Local Interpretable Model-Agnostic Explanations (LIME), SHAP, Integrated Gradient (IG), Explainability for Linear Models, Non-linear models and Deep Learning Models.

UNIT IV:

Evaluation of XAI Methods: Quantitative metrics for interpretability, Human-centric evaluation methods, Ethical and Societal Implications of XAI, is and fairness in interpretable AI, Trust and accountability in AI systems,Regulatory considerations.

UNIT V:

Applications of XAI: Healthcare (e.g., medical diagnosis, personalized treatment) Finance (e.g., credit scoring, fraud detection), Autonomous systems (e.g., self-driving cars, drones). Explainability in Time Series Forecasting, Natural Language Processing, and Computer Vision

Text Books:

1. "Interpretable Machine Learning" by Christoph Molnar
2. "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning" by L. Liu and G. Hu

Reference Books:

1. "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable" by Christoph Molnar
2. "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning" by L. Liu and G. Hu
3. "Explainable AI in Healthcare: Exploring Interpretable Models and Learning from Patient Data" edited by F. E. Elsayed and B. G. Stoecklin



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Online Resources:

1. <https://christophm.github.io/interpretable-ml-book/>



GENERATIVE AI	L	T	P	C
	3	0	0	3

Course Objective:

The main objectives of the course are to introduce the basics of Generative AI, Text Generation and the process of generating videos, GAN and its variants.

UNIT I:

Introduction To Gen Ai: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

UNIT II:

Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

UNIT III:

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- DALL-E2 and DALL-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

UNIT IV:

Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT V:

Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT4All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:

1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition, Packt Books, 2024

Reference Books:

1. David Foster, ”Generative Deep Learning”, O’Reilly Books, 2024.
2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024.



Agentic AI	L	T	P	C
	3	0	0	3

Course Outcomes:

1. Understand the genesis, evolution, and classifications of AI agents, and analyze the role of technological advancements in shaping intelligent agent systems.
2. Evaluate AI agent architectures and frameworks, and identify the challenges in developing scalable, secure, and efficient AI agent-based solutions.
3. Demonstrate knowledge of multi-agent systems (MAS), including coordination techniques, communication strategies, conflict resolution, and their applications in real-world scenarios.
4. Analyze the economic implications of AI agents, including the agentic economy, block chain integration, and token-based incentive mechanisms in autonomous systems.
5. Examine the role of AI agents in automating business workflows, fostering human-AI collaboration, and identify tasks where AI agents augment or cannot fully replace human intervention.

UNIT-I:Genesis and Evolution of AI Agents: Definition of AI, Historical Trajectory of AI Agents, Reactive Agents, Hybrid Agents, Learning Agents, Cognitive Agents, Collaborative Agents, Domain Specific Agents, Technological Drivers of the AI Agent Renaissance, Examples.

UNIT-II: AI Agent Tools and Frameworks: Seven-Layer AI Agent Architecture, Features and Comparison of AI Agent Framework, Challenges: Framework and Tooling, Integration, Scalability, Security, Higher-Quality Data source, Skilled workforce Availability.

UNIT-III: Multi-Agent Coordination: Introduction to MASs, Coordination Techniques in MASs, Communication in MASs, Conflict Resolution in Multi-Agent Environment, Designing Multi-Agent Environments, System Maintenance and Evolution, Real-World Application of MASs, AI Agent to Multi-Agent Systems, Build API for AI Agents in Multi-Agent Systems, Future Directions in MAS.

UNIT-IV:AI Agent Economy: AI Agent Impact on Economy Theory, Agentic Economy on Blockchain, Role of Tokens in the Agentic Economy, Designing Token Incentives for AI Agent, Case Study: Incentives in an Autonomous Investment Ecosystem.

AI Agents and Business Workflow: Business Workflows with AI Agents, AI Agent Enabled Full Automation, Human-AI Collaboration, What AI Agent Cannot Replace, Real-World Case Study of AI Agents in Business Workflows.

UNIT-V:AI Agents in Robotics: Agentic Framework for Robotics, Advanced Modules for Humanoid Robots, Applications of AI Agents in Robotics, NVIDIA's Robotics strategies, platforms and technology, Google DeepMind's Robotics Strategies, platforms and technology, Unitree Robotics, Governances and Ethical Considerations.



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Text Books:

1. “Agentic AI: Theories and Practice”, Foreword by Mathew R. Versaggi and Yang Wang , Springer Publications, 2025.