

**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         |
| <b>Total</b> |                     |                                               | <b>13</b> | <b>00</b> | <b>15</b> | <b>20.5</b> |

**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             | <b>Explain</b> the need of coherent sources and the conditions for sustained interference (L2). <b>Identify</b> the applications of interference in engineering (L3). <b>Analyze</b> the differences between interference and diffraction with applications (L4). <b>Illustrate</b> the concept of polarization of light and its applications (L2). <b>Classify</b> ordinary refracted light and extraordinary refracted rays by their states of polarization (L2) |
| CO2             | <b>Interpret</b> various crystal systems (L2) and <b>Analyze</b> the characterization of materials by XRD (L4). <b>Identify</b> the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique (L3). <b>Analysis</b> of structure of the crystals by Laue's and Powder techniques (L2).                                                                                     |
| CO3             | <b>Explain</b> the concept of dielectric constant and polarization in dielectric materials (L2). <b>Summarize</b> various types of polarization of dielectrics (L2). <b>Interpret</b> Lorentz field and Claussius-Mosotti relation in dielectrics (L2). <b>Classify</b> the magnetic materials based on susceptibility and their temperature dependence (L2).                                                                                                      |
| CO4             | <b>Describe</b> the dual nature of matter (L1). <b>Explain</b> the significance of wave function (L2). <b>Identify</b> the role of Schrodinger's time independent wave equation in studying particle in one-dimensional infinite potential well (L3). <b>Identify</b> the role of classical and quantum free electron theory in the study of electrical conductivity (L3).                                                                                         |
| CO5             | <b>Classify</b> the crystalline solids (L2). <b>Outline</b> the properties of charge carriers in semiconductors (L2). <b>Identify</b> the type of semiconductor using Hall effect (L2). <b>Apply</b> 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, 11<sup>th</sup> 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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**B.Tech. I Year Syllabus**  
**Engineering Physics Laboratory**  
**(Common for all Branches)**  
**(R23 Regulation)**

**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](http://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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DEPARTMENT OF ECE  
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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<br>(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**

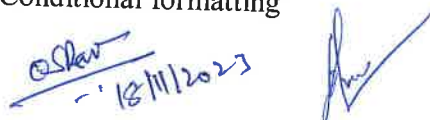
**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**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.

### **LOOKUP/VLOOKUP**

**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, 3<sup>rd</sup> edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2<sup>nd</sup> 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, 3<sup>rd</sup> edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3<sup>rd</sup> edition

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| I Year - I Semester | INTRODUCTION TO PROGRAMMING<br>(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, 2<sup>nd</sup> edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3<sup>rd</sup> edition



|                     |                                                                            |          |          |          |          |
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| I Year - I Semester | <b>COMPUTER PROGRAMMING LAB</b><br>(Common to All branches of Engineering) | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                     |                                                                            | 0        | 0        | 3        | 1.5      |

**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

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc
- Writing simple programs using input and Output Statements
- 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

- Simple statistics Operations- Sum and average etc
- Conversion of Fahrenheit to Celsius and vice versa
- 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



- 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,

*OSR*  
*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

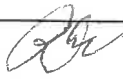
| Upon completion of the course, the student will be able to: |                                                                                                                                                                            | Cognitive Level |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 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<br>(Chairman)                                                    | Dr. T.V.S. Sekhar<br>(Member) | Dr. Ch. Ramireddy<br>(Member) | Dr. T. Hymavathi<br>(Member) | Dr.G.V.S.R.<br>Deekshitulu<br>(Member) | Dr. S.K.Vali<br>(Member) | Dr.K.Sobhan Babu<br>(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.

**Members of BoS:**

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

**University Engineering College(A): J N T University Kakinada**  
**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](https://en.wikipedia.org/wiki/System_of_linear_equations)
2. [https://en.wikipedia.org/wiki/Eigenvalues\\_and\\_eigenvectors](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](https://en.wikipedia.org/wiki/Quadratic_form)
5. <https://en.wikipedia.org/wiki/Calculus>
6. [https://en.wikipedia.org/wiki/Partial\\_derivative](https://en.wikipedia.org/wiki/Partial_derivative)
7. [https://www.whitman.edu/mathematics/calculus\\_online/section14.03.html](https://www.whitman.edu/mathematics/calculus_online/section14.03.html)
8. [https://en.wikipedia.org/wiki/Multiple\\_integral](https://en.wikipedia.org/wiki/Multiple_integral)
9. <http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx>

**Members of BoS:**

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

## **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

MR  
HMED

A. M.

**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

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA**  
**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    |

|                                  |                                  |                                  |                                         |                               |
|----------------------------------|----------------------------------|----------------------------------|-----------------------------------------|-------------------------------|
| Dr. R. Srinivasa Rao<br>(Member) | Dr. K. Venkata Reddy<br>(Member) | Dr. M. Nageswara Rao<br>(Member) | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(Chairman) |
|                                  |                                  |                                  | 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

|                                |                                                                                 |                                         |                        |                      |
|--------------------------------|---------------------------------------------------------------------------------|-----------------------------------------|------------------------|----------------------|
| <b>COURSE CODE – R2011XXYY</b> | <b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING<br/>(For EEE Branch only)</b> | <b>CATEGORY<br/>Engineering Science</b> | <b>L-T-P<br/>3-0-0</b> | <b>CREDITS<br/>3</b> |
|--------------------------------|---------------------------------------------------------------------------------|-----------------------------------------|------------------------|----------------------|

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

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

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

| UNIT            | CONTENTS                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contact Hours |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|                 | <b>PART A: BASIC ELECTRICAL ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                                  |               |
| <b>UNIT - 1</b> | <b>Introduction to Electrical Circuits</b><br>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             |
| <b>UNIT - 2</b> | <b>Magnetic Circuits</b><br>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             |

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



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

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| UNIT - 3                                     | <b>Electrical Wiring, Electricity Bill &amp; Safety Measures</b><br><b>Electrical Wiring:</b> 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.<br><b>Electricity bill:</b> Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc., Types of electricity tariff, calculation of electricity bill for domestic consumers.<br><b>Equipment Safety Measures:</b> 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 |
| <b>PART B: BASIC ELECTRONICS ENGINEERING</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
| UNIT - 4                                     | <b>Review of Semi-Conductor Physics</b><br>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                                     | <b>Junction Diode Characteristics</b><br>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                                       | <b>Special Semiconductor Devices</b><br>Operation and V-I characteristics of Zener Diode, Breakdown mechanisms, Zener diode as voltage regulator; LED, Photodiode, Tunnel diode, SCR and UJT.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 8 |
| <b>Total</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |

**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, 8<sup>th</sup> edition, 2023.
2. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, First Edition, 2019

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



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK, KAKINADA  
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, 8<sup>th</sup> edition, McGraw Hill 2015.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press.

| Dr. R. Srinivasa Rao<br>(Member) | Dr. K. Venkata Reddy<br>(Member) | Dr. M. Nageswara Rao<br>(Member) | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(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<br>(For EEE Branch only) | CATEGORY<br>Engineering Science | L-T-P<br>0-0-3 | CREDITS<br>1.5 |
|-------------------------|------------------------------------------------------------------------|---------------------------------|----------------|----------------|
|-------------------------|------------------------------------------------------------------------|---------------------------------|----------------|----------------|

**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.                                                                                                                |               |

|                                  |                                  |                                  |                                         |                               |
|----------------------------------|----------------------------------|----------------------------------|-----------------------------------------|-------------------------------|
| Dr. R. Srinivasa Rao<br>(Member) | Dr. K. Venkata Reddy<br>(Member) | Dr. M. Nageswara Rao<br>(Member) | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(Chairman) |
|                                  |                                  |                                  | 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

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                                                                          |               |

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



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

**I B.Tech**

|                                |                                                                                                                 |                                        |                       |                     |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------|---------------------|
| <b>COURSE CODE – R2011XXYY</b> | <b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING</b><br>(Common to CE, ME, ECE CSE, AIML PE, CHE (Except EEE)) | <b>CATEGORY</b><br>Engineering Science | <b>L-T-P</b><br>3-0-0 | <b>CREDITS</b><br>3 |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------|---------------------|

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

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

#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 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|                 | <b>PART A: BASIC ELECTRICAL ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |               |
| <b>UNIT - 1</b> | <b>DC &amp; AC Circuits</b><br><b>DC Circuits:</b> Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits.<br><b>AC Circuits:</b> 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                         |                               |



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

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                 | Concept of reactance and Impedance, Concept of power factor, Active power, reactive power and apparent power.<br>(Simple numerical problems)                                                                                                                                                                                                                                                                                            |   |
| <b>UNIT - 2</b> | <b>Machines</b><br>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.<br>(Simple numerical problems on DC Generator.)                                                                                                                                                      | 8 |
| <b>UNIT - 3</b> | <b>Electricity Bill &amp; Equipment Safety Measures</b><br><b>Electricity Bill:</b> Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Types of Tariff, Calculation of electricity bill for domestic consumers.<br><b>Equipment Safety Measures:</b> Working principle of Fuse and Miniature Circuit Breaker(MCB).<br>Electric Shock, Safety Precautions to avoid shock, concept of Earthing | 6 |
|                 | <b>PART B: BASIC ELECTRONICS ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                            |   |
| <b>UNIT - 4</b> | <b>Collect syllabus from the ECE department</b>                                                                                                                                                                                                                                                                                                                                                                                         |   |
| <b>UNIT - 5</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
| <b>UNIT-6</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
|                 | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |   |

**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<br>(Member) | Dr. K. Venkata Reddy<br>(Member) | Dr. M. Nageswara Rao<br>(Member) | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(Chairman) |
|                                  |                                  |                                  | Attended online                         |                               |



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

**I B.Tech**

|                                |                                                                                                                    |                     |                    |                    |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|--------------------|
| <b>COURSE CODE – R2011XXYY</b> | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING WORKSHOP</b><br>(Common to CE, ME, ECE CSE, AIML PE, CHE (Except EEE)) | <b>CATEGORY BSC</b> | <b>L-T-P 0-0-3</b> | <b>CREDITS 1.5</b> |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|--------------------|

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

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

#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. |               |

|                                  |                                  |                                  |                                         |                               |
|----------------------------------|----------------------------------|----------------------------------|-----------------------------------------|-------------------------------|
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|                                  |                                  |                                  | 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.     |                     |               |

|                                  |                                  |                                  |                                         |                               |
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| Dr. R. Srinivasa Rao<br>(Member) | Dr. K. Venkata Reddy<br>(Member) | Dr. M. Nageswara Rao<br>(Member) | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(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 /<br>Fundamental Chemistry                                                             | 3         | 0         | 0         | 3           |
| 3            | Engineering<br>Science | Differential Equations & Vector Calculus                                                                                 | 3         | 0         | 0         | 3           |
| 4            | Engineering<br>Science | Basic Civil & Mechanical Engineering                                                                                     | 3         | 0         | 0         | 3           |
| 5            | Professional<br>Core   | Engineering Mechanics/Network Analysis/<br>Data structures (Branch specific)                                             | 3         | 0         | 0         | 3           |
| 6            | BS&H                   | Communicative English Lab                                                                                                | 0         | 0         | 2         | 1           |
| 7            | BS&H                   | Engineering Chemistry / Chemistry /<br>Fundamental Chemistry Lab                                                         | 0         | 0         | 2         | 1           |
| 8            | Engineering<br>Science | Engineering Workshop                                                                                                     | 0         | 0         | 3         | 1.5         |
| 9            | Professional<br>Core   | Engineering Mechanics & Building Practices Lab<br>Engineering Mechanics Lab/Network Analysis Lab/<br>Data structures Lab | 0         | 0         | 3         | 1.5         |
| 10           |                        | Health and wellness, Yoga and Sports                                                                                     | -         | -         | 1         | 0.5         |
| <b>Total</b> |                        |                                                                                                                          | <b>14</b> | <b>00</b> | <b>11</b> | <b>19.5</b> |

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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*SG*

**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:**

*Reema*

*[Signature]*

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](http://www.bbc.co.uk/learningenglish)
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. [www.eslpod.com/index.html](http://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](https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA)

*Rehman*

*SG*

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

*Reema*

*SF*

## Web Resources:

### Spoken English:

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://www.englishinteractive.net)
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. [https://www.youtube.com/c/mmmEnglish\\_Emma/featured](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](https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw)

### Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. [https://www.youtube.com/channel/UC\\_OskgZBoS4dAnVUgJVexc](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
4. [https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)

Green

SG

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

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**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  $\Psi$  and  $\Psi^2$  - particle in one dimensional box - molecular orbital theory - bonding in homo and heteronuclear diatomic molecules - energy level diagrams of  $O_2$  and CO -  $\pi$ -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, 5<sup>th</sup> 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**

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**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 6<sup>th</sup> 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<br>(Chairman)                                                    | Dr. T.V.S. Sekhar<br>(Member) | Dr. Ch. Ramireddy<br>(Member) | Dr. T. Hymavathi<br>(Member) | Dr.G.V.S.R.<br>Deekshitulu<br>(Member)                                               | Dr. S.K.Vali<br>(Member) | Dr.K.Sobha<br>(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.

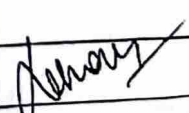
#### TEXT BOOKS

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<br>(Chairman)                                                  | Dr. T.V.S. Sekhar<br>(Member) | Dr. Ch. Ramireddy<br>(Member) | Dr. T. Hymavathi<br>(Member) | Dr. G.V.S.R. Deekshitulu<br>(Member)                                                 | Dr. S.K. Vali<br>(Member) | Dr. K. Sobhan Babu<br>(Member)                                                        |
|------------------------------------------------------------------------------------|-------------------------------|-------------------------------|------------------------------|--------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------|
|  |                               |                               |                              |  |                           |  |

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## 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 measures 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 - Steel - Introduction to Prefabricated construction Techniques.

### UNIT II

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

### UNIT III

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

**Water Resources and Environmental Engineering:** Introduction, Sources of water - 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. Puri, 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, 38<sup>th</sup> 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  
HMGD

J. K.

(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

|                                |                                        |                                   |                    |                  |
|--------------------------------|----------------------------------------|-----------------------------------|--------------------|------------------|
| <b>COURSE CODE – R2011XXYY</b> | <b>ELECTRICAL CIRCUIT ANALYSIS - I</b> | <b>CATEGORY Professional Core</b> | <b>L-T-P 3-0-0</b> | <b>CREDITS 3</b> |
|--------------------------------|----------------------------------------|-----------------------------------|--------------------|------------------|

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                    |

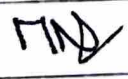
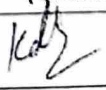
#Based on suggested Revised BTL

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 | <b>Single Phase A.C Systems</b><br>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.<br>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 | <b>Resonance and Locus Diagrams</b><br>Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies;<br>Parallel resonance: Q-factor, selectivity and bandwidth;<br>Locus diagram: RL, RC, RLC with R, L and C variables.                                                                                                                                                          |               |

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



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

|                 |                                                                                                                                                                                                                                                     |  |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>UNIT - 3</b> | <b>Network Theorems (DC &amp; AC Excitations)</b><br>Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem and Tellegen's theorem.              |  |
| <b>UNIT - 4</b> | <b>Balanced Three Phase Circuits</b><br>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. |  |
| <b>UNIT - 5</b> | <b>Unbalanced Three Phase Circuits</b><br>Loop method, Star-Delta transformation technique, two wattmeter method for measurement of three phase power.                                                                                              |  |
|                 | <b>Total</b>                                                                                                                                                                                                                                        |  |

**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, 8<sup>th</sup> edition, 2023.

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

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

**I B.Tech II Semester**

|                                |                                |                                   |                    |                    |
|--------------------------------|--------------------------------|-----------------------------------|--------------------|--------------------|
| <b>COURSE CODE – R2011XXYY</b> | <b>ELECTRICAL CIRCUITS LAB</b> | <b>CATEGORY Professional Core</b> | <b>L-T-P 0-0-3</b> | <b>CREDITS 1.5</b> |
|--------------------------------|--------------------------------|-----------------------------------|--------------------|--------------------|

**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- $\phi$ 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 |               |

|                                                                                     |                                                                                     |                                                                                     |                                         |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------|
| Dr. R. Srinivasa Rao<br>(Member)                                                    | Dr. K. Venkata Reddy<br>(Member)                                                    | Dr. M. Nageswara Rao<br>(Member)                                                    | Dr. Ch.V.V.S. Bhaskar Reddy<br>(Member) | Dr. K. Ravindra<br>(Chairman)                                                         |
|  |  |  | 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. L. 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

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## 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

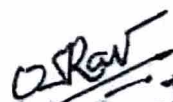
**Hashing:** Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2<sup>nd</sup> 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

  
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Dept. of Computer Science & Engg.  
University College of Engineering  
JNTU University, Kakatiya - 503 007

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## 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, 2<sup>nd</sup> 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.

askar 7/21/2024  
Head of the Department  
Dept. of Computer Science & Engg.  
University College of Engineering  
JNT University, Kakinada - 533 003

|                     |   |   |   |   |
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| I Year - I Semester | L | T | P | C |
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| NETWORK ANALYSIS    |   |   |   |   |
| available to        |   |   |   |   |

**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, 3<sup>rd</sup> Edition, 2000.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9<sup>th</sup> 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, 5<sup>th</sup> 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  
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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  
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DEPARTMENT OF ECE  
UOEC JNTUK, KALAHNADA.



**University College of Engineering Kakinada (A)**  
**Jawaharlal Nehru Technological University Kakinada**  
**B.Tech CSE (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                     | Managerial Economics and Financial Analysis  | 2         | 0        | 0        | 2         |
| 3            | Engineering Science      | Computer Organization & Architecture         | 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        | -         |
| <b>Total</b> |                          |                                              | <b>16</b> | <b>2</b> | <b>8</b> | <b>20</b> |

**B.Tech.– II Year II Semester**

| S.No.                                                                                      | Category                           | Title                                          | L         | T        | P         | Credits   |
|--------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------|-----------|----------|-----------|-----------|
| 1                                                                                          | Management Course- I               | Universal Human Values – Understanding Harmony | 2         | 1        | 0         | 3         |
| 2                                                                                          | Engineering Science/ Basic Science | Probability & Statistics                       | 3         | 0        | 0         | 3         |
| 3                                                                                          | Professional Core                  | Operating Systems                              | 3         | 0        | 0         | 3         |
| 4                                                                                          | Professional Core                  | Database Management Systems                    | 3         | 0        | 0         | 3         |
| 5                                                                                          | Professional Core                  | Software Engineering                           | 2         | 1        | 0         | 3         |
| 6                                                                                          | Professional Core                  | Operating Systems 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 –I                      | 0         | 1        | 2         | 2         |
| 9                                                                                          | BS&H                               | Design Thinking & Innovation                   | 1         | 0        | 2         | 2         |
| <b>Total</b>                                                                               |                                    |                                                | <b>14</b> | <b>2</b> | <b>10</b> | <b>21</b> |
| Mandatory Community Service Project Internship of 08 weeks duration during summer vacation |                                    |                                                |           |          |           |           |



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**II Year I Semester**

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**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<br>(1 – Low, 2 - Medium, 3 – High) |     |      |     |     |     |     |     |     |     |      |      |       |
|------------------------------------------------------------------------------------------------------------|-----|------|-----|-----|-----|-----|-----|-----|-----|------|------|-------|
| CO                                                                                                         | PO1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO 12 |
| 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



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Diagrams, Functions: Bijjective, Composite function, Inverse function and Recursive functions, Lattice, and its properties

**UNIT-III: Combinatorics and Recurrence Relations:**

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

**Recurrence Relations:**

Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

**UNIT-IV: Graph Theory:**

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

**Unit-V: Multi Graphs**

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

**Text Books:**

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. 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, 3<sup>rd</sup> 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, 7<sup>th</sup> Edition, Tata McGraw Hill.



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**B.Tech CSE (R23- II Year COURSE STRUCTURE & SYLLABUS)**

**II Year I Semester**

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**Managerial Economics and Financial Analysis**

**Course Objectives:**

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

**Course Outcomes:**

- Define the concepts related to Managerial Economics, financial accounting and management.
- Understand the fundamental also Economics viz., Demand, Production, cost, revenue and markets
- Apply the Concept of Production cost and revenues for effective Business decision
- Analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Develop the accounting statements and evaluate the financial performance of Business entity.

**UNIT-I**

Managerial Economics: Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

**UNIT-II**

Production and Cost Analysis: Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and long run Production Function- Isoquants and Isocosts, MRTS -Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) -Determination of Break- Even Point (Simple Problems)- Managerial significance and limitations of Break- Even Analysis.

**UNIT-III**

Business Organizations and Markets: Introduction–Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets – Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination-Pricing Methods and Strategies

**UNIT-IV**

Capital Budgeting: Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working



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**B.Tech CSE (R23- II Year COURSE STRUCTURE & SYLLABUS)**

capital requirements. Capital Budgeting–Features, Proposals, Methods and Evaluation. Projects– Pay Back Method ,Accounting Rate of Return(ARR) Net Present Value(NPV)Internal Rate Return(IRR) Method (sample problems)

**UNIT-V**

Financial Accounting and Analysis: Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis-Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

**Text Books:**

1. Varshney & Maheswari: Managerial Economics ,Sultan Chand,2013.

**Reference Books:**

1. Managerial Economics: Principles And Worldwide Applications, 9E (Adaptation), Dominick Salvatore and Siddhartha Rastogi
2. Managerial Economics: Principles and Worldwide Applications, Dominick Salvatore



**University College of Engineering Kakinada (A)**  
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**B.Tech CSE (R23- II Year COURSE STRUCTURE & SYLLABUS)**

**II Year I Semester**

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| 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 I Semester**

**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**

**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., abstract classes

**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.

**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.



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### **UNIT III**

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

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

### **UNIT IV**

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

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

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

### **UNIT V**

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

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

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

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

### **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) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4<sup>th</sup> Edition, Pearson.



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**References Books:**

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup> Edition, Y Daniel Liang, Pearson

**Online Resources:**

- 1) <https://nptel.ac.in/courses/106/105/106105191/>
- 2) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_012880464547618816347\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)



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**II Year I Semester**

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



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**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**

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**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, Java FX 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 String Buffer 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
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) 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**

**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 Used on Lists, List Methods, del Statement.



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**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:**

1. 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.
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.



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**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, 2<sup>nd</sup> 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**

**ENVIRONMENTAL SCIENCE**

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**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– 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



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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: Visitation 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 slopes, etc..

#### **Text books:**

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “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.

#### **Reference Books:**

1. Deeksha Dave and E.Sai Baba Reddy, “Text book of Environmental Science”, engage



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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**

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**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.

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNIT I</b> | Introduction to Value Education (6 lectures and 3 tutorials for practice session)<br>Lecture1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)<br>Lecture2: Understanding Value Education<br>Tutorial 1: Practice Session PS1 Sharing about One self<br>Lecture 3: self-exploration as the Process for Value Education<br>Lecture 4: Continuous Happiness and Prosperity–the Basic Human Aspirations<br>Tutorial 2: Practice Session PS2 Exploring Human Consciousness<br>Lecture 5: Happiness and Prosperity – Current Scenario<br>Lecture 6: Method to Fulfill the Basic Human Aspirations<br>Tutorial 3: Practice Session PS3 Exploring Natural Acceptance |
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- 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  
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



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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](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 II Semester**

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## 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 |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------|
| <b>CO1</b>                                                  | Classify the concepts of data science and its importance                                  | K2              |
| <b>CO2</b>                                                  | Interpret the association of characteristics and through correlation and regression tools | K4              |
| <b>CO3</b>                                                  | Apply discrete and continuous probability distributions                                   | K3              |
| <b>CO4</b>                                                  | Design the components of test of hypothesis.                                              | K6              |
| <b>CO5</b>                                                  | 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<br>(1 – Low, 2 - Medium, 3 – High) |     |     |     |     |     |     |     |     |     |      |      |      |
|------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO                                                                                                         | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| <b>CO1</b>                                                                                                 | 2   | 3   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO2</b>                                                                                                 | 3   | 3   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO3</b>                                                                                                 | 3   | 2   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO4</b>                                                                                                 | 2   | 3   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO5</b>                                                                                                 | 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,  $\chi^2$  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,  $\chi^2$ -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, 8<sup>th</sup> Edition, Pearson 2007.
2. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8<sup>th</sup> Edition, Cengage.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4<sup>th</sup> Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3<sup>rd</sup> Edition, Pearson, 2010



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**II Year II Semester**

**OPERATING SYSTEMS**

**Course Objectives:**

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

**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, Multiprocessor 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.



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Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix

**Text Books:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson , 2016

**Reference Books:**

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

**Online Learning Resources:**

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



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**II Year II Semester**

**DATABASE 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, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

**Reference Books:**

1. Introduction to Database Systems, 8<sup>th</sup> edition, C J Date, Pearson.
2. Database Management System, 6<sup>th</sup> 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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview)



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**II Year II Semester**

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**SOFTWARE ENGINEERING**

**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, How to 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, ISO 9000.SEI Capability maturity model. Few other



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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 reuse 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, 5<sup>th</sup> Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9<sup>th</sup> Edition, McGraw Hill International Edition.

**Reference Books:**

1. Software Engineering, Ian Sommerville, 10<sup>th</sup> 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](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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)



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**II Year II Semester**

| L | T | P | C   |
|---|---|---|-----|
| 0 | 0 | 3 | 1.5 |

**OPERATING SYSTEMS LAB**

**Course Objectives:**

The main objectives of the course are to

- Provide insights into system calls, file systems, semaphores,
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation
- Implement Bankers Algorithms to Avoid the Dead Lock

**Experiments covering the Topics:**

- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

**Sample Experiments:**

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls  
fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms  
a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with  
a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition  
a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms  
a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies  
a) Sequential b) Indexed c) Linked
13. Download and install nachos operating system and experiment with it

**Reference Books:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson, 2016
3. Operating Systems –Internals and Design Principles, Stallings W, 9<sup>th</sup> edition, Pearson, 2018



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4. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3<sup>rd</sup> Edition, McGraw-Hill, 2013

**Online Learning Resources:**

1. <https://www.cse.iitb.ac.in/~mythili/os/>
2. <http://peterindia.net/OperatingSystems.html>
3. [www.cs.washington.edu/~tom/nachos](http://www.cs.washington.edu/~tom/nachos)



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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, NOT EXISTS, 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.



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8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

**Text Books/Suggested Reading:**

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



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| L | T | P | C |
|---|---|---|---|
| 0 | 1 | 2 | 2 |

**II Year II Semester**

**FULL STACK DEVELOPMENT – 1**  
**(SKILL ENHANCEMENT COURSE)**

**Course Objectives:**

The main objectives of the course are to

- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- 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**

- a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- b. 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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- c. 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, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- d. 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 ☐ hyperlink. 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>, <span> 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
  - i. Simple selector (element, id, class, group, universal)
  - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
  - iii. Pseudo-class selector
  - iv. Pseudo-element selector
  - v. 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. Java Script 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. Java Script 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.,  $13 + 53 + 33 = 153$ ]
- 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. Java Script Functions and Events**

- a. Design a appropriate function should be called to display
  - i. Factorial of that number
  - ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. 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
  - i. Factorial of that number
  - ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. 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 [xxxxxxx@xxxxxx.xxx](mailto:xxxxxxx@xxxxxx.xxx))

**Text Books:**

- 1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.



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2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasani Subramanian, 2<sup>nd</sup> edition, APress, O'Reilly.

**Web Links:**

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>



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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.

**Course Outcomes:**

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

**UNIT – I Introduction to Design Thinking**

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

**UNIT - II Design Thinking Process**

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

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

**UNIT - III Innovation**

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

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.



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**UNIT - IV     Product Design**

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

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

**UNIT – V     Design Thinking in Business Processes**

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

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

**Textbooks:**

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

**Reference Books:**

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

**Online Learning Resources:**

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- [https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)
- [https://onlinecourses.nptel.ac.in/noc22\\_de16/preview](https://onlinecourses.nptel.ac.in/noc22_de16/preview)



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

## B.Tech CSE (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                                                             | Data Warehousing and Data Mining                                                                                                                                                                                                      | 3  | 0 | 0  | 3   |
| 2     | Professional Core                                                             | Computer Networks                                                                                                                                                                                                                     | 3  | 0 | 0  | 3   |
| 3     | Professional Core                                                             | Formal Languages and Automata Theory                                                                                                                                                                                                  | 3  | 0 | 0  | 3   |
| 4     | Professional Elective-I                                                       | 1. Object Oriented Analysis and Design (2-1-0-3)<br>2. Design and Analysis of Algorithms<br>3. Microprocessors & Microcontrollers<br>4. Quantum Computing<br>5. 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                                                             | Data Mining 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                                                                                                                                                                                                              | 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 Internship                                    |                                                                                                                                                                                                                                       | -  | - | -  | 2   |
| Total |                                                                               |                                                                                                                                                                                                                                       | 15 | 1 | 10 | 23  |
| MC    | Minor Course<br>(Student may select from the same specialized minors pool)    |                                                                                                                                                                                                                                       | 3  | 0 | 0  | 3   |
| MC    | Minor Course<br>A minimum of 12 week, 3 credit course through SWAYAM / NPTEL  |                                                                                                                                                                                                                                       | 3  | 0 | 0  | 3   |
| HC    | Honors Course<br>(Student may select from the same specialized honors pool)   |                                                                                                                                                                                                                                       | 3  | 0 | 0  | 3   |
| HC    | Honors Course<br>A minimum of 12 week, 3 credit course through SWAYAM / NPTEL |                                                                                                                                                                                                                                       | 3  | 0 | 0  | 3   |



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## B.Tech CSE (R23-COURSE STRUCTURE & SYLLABUS)

### B.Tech. III Year II Semester

| S.No                                                                                     | Category                                                                      | Title                                                                                                                                                                                                       | L         | T        | P         | C         |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|-----------|
| 1                                                                                        | Professional Core                                                             | Compiler Design                                                                                                                                                                                             | 3         | 0        | 0         | 3         |
| 2                                                                                        | Professional Core                                                             | Artificial Intelligence                                                                                                                                                                                     | 3         | 0        | 0         | 3         |
| 3                                                                                        | Professional Core                                                             | Cryptography & Network Security                                                                                                                                                                             | 3         | 0        | 0         | 3         |
| 4                                                                                        | Professional Elective-II                                                      | 1. Software Testing Methodologies<br>2. Cloud Computing<br>3. DevOps<br>4. Internet of Things<br>5. A minimum of 12 week MOOC Swayam / NPTEL course recommended by the BoS                                  | 3         | 0        | 0         | 3         |
| 5                                                                                        | Professional Elective-III                                                     | 1. Software Project Management<br>2. Mobile Adhoc & Sensor Networks<br>3. Big Data Analytics<br>4. Distributed Operating System<br>5. A minimum of 12 week MOOC Swayam/ NPTEL course recommended by the BoS | 3         | 0        | 0         | 3         |
| 6                                                                                        | Open Elective – II                                                            |                                                                                                                                                                                                             | 3         | 0        | 0         | 3         |
| 7                                                                                        | Professional Core                                                             | Artificial Intelligence Lab                                                                                                                                                                                 | 0         | 0        | 3         | 1.5       |
| 8                                                                                        | Professional Core                                                             | Compiler Design & Network Security Lab                                                                                                                                                                      | 0         | 0        | 3         | 1.5       |
| 9                                                                                        | Skill Enhancement course                                                      | Soft skills / SWAYAM Plus - 21st Century Employability Skills                                                                                                                                               | 0         | 1        | 2         | 2         |
| 10                                                                                       | Audit Course                                                                  | Technical Paper Writing & IPR                                                                                                                                                                               | 2         | 0        | 0         | -         |
| <b>Total</b>                                                                             |                                                                               |                                                                                                                                                                                                             | <b>20</b> | <b>1</b> | <b>08</b> | <b>23</b> |
| Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation |                                                                               |                                                                                                                                                                                                             |           |          |           |           |
| MC                                                                                       | Minor Course<br>(Student may select from the same specialized minors pool)    |                                                                                                                                                                                                             | 3         | 0        | 3         | 4.5       |
| MC                                                                                       | Minor Course<br>A minimum of 12 week, 3 credit course through SWAYAM / NPTEL  |                                                                                                                                                                                                             | 3         | 0        | 0         | 3         |
| HC                                                                                       | Honors Course<br>(Student may select from the same specialized honors pool)   |                                                                                                                                                                                                             | 3         | 0        | 0         | 3         |
| HC                                                                                       | Honors Course<br>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 Application



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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## B.Tech CSE (R23-COURSE STRUCTURE & SYLLABUS)

### B.Tech. IV Year I Semester

| S. No        | Category                                                                   | Title                                                                                                                                                                                                    | L         | T        | P         | C         |
|--------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|-----------|
| 1            | Professional Core                                                          | Machine Learning                                                                                                                                                                                         | 2         | 0        | 2         | 3         |
| 2            | Management Course- II                                                      | Human Resources & Project Management                                                                                                                                                                     | 2         | 0        | 0         | 2         |
| 3            | Professional Elective-IV                                                   | 1. Software Architecture & Design Patterns<br>2. Cyber Security<br>3. Augmented Reality & Virtual Reality<br>4. Deep Learning<br>5. A minimum of 12 week MOOC Swayam/NPTEL course recommended by the BoS | 3         | 0        | 0         | 3         |
| 4            | Professional Elective-V                                                    | 1. Agile Methodologies<br>2. Generative AI<br>3. Computer Vision<br>4. Cyber Physical Systems<br>5. A minimum of 12 week MOOC Swayam / NPTEL course recommended 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            | Internship                                                                 | Evaluation of Industry Internship /Mini Project                                                                                                                                                          | -         | -        | -         | 2         |
| <b>Total</b> |                                                                            |                                                                                                                                                                                                          | <b>18</b> | <b>2</b> | <b>02</b> | <b>21</b> |
| MC           | Minor Course<br>(Student may select from the same specialized minors pool) |                                                                                                                                                                                                          | 3         | 0        | 3         | 4.5       |
| HC           | Honors Course<br>( 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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**KAKINADA – 533 003, Andhra Pradesh, India**

**B.Tech CSE (R23-COURSE STRUCTURE & SYLLABUS)**

**B.Tech. IV Year II Semester**

| <b>S.No</b> | <b>Category</b>           | <b>Title</b>                            | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|-------------|---------------------------|-----------------------------------------|----------|----------|----------|----------|
| 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 (11<sup>th</sup> criteria, as per R23 Regulations); they are allowed to register one semester in advance



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**Open Electives, offered to other department students:**

Open Elective I: Principles of Operating Systems / Computer Organization and  
Architecture

Open Elective II: Principles of Database Management Systems / Data Structures for Data  
Science

Open Elective III: Object Oriented Programming through Java / Cyber Security

Open Elective IV: Principles of Software Engineering / Quantum Science & Technology



### 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

**Any three of the following courses in offline mode.**

- |                                                  |                       |
|--------------------------------------------------|-----------------------|
| 1. Principles of Software Engineering            | 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. Principles of Operating Systems               | 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
5. Discrete Mathematics for CS

#### Minor in Quantum Technologies

##### Mandatory Courses

- |                                                |         |
|------------------------------------------------|---------|
| Survey of Quantum Technologies and Application | 3-0-0-3 |
| Foundations of Quantum Technologies            | 3-0-0-3 |

##### Atleast one of the following is Mandatory

- |                                                  |         |
|--------------------------------------------------|---------|
| Basic Programming Lab                            | 2-0-2-3 |
| Basic Laboratory Course for Quantum Technologies | 2-0-2-3 |

##### Atleast one of the following is Mandatory

- |                                       |         |
|---------------------------------------|---------|
| Introduction to Quantum Computation   | 3-0-0-3 |
| Introduction to Quantum Communication | 3-0-0-3 |
| Introduction to Quantum Sensing       | 3-0-0-3 |
| Introduction to Quantum Materials     | 3-0-0-3 |

##### Optional / Additional Courses (at most two)

- |                                                 |         |
|-------------------------------------------------|---------|
| Engineering Foundations of Quantum Technologies | 3-0-0-3 |
| Solid State Physics for Quantum Technologies    | 3-0-0-3 |
| Quantum Optics                                  | 3-0-0-3 |
| Quantum Algorithms and Cryptography             | 3-0-0-3 |
| Quantum Cyber Security                          | 3-0-0-3 |
| Quantum Machine Learning                        | 3-0-0-3 |



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**COURSES OFFERED FOR HONORS DEGREE IN CSE**

- 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**

**Any three of the following courses in offline mode:**

|                                |         |
|--------------------------------|---------|
| 1. Principles of Secure Coding | 3-0-0-3 |
| 2. Recommender Systems         | 3-0-0-3 |
| 3. Blockchain Technology       | 3-0-0-3 |
| 4. Natural Language Processing | 3-0-0-3 |
| 5. High Performance Computing  | 3-0-0-3 |

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

|                                                                       |                                  |
|-----------------------------------------------------------------------|----------------------------------|
| 1. Social Network Analysis                                            | 12 Week 3 Credit Course, MOOCS   |
| 2. Applied Linear Algebra in AI & ML                                  | 12 Week 3 Credit Course, MOOCS   |
| 3. Design & Implementation of Human-Computer Interfaces – NPTEL MOOCS |                                  |
| 4. Privacy and Security in Online Social Media                        | 12 Week 3 Credit Course, MOOCS   |
| 5. Computer Vision                                                    | - 12 Week 3 Credit Course, MOOCS |
| 6. Applied Time-Series Analysis                                       | 12 Week 3 Credit Course, MOOCS   |
| 7. Parallel Computer Architecture                                     | 12 Week 3 Credit Course, MOOCS   |
| 8. Reinforcement Learning                                             | 12 Week 3 Credit Course, MOOCS   |
| 9. GPU Architecture and Programming                                   | 12 Week 3 Credit Course, MOOCS   |
| 10. Computational Complexity                                          | 12 Week 3 Credit Course, MOOCS   |
| 11. Quantum Algorithms and Cryptography                               | 12 Week 3 Credit Course, MOOCS   |
| 12. Unmanned Aerial Systems & Robotics                                | 12 Week 3 Credit Course, MOOCS   |



| III Year I Semester | DATA WAREHOUSING AND DATA MINING | L | T | P | C |
|---------------------|----------------------------------|---|---|---|---|
|                     |                                  | 3 | 0 | 0 | 3 |

**Pre-requisites:** Data Structures, Algorithms, Probability & Statistics, Data Base Management Systems

**Course Objectives:** The main objective of the course is to

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

**UNIT-I:**

**Data Warehousing and Online Analytical Processing:** Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Pattern Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1)

**UNIT II:**

**Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

**UNIT-III:**

**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

**UNIT-IV:**

**Association Analysis:** Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

**UNIT-V:**

**Cluster Analysis:** Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secing K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

**Text Books:**

1. Data Mining concepts and Techniques, 3<sup>rd</sup> edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.



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**Reference Books:**

1. Data Mining: Vikram Pudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3<sup>rd</sup> edition, Universities Press, 2013.
3. (NPTEL course by Prof. Pabitra Mitra)  
[http://onlinecourses.nptel.ac.in/noc17\\_mg24/preview](http://onlinecourses.nptel.ac.in/noc17_mg24/preview)
4. [http://www.saedsayad.com/data\\_mining\\_map.htm](http://www.saedsayad.com/data_mining_map.htm)



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

**Course Objectives:** The main objective of the course is 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, Atul Kahate
2. Computer Networks, Mayank Dave, CENGAGE



| III Year I Semester | FORMAL LANGUAGES AND<br>AUTOMATA THEORY | L | T | P | C |
|---------------------|-----------------------------------------|---|---|---|---|
|                     |                                         | 3 | 0 | 0 | 3 |

**Course Objectives:** The main objective of the course is to

- Learn fundamentals of Regular and Context Free Grammars and Languages
- Understand the relation between Regular Language and Finite Automata and machines, Contexts free Languages, PDA and TM
- Learn how to design Automata's and machines as Acceptors, Verifiers and Translators, PDA as acceptor and TM as Calculators

### **UNIT I**

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automata, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with  $\epsilon$ -Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

### **UNIT II**

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

### **UNIT III**

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols,  $\epsilon$ -Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

### **UNIT IV**

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

### **UNIT V**

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

### **Text Books:**

1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3<sup>rd</sup> Edition, Pearson, 2008
2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3<sup>rd</sup> Edition, PHI, 2007



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**Reference Books:**

1. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H., Pearson /PHI
2. Theory of Computation, V. Kulkarni, Oxford University Press, 2013
3. Theory of Automata, Languages and Computation, Rajendra kumar, McGraw Hill, 2014

**e-Resources:**

- 1) <https://nptel.ac.in/courses/106/104/106104028/>



| III Year I Semester | OBJECT ORIENTED ANALYSIS AND DESIGN | L | T | P | C |
|---------------------|-------------------------------------|---|---|---|---|
|                     |                                     | 2 | 1 | 0 | 3 |

**Course Objectives:** The main objective of the course is to

- Become familiar with all phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

#### UNIT I:

**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

#### UNIT II:

**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

#### UNIT III:

**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

#### UNIT IV:

**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

#### UNIT V:

**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

#### Text Books:

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

#### Reference Books:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, McGraw-Hill. .



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4. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.



| III Year I Semester | DESIGN AND ANALYSIS OF<br>ALGORITHMS | L | T | P | C |
|---------------------|--------------------------------------|---|---|---|---|
|                     |                                      | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objective of the course is to

- Understand, analyze and denote time complexities of algorithms
- Introduce the different algorithmic approaches for problem solving through numerous example problems
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
- Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**UNIT I:**

Introduction: Algorithm- introduction, Algorithm characteristics, Pseudo code Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Probabilistic Complexity, Asymptotic Notation, Practical Complexities, Big and little- O notations.

**UNIT II:**

Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort. The Greedy Method: The general Method, knapsack problem, Job sequencing with deadlines, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.

**UNIT III:**

Dynamic Programming: General Method, Travelling Sales Person Problem, 0/1 Knapsack Problem, Optimal Binary Search Tree, Matrix Chain Multiplication, All pairs-shortest paths Floyd-Warshall algorithm for shortest path, String Editing, Reliability Design,.

**UNIT IV:**

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.

Branch and Bound: The Method, Least cost (LC) Search, The 15- Puzzle: an Example, Control Abstraction for LC-Search.

**UNIT V:**

Bounding, FIFO Branch and-Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling Salesperson problem, Introduction to NP-Hard and NP- Completeness - Decision Trees - P, NP and NP – Complete Problems - Cook's theorem.

**Text Books:**

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2<sup>nd</sup> Edition, Universities Press.
2. Introduction to Algorithms Thomas H. Cormen, PHI Learning

**Reference Books:**

1. Harsh Bhasin, “Algorithms Design & Analysis”, Oxford University Press.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “The Design and Analysis of



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Computer Algorithms”, Pearson Education India, 1 January 2004.

3. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press.



| III Year I Semester | MICROPROCESSORS &<br>MICROCONTROLLERS | L | T | P | C |
|---------------------|---------------------------------------|---|---|---|---|
|                     |                                       | 3 | 0 | 0 | 3 |

**Course Objectives:** The main objectives of the course are to

- Introduce fundamental architectural concepts of microprocessors and microcontrollers.
- Introduce 16 bit and 32 bit microcontrollers, impart knowledge on addressing modes and instruction set of 8086 and 8051
- Introduce assembly language programming concepts and explain memory and I/O interfacing with 8086 and 8051

**UNIT I:**

**8086 Architecture:** Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

**UNIT II:**

**8086 Programming:** Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

**UNIT III:**

**8086 Interfacing:** Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

**UNIT IV:**

Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

**UNIT V:**

Interfacing Microcontroller, Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**Textbooks:**

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3<sup>rd</sup> Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3<sup>rd</sup> edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2<sup>nd</sup> edition, Pearson, 2012.

**Reference Books:**

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6<sup>th</sup> edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3<sup>rd</sup> edition, Cengage Learning, 2004.



| III Year I Semester | QUANTUM COMPUTING | L | T | P | C |
|---------------------|-------------------|---|---|---|---|
|                     |                   | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objectives of the course is 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



| III Year I Semester | DATA MINING LAB | L | T | P | C   |
|---------------------|-----------------|---|---|---|-----|
|                     |                 | 0 | 0 | 3 | 1.5 |

**Pre-requisites:** Data Base Management Systems, Python Programming

**Course Objectives:** The main objective of the course is to

- Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasize hands-on experience working with all real data sets.
- Test real data sets using popular data mining tools such as WEKA, Python Libraries
- Develop ability to design various algorithms based on data mining tools.

**Software Requirements:** WEKA Tool/Python/R-Tool/Oracle Data mining

**List of Experiments:**

1. Creation of a Data Warehouse.
  - Build Data Warehouse/Data Mart (using open source tools like Microsoft-SSIS)
  - Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
  - Write ETL scripts and implement using data warehouse tools.
  - Perform Various OLAP operations such slice, dice, roll up, drill up and pivot
2. Explore machine learning tool “WEKA”
  - Explore WEKA Data Mining/Machine Learning Toolkit.
  - Downloading and/or installation of WEKA data mining toolkit.
  - Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
  - Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
  - Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
  - Load each dataset and observe the following:
    1. List the attribute names and they types
    2. Number of records in each dataset
    3. Identify the class attribute (if any)
    4. Plot Histogram
    5. Determine the number of records for each class.
    6. Visualize the data in various dimensions
3. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
  - Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
  - Load weather. nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values.
  - Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.



- Derive interesting insights and observe the effect of discretization in the rule generation process.
4. Demonstrate performing classification on data sets Weka
    - Load each dataset and run Id3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
    - Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
    - Load each dataset and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
    - Plot RoC Curves
    - Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.
  5. Demonstrate performing clustering of data sets
    - Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters).
    - Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
    - Explore other clustering techniques available in Weka.
    - Explore visualization features of Weka to visualize the clusters. Derive interesting insights and explain.
  6. Demonstrate knowledge flow application on data sets into Weka
    - Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms
    - Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm
    - Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree
  7. Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations
  8. Write a program to calculate chi-square value using Python/R. Report your observation.
  9. Write a program of Naive Bayesian classification using Python/R programming language.
  10. Write a program to cluster your choice of data using simple k-means algorithm using JDK
  11. Write a program of cluster analysis using simple k-means algorithm using Python/R programming language.
  12. Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python
  13. Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)



| III Year I Semester | COMPUTER NETWORKS LAB | L | T | P | C   |
|---------------------|-----------------------|---|---|---|-----|
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**Course Objectives:**

The main objectives of the course are to learn 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 Year I Semester | FULL STACK DEVELOPMENT - 2 | L | T | P | C |
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### 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

- a. Write a program to work with props and states.



- b. Write a program to add styles (CSS & Sass Styling) and display data.
- c. Write a program for responding to events.

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

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

**8. ReactJS – React Router, Updating the Screen**

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

**9. ReactJS – Hooks, Sharing data between Components**

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

**10. MongoDB – Installation, Configuration, CRUD operations**

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

**11. MongoDB – Databases, Collections and Records**

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

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

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

**Text Books:**

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasanth Subramanian, 2<sup>nd</sup> edition, APress, O'Reilly.
2. Node.js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
3. React Quickly, Azat Mardan, Manning Publications (Chapters 1-8, 12-14)

**Web Links:**

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



| III Year I Semester | USER INTERFACE DESIGN USING<br>FLUTTER | L | T | P | C |
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**Course Objectives:** The main objectives of the course are to

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widges 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 1<sup>st</sup> Edition, Apres
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.



| III Year II Semester | COMPILER DESIGN | L | T | P | C |
|----------------------|-----------------|---|---|---|---|
|                      |                 | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objectives of the course are to understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

**UNIT I:**

**Lexical Analysis:** Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

**Syntax Analysis:** The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring,

**UNIT II:**

**Top Down Parsing:** Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

**Bottom Up Parsing:** Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

**UNIT III:**

**Syntax Directed Translation:** Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

**UNIT IV:**

**Code Optimization:** The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

**UNIT V:**

**Run Time Environments:** Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

**Code Generation:** Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

**Text Books:**

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson, 2007.

**Reference Books:**

1. Compiler Construction, Principles and Practice, Kenneth C Loudon, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.



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3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990



| III Year II Semester | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|----------------------|-------------------------|---|---|---|---|
|                      |                         | 3 | 0 | 0 | 3 |

**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:**

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

**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-Adversarial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

**UNIT - III**

**Knowledge Representation:** 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 Dempstershafer theory.

**UNIT - IV**

**Mathematical Logic:** 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, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

**UNIT - V**

**Expert Systems:** Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

**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)”, Mc Graw Hill



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**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](https://swayam.gov.in/nd1_noc19_me71/preview)



| III Year II Semester | CRYPTOGRAPHY & NETWORK<br>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, 3<sup>rd</sup> Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4<sup>th</sup> Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1<sup>st</sup> Edition, Keith M.Martin, Oxford,2016

### Reference Books:

1. Network Security and Cryptography, 1<sup>st</sup> Edition, Bernard Meneges, Cengage Learning,2018



| III Year II Semester | SOFTWARE TESTING<br>METHODOLOGIES | L | T | P | C |
|----------------------|-----------------------------------|---|---|---|---|
|                      |                                   | 3 | 0 | 0 | 3 |

**Course Objectives:** 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 – Baris Beizer, 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 Year II Semester | CLOUD COMPUTING | L | T | P | C |
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**Course Objectives:** The main objectives of the course are to

- Explain the evolving utility computing model called cloud computing and 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, 2<sup>nd</sup> edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, 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, 2<sup>nd</sup> 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 Year 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.



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#### **Text Books:**

1. Joyner, Joseph, DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and It Professionals, 1<sup>st</sup> Edition Mihails Konoplow, 2015.
2. Alisson Machado de Menezes, Hands-on DevOps with Linux, 1<sup>st</sup> 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, 1<sup>st</sup> Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2<sup>nd</sup> edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952



| III Year II Semester | INTERNET OF THINGS | L | T | P | C |
|----------------------|--------------------|---|---|---|---|
|                      |                    | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objective of the course is to introduce the application areas of IOT, revolution of Internet in Mobile Devices, Cloud & Sensor Networks, building blocks of Internet of Things and characteristics

**UNIT I:**

Predecessors of IoT: Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT

**UNIT II:**

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

**UNIT III:**

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth

IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.

**UNIT IV:**

IoT Interoperability: Introduction, Standards, Frameworks

Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing

**UNIT V:**

Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT

IoT Case Studies: Agricultural IoT, Vehicular IoT

**Text Books:**

1. Introduction to IoT, Sudip Misra, Anandarup Mukhaerjee, Arjit Roy, Cambridge University Press, 2021
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education

**Reference Books:**

1. Fog and Edge Computing: Principles and Paradigms, RajkumarBuyya (Editor), Satish narayanaSrirama (Editor), ISBN: 978-1-119-52498-4, January 2019
2. Getting Started with the Internet of Things, CunoPfister, O'Reilly



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



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**Reference Books:**

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



| III Year II 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 Ambiga Dhiraj, 1<sup>st</sup> 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



| III Year II Semester | DISTRIBUTED OPERATING SYSTEM | L | T | P | C |
|----------------------|------------------------------|---|---|---|---|
|                      |                              | 3 | 0 | 0 | 3 |

### Course Objectives:

The main objective of the course is to introduce design issues and different message passing techniques in DOS, distributed systems, RPC implementation and its performance in DOS, distributed shared memory and resource management, distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors

### Unit I:

**Fundamentals:** Definition of Distributed Computing Systems. Evolution of Distributed Computing System; Distributed Computing System Models; Distributed Operating System, Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment(DCE).

**Message Passing:** Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

### Unit II:

**Remote Procedure Calls:** Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC

### Unit III:

**Distributed Shared Memory:** Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

### Unit IV:

**Resource Management:** Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

### Unit V:

**Distributed File Systems:** Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

### Text books

1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI, 2007.

### Reference Books:

1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015



| III Year II Semester | ARTIFICIAL INTELLIGENCE LAB | L | T | P | C   |
|----------------------|-----------------------------|---|---|---|-----|
|                      |                             | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

The main objective of the course is to provide students with hands-on experience and practical skills in AI technologies, fostering innovation and research, and enabling them to solve real-world problems using AI

**List of Experiments:**

1. Introduction of various Python libraries used for Artificial Intelligence.
2. Write a Python Program to implement Uninformed Search Technique: Breadth First Search
3. Write a Python Program to implement Uninformed Search Technique: Depth First Search
4. Write a Python Program to implement Informed Search Technique: A\* Algorithm
5. Write a Python Program to implement Informed Search Technique: AO\* Algorithm
6. Write a Python Program to implement Local Search Technique: Hill Climbing Algorithm
7. Write a Python Program to implement Game Playing Algorithms: Minimax and Alpha Beta Pruning
8. Create a Chatbot in Python
9. Write a Program to Implement N-Queens Problem using Python
10. Write a Program to Implement Missionaries Cannibals Problems using Python



| III Year II Semester | COMPILER DESIGN & NETWORK<br>SECURITY LAB | L | T | P | C   |
|----------------------|-------------------------------------------|---|---|---|-----|
|                      |                                           | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

The main objectives of the course is to learn basic understanding of compiler design, cryptography some key encryption techniques and implementing parsers, encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

**List of Experiments:**

**Compiler Design Lab:**

1. Write a C program to identify different types of Tokens in a given Program.
2. Write a C program to Simulate Lexical Analyzer to validating a given input String.
3. Write a C program to implement the Brute force technique of Top down Parsing.
4. Write a C program to implement a Recursive Descent Parser.
5. Write C program to compute the First and Follow Sets for the given Grammar.
6. Write a C program for eliminating the left recursion and left factoring of a given grammar
7. Write a C program to check the validity of input string using Predictive Parser.
8. Write a C program for implementation of LR parsing algorithm to accept a given input string.

**Network Security Lab:**

1. Write a C program that contains a string (char pointer) with a value 'Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello World'. The program should AND, OR and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
  - Ceaser Cipher
  - Substitution Cipher
  - Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a JAVA program to implement the BlowFish algorithm logic
6. Write a JAVA program to implement the Rijndael algorithm logic.
7. Write a Java program to implement RSA Algorithm
8. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.



| III Year II Semester | SOFT SKILLS | L | T | P | C |
|----------------------|-------------|---|---|---|---|
|                      |             | 0 | 1 | 2 | 2 |

**Course Objectives:** The main objectives of the course is to

- Equip the students with the skills to effectively communicate in English and 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](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”, 1<sup>st</sup> 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”, 2<sup>nd</sup> 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 Year I Semester | MACHINE LEARNING | L | T | P | C |
|--------------------|------------------|---|---|---|---|
|                    |                  | 2 | 0 | 2 | 3 |

**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), Backpropagation 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.

**List of Experiments:**

**Requirements:** Develop the following program using Anaconda/Jupyter/Spider and evaluate ML models.



**Experiment-1:**

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

**Experiment-2:**

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

**Experiment-3:**

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

**Experiment-4:**

Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

**Experiment-5:** Develop a program for Bias, Variance, Remove duplicates , Cross Validation

**Experiment-6:** Write a program to implement Categorical Encoding, One-hot Encoding

**Experiment-7:**

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

**Experiment-8:**

Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

**Experiment-9:** Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**Experiment-10:**

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

**Experiment-11:** Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

**Experiment-12:** Exploratory Data Analysis for Classification using Pandas or Matplotlib.

**Experiment-13:**

Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

**Experiment-14:**

Write a program to Implement Support Vector Machines and Principle Component Analysis



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**Experiment-15:**

Write a program to Implement Principle Component Analysis

**Text Books:**

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

**Reference Books:**

1. “Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2. “Machine Learning in Action”, Peter Harrington, Dream Tech
3. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7<sup>th</sup> Edition, 2019.



| IV Year I Semester | HUMAN RESOURCES &<br>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, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
2. Sharon Pande and Swapnalekha Basak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.
3. Stewart R. Clegg, Torgeir Skyttermoen, 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”, 4<sup>th</sup> edition, Himalaya Publications, 2018.
5. Lalitha Balakrishnan, Gowri, “Project Management”, Himalaya publishing house, New Delhi, 2022.



| IV Year I Semester | SOFTWARE ARCHITECTURE &<br>DESIGN PATTERNS | L | T | P | C |
|--------------------|--------------------------------------------|---|---|---|---|
|                    |                                            | 3 | 0 | 0 | 3 |

**Course Objectives:** The main objectives of the course are to

- Understand the basic concepts to identify state behavior of real world objects
- Apply Object Oriented Analysis and Design concepts to solve complex problems
- Construct various UML models using the appropriate notation for specific problem context
- Design models to Show the importance of systems analysis and design in solving complex problems using case studies
- Study of Pattern Oriented approach for real world problems

#### UNIT – I:

**Introduction:** Design pattern, Describing design patterns, the catalog of design pattern, organizing the catalog, design patterns solving design problems, selecting a design pattern, using a design pattern, object oriented development, key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

#### UNIT – II:

**Analysis a System:** Overview of the analysis phase, stage 1-gathering the requirements, functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation.

#### UNIT – III:

**Design Pattern Catalog:** Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

#### UNIT – IV:

**Interactive systems and the MVC architecture:** Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

#### UNIT – V:

**Designing with Distributed Objects:** Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

#### Text Books:

1. Object Oriented Analysis, Design and Implementation, Brahma Dathan, Sarnath Rammath , Universities Press, 2013
2. Design Patterns, Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, PEARSON Publication, 2013

#### Reference Books:

1. Frank Bachmann, Regine Meunier, Hans Rohnert “Pattern Oriented Software Architecture”, Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998



| IV Year I Semester | CYBER SECURITY | L | T | P | C |
|--------------------|----------------|---|---|---|---|
|                    |                | 3 | 0 | 0 | 3 |

**Course Objectives:**

The aim of the course is to

- Identify security risks and take preventive steps
- Understand the forensics fundamentals, evidence capturing process and preservation of digital evidence

**UNIT I:**

**Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/CellPhones, Network and Computer Attacks.

**UNIT II:**

**Tools and Methods :** Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

**UNIT III:**

**Cyber Crime Investigation:** Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

**UNIT IV:**

**Computer Forensics and Investigations:** Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

**UNIT V:**

**Cyber Crime Legal Perspectives:** Introduction, Cybercrime and the Legal Landscape around the World, The Indian ITAct, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian ITAct, Amendments to the Indian ITAct, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.

**Text Books:**

1. Sunit Belapure Nina Godbole “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.



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**Reference Books:**

1. Michael T. Simpson, Kent Backman and James E. Corley, “Hands on Ethical Hacking and Network Defence”, Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar “Cyber Security and Cyber Laws” , Cengage,2018.

**E-Resources:**

1. CERT-In Guidelines- <http://www.cert-in.org.in/>
2. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> [ Online course]
3. <https://computersecurity.stanford.edu/free-online-videos> [ Free Online Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu> License: Creative CommonsBY-NC-SA.



| IV Year I Semester | AUGMENTED REALITY & VIRTUAL REALITY | L | T | P | C |
|--------------------|-------------------------------------|---|---|---|---|
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**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, 1<sup>st</sup> 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”, Sanni Siltanen, 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 | DEEP LEARNING | L | T | P | C |
|--------------------|---------------|---|---|---|---|
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**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, Yoshua Bengio and Aaron Courville, MIT Press, 2017
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s):



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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](https://onlinecourses.nptel.ac.in/noc22_cs22/preview)



| IV Year I Semester | AGILE METHODOLOGIES | L | T | P | C |
|--------------------|---------------------|---|---|---|---|
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### 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 | GENERATIVE AI | L | T | P | C |
|--------------------|---------------|---|---|---|---|
|                    |               | 3 | 0 | 0 | 3 |

**Course Objectives:**

The objectives of the course are to introduce the basics of Generative AI, Text Generation, the process of generating videos and GAN & variants.

**UNIT I :**

Introduction To Gen AI: Historical Overview of Generative modeling, 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, GPT 4 All, 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.



| IV Year I 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), 4<sup>th</sup> 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.



| IV Year I Semester | CYBER PHYSICAL SYSTEMS | L | T | P | C |
|--------------------|------------------------|---|---|---|---|
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**Course Objectives:**

The main objectives of the course are to

- Introduce the core principles behind Cyber Physical Systems,
- Identify Security mechanisms of Cyber physical system,
- Describe Synchronization in Distributed Cyber-Physical Systems

**UNIT I:**

**Symbolic Synthesis for Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

**UNIT II:**

**Security of Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

**UNIT III:**

**Synchronization in Distributed Cyber-Physical Systems:** Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

**UNIT IV:**

**Real-Time Scheduling for Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques, Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

**UNIT V:**

**Model Integration in Cyber-Physical Systems:** Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

**Text Books:**

1. Raj Kumar, Dionisio De Niz, Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press

**Reference Books:**

1. E.A.Lee, Sanjit Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, MIT Press
2. Andre Platzer, Logical Foundations of Cyber-Physical Systems, 2e, Springer Publishing, 2018



| IV Year I Semester | PROMPT ENGINEERING<br>(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, 1<sup>st</sup> Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1<sup>st</sup> Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar, 2015

**Reference Books:**

1. Indian Constitution Law, 7<sup>th</sup> Edition, M. P. Jain, Lexis Nexis, 2014



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## **Open Electives**

Offered to other department students



| III Year I Semester | PRINCIPLES OF OPERATING<br>SYSTEMS<br>(Open Elective I) | L | T | P | C |
|---------------------|---------------------------------------------------------|---|---|---|---|
|                     |                                                         | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

**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.

**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.

**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.

**Text Books:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson , 2016

**Reference Books:**

1. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3<sup>rd</sup> 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 Year I Semester | COMPUTER ORGANIZATION AND<br>ARCHITECTURE<br>(Open Elective I) | L | T | P | C |
|---------------------|----------------------------------------------------------------|---|---|---|---|
|                     |                                                                | 3 | 0 | 0 | 3 |

**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

**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 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:**



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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, 7<sup>th</sup> ed., William Stallings, PHI, 2006
4. Structured Computer Organization, Andrew S. Tanenbaum, 4<sup>th</sup> Edition, PHI/Pearson.



| III Year II Semester | PRINCIPLES OF DATABASE<br>MANAGEMENT SYSTEMS<br>(Open Elective II) | L | T | P | C |
|----------------------|--------------------------------------------------------------------|---|---|---|---|
|                      |                                                                    | 3 | 0 | 0 | 3 |

**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
- Introduce the concepts of SQL
- 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 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. [Text Book -2]

**UNIT II:**

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Extended ER features [Text Book -1]

**UNIT III:**

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views [Text Book -1]]

**UNIT IV:**

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. [Text Book -1]

**UNIT V:**

**Normal Forms:** Introduction to Schema Refinement, Functional Dependencies, Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization. [Text Book -1]

**Text Books:**

- 1) Database Management Systems, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4,5)
- 2) Database System Concepts, 6<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)



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**Reference Books:**

- 1) Introduction to Database Systems, 8<sup>th</sup> edition, C J Date, Pearson.
- 2) Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, 10<sup>th</sup> edition, Corlos 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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview)



| III Year II Semester | DATA STRUCTURES FOR DATA<br>SCIENCE<br>(Open Elective II) | L | T | P | C |
|----------------------|-----------------------------------------------------------|---|---|---|---|
|                      |                                                           | 3 | 0 | 0 | 3 |

**Course Objectives:** The main objectives of the course are to

- Introduce fundamental data structures using Python in the context of data science.
- Develop problem-solving skills through structured data organization.
- Explore real-world data scenarios using appropriate data structures.
- Demonstrate how data structures influence the performance of data processing tasks.
- Prepare students for data analysis using structured and unstructured data.

#### UNIT I:

Introduction to Data Structures and Python Refresher: Python refresher: variables, data types, control structures, functions; Importance of data structures in data science; Introduction to complexity: time and space; Built-in Python data structures: lists, tuples, dictionaries, sets; Case Study: Handling simple datasets (CSV files) using lists and dictionaries.

#### UNIT II:

Linear Data Structures: Arrays vs Lists in Python; Stacks and Queues: concepts, operations, and use cases. Linked Lists: singly and doubly linked lists. Applications in parsing data streams and data preprocessing. Practical: Simulating real-world queues (e.g., customer service, job scheduling).

#### UNIT III:

Non-Linear Data Structures: Trees: binary trees, binary search trees, introduction to decision trees. Graphs: representation using adjacency list/matrix, traversal (BFS, DFS). Use in social networks, recommendation systems, clustering; Visualization with libraries: networkx, matplotlib.

#### UNIT IV:

Searching, Sorting, and Hashing: Linear and Binary Search. Sorting algorithms: bubble, selection, insertion, merge, quick (overview and applications). Hashing: concepts, hash functions, collisions, and resolution strategies; Applications: fast lookups in datasets, data indexing.

#### UNIT V:

Data Structures for Data Science Applications: Working with tabular data using Pandas DataFrame. Hierarchical data: JSON, XML – parsing and storing using trees/dictionaries. Time series data and sliding window techniques. Case Studies: Analyzing sensor data from IoT devices. Real-world data wrangling using Pandas and Numpy. Mini project: Data structure-based solution for a small data science problem.

#### Text Books :

1. “Problem Solving with Algorithms and Data Structures using Python” – Brad Miller and David Ranum
2. “Data Structures and Algorithms in Python” – Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser

#### Reference Books:

1. “Python for Data Analysis” – Wes McKinney



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**Online resources:**

GeeksforGeeks, LeetCode, Kaggle datasets



| IV Year I Semester | OBJECT ORIENTED PROGRAMMING<br>THROUGH JAVA<br>(Open Elective III) | L | T | P | C |
|--------------------|--------------------------------------------------------------------|---|---|---|---|
|                    |                                                                    | 3 | 0 | 0 | 3 |

**Course Objectives:**

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Introduce the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Introduce how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Describe how to design applications with threads and 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, 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, Autoboxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

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

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

#### **UNIT V:**

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

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

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

#### **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. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4<sup>th</sup> 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

#### **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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)



| IV Year I Semester | CYBER SECURITY<br>(Open Elective III) | L | T | P | C |
|--------------------|---------------------------------------|---|---|---|---|
|                    |                                       | 3 | 0 | 0 | 3 |

**Course Objectives:**

The aim of the course is to

- Identify security risks and take preventive steps
- Understand the forensics fundamentals, the evidence capturing process and the preservation of digital evidence

**UNIT I:**

**Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/CellPhones, Network and Computer Attacks.

**UNIT II:**

**Tools and Methods :** Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

**UNIT III:**

**Cyber Crime Investigation:** Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

**UNIT IV:**

**Computer Forensics and Investigations:** Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

**UNIT V:**

**Cyber Crime Legal Perspectives:** Introduction, Cybercrime and the Legal Landscape around the World, The Indian ITAct, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian ITAct, Amendments to the Indian ITAct, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.

**Text Books:**

1. Sunit Belapure Nina Godbole “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.



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**Reference Books:**

1. Michael T. Simpson, Kent Backman and James E. Corley, “Hands on Ethical Hacking and Network Defence”, Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar “Cyber Security and Cyber Laws” , Cengage,2018.

**E-Resources:**

1. CERT-In Guidelines- <http://www.cert-in.org.in/>
2. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> [ Online course]
3. <https://computersecurity.stanford.edu/free-online-videos> [ Free Online Videos]
4. NickolaiZeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu> License:Creative CommonsBY-NC-SA.



| IV Year I Semester | PRINCIPLES OF SOFTWARE<br>ENGINEERING<br>(Open Elective IV) | 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, 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, characterizing 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, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

### UNIT V:

**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 reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.



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**Text Books:**

1. Fundamentals of Software Engineering, Rajib Mall, 5<sup>th</sup> Edition, PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9<sup>th</sup> Edition, Mc-Graw Hill International Edition.

**Reference Books:**

1. Software Engineering, Ian Sommerville, 10<sup>th</sup> 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](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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)



| IV Year I Semester | QUANTUM SCIENCE & TECHNOLOGY<br>(Open Elective IV) | L | T | P | C |
|--------------------|----------------------------------------------------|---|---|---|---|
|                    |                                                    | 3 | 0 | 0 | 3 |

**Prerequisites:** Basic Physics, Linear Algebra, and Introduction to Modern Physics

**Course Objectives:** The main objectives of the course are to

- Introduce fundamental concepts of quantum mechanics and its mathematical formalism.
- Explore quantum computing and communication principles and technologies.
- Understand the physical implementation and limitations of quantum systems.
- Enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
- Familiarize students with the emerging trends in quantum technologies.

#### Unit I:

**Fundamentals of Quantum Mechanics:** Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrödinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian;

#### Unit II:

**Quantum Information Theory:** Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states and EPR paradox; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation;

**Unit III: Quantum Computing:** Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance);

#### Unit IV:

Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, and Shor's 9-qubit code; Introduction to quantum programming: Qiskit, Cirq, IBM Quantum Experience (overview)

#### Unit V:

**Quantum Technologies and Applications:** Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era; Global initiatives: IBM, Google, D-Wave, IonQ, India's NQM; Ethical concerns and future prospects

#### Text Books:

1. "Quantum Computation and Quantum Information", Michael A. Nielsen, Isaac L. Chuang
2. "Quantum Mechanics: Concepts and Applications", Nouredine Zettili



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# **Minor in CSE**



| PRINCIPLES OF 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, 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, How to 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, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

### UNIT V:

**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 reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.



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**Text Books:**

1. Fundamentals of Software Engineering, Rajib Mall, 5<sup>th</sup> Edition, PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9<sup>th</sup> Edition, Mc-Graw Hill International Edition.

**Reference Books:**

1. Software Engineering, Ian Sommerville, 10<sup>th</sup> 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](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](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)



| PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS | L | T | P | C   |
|-------------------------------------------|---|---|---|-----|
|                                           | 3 | 0 | 3 | 4.5 |

**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 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, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

**Reference Books:**

- 1) Introduction to Database Systems, 8<sup>th</sup> edition, C J Date, Pearson.
- 2) Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, 10<sup>th</sup> 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](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.
8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURES.



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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 Science domain
- 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](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, Sahni Sartaj, Mehta, Dinesh, 2<sup>nd</sup> Edition, Universities Press



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2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2<sup>nd</sup> 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/>



| PRINCIPLES OF OPERATING SYSTEMS | L | T | P | C |
|---------------------------------|---|---|---|---|
|                                 | 3 | 0 | 0 | 3 |

**Course Objectives:**

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

**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.

**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.

**Text Books:**

3. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
4. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson , 2016

**Reference Books:**

2. Operating Systems: A Concept Based Approach, D.M Dhamdhare, 3<sup>rd</sup> Edition,



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McGraw- Hill, 2013

**Online Learning Resources:**

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



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**B.Tech CSE (R23-COURSE STRUCTURE & SYLLABUS)**

# **Minor in Quantum Technologies**



| SURVEY OF QUANTUM TECHNOLOGIES AND APPLICATION | L | T | P | C |
|------------------------------------------------|---|---|---|---|
|                                                | 3 | 0 | 0 | 3 |

### Course Objectives:

This course is meant to give an overview of the field of quantum technologies and make the students familiar with the state-of-the-art in all four verticals. The emphasis is not on depth in this course, but on covering the exciting aspects of the field.

#### UNIT – 1:

##### **Quantum Technologies – four verticals:** Motivation for Quantum Technologies

A qualitative overview of salient aspects of quantum physics: Quantum States, Wave functions, Probabilistic interpretation, Physical observables, Hermitian operators, expectation values,

Heisenberg uncertainty principle, Schrodinger equation, Time evolution; distinction from classical physics; Heuristic description of Superposition, Tunnelling and entanglement; No cloning theorem; Simulating classical systems – Feynman’s idea of a quantum simulator and the birth of the field.

#### UNIT-II:

**Quantum Computation:** Basics of qubits -- How is it different from a classical bit. – Review of classical logic gates; Di Vincenzo criteria for realizing qubits; Basics of qubit gates and quantum circuits; Physical implementation of qubits (very qualitative description); Solid State Qubits: Semiconducting Qubits – quantum dots, spins, Superconducting Qubits – charge, flux and phase, Topological Qubits – proposals and advantages;

Atoms and Ions: Trapped ions, Rydberg atoms, Neutral atoms; Photonic Qubits: Conventional linear optical setups, Integrated Photonics; NMR qubits: Conventional NMR qubits, NV centres

Overview of applications and recent achievements: RSA and Shor’s algorithm, Quantum Advantage; Long term goals and strategies being followed :Error correction

#### UNIT-III:

**Quantum Sensing:** Basics of quantum sensing, Basics of Photon (single and entangled) generation and detection, Gravimetry, Atomic clock, Magnetometry, State of the art in Quantum Sensing

#### UNIT-IV:

**Quantum Communications:** Basics of digital communication, Quantifying classical information – Shannon entropy, Basic ideas of quantum communication, security, eavesdropping, Overview of quantum communication achievements :Terrestrial – fibre-based, Free space, Satellite-based

#### UNIT-V:

**Introduction to Quantum Materials:** What are quantum materials, Why are they important, Applications (quantum computing, spintronics, etc.)

Overview of Key Classes of Quantum Materials: Topological Insulators, Superconductors, Mott Insulators, 2D Materials and Quantum Spin Liquids.

### Course References:

1. Quantum Information Science – Manenti R., Motta M., 1st Edition, Oxford University Press (2023)



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2. Quantum computation and quantum information – Nielsen M. A., and Chuang I. L., 10th Anniversary edition, Cambridge University Press (2010)
3. Elements of Quantum Computation and Quantum Communication, A. Pathak, Boca Raton, CRC Press (2015)
4. An Introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, and Michele Mosca, Oxford University Press (2006)
5. Quantum computing explained, David McMahon, Wiley (2008)



| FOUNDATIONS OF QUANTUM TECHNOLOGIES | L | T | P | C |
|-------------------------------------|---|---|---|---|
|                                     | 3 | 0 | 0 | 3 |

### Course Objectives:

This course is meant for laying down the central theoretical aspects of quantum mechanics in a rigorous manner where students learn the techniques and develop a good intuition for quantum physics.

### UNIT-I:

Brief overview of classical physics (This segment is meant for the student to understand what a Hamiltonian is, which will feature later in quantum mechanics) : Hamiltonian function and Hamilton's equations, Phase-space description of a system, Connection and Equivalence with Newton's laws for simple systems – free particle, particle moving in a conservative potential, examples of Harmonic oscillator, hydrogen atom

Historical evolution of quantum mechanics: Planck's quantum hypothesis, Photo electric effect, Atomic spectra, Bohr's quantisation principle, De Broglie's Wave particle duality

### UNIT-II:

Postulates of Quantum Mechanics: State vectors and Hilbert Space, Dirac Bra-Ket notation, Measurables and Hermitian Operators, Unitary Transformations, Schrodinger Equation and Time evolution of quantum states, Measurement Postulate, Schrodinger, Heisenberg and Interaction pictures, Eigen values, Expectation values and Matrix elements, Heisenberg's Uncertainty principle

### UNIT-III:

Density operator formalism of quantum mechanics – pure and mixed states; Superposition and Entanglement in quantum mechanics; No cloning theorem; Applications of postulates – Particle in a box, Hydrogen atom, Harmonic Oscillator

Number states, ladder operators and Coherent states of a harmonic oscillator; Spin and Angular momentum – spin half particles; Rabi problem of a spin-half particle in a rotating magnetic field; Bosons and Fermions

### UNIT-IV:

Statistical Physics: Quick review of first and second laws of thermodynamics, Thermal Equilibrium and Gibbs principle, Applying Gibbs principle to Classical and Quantum harmonic oscillators, Bosons and Fermions and Quantum statistics – Fermi-Dirac and Bose-Einstein distributions

### UNIT - V:

Information Science: Digital communication and information: Quantifying information in terms of Shannon entropy; Basic ideas of quantum information; Decoherence and noise; Introductory ideas of Kraus operators

Brief overview of Computational Complexity: Qualitative ideas of a Turing machine: Types of Turing machines; Time and Space complexity – P vs NP, PSPACE; Quantum complexity classes – Q, EQP, BQP, BPP, QMA; Post Quantum Cryptography (PQC)

### Course References:

- 1.Introduction to Quantum Mechanics, Griffiths D. J., 3rd Edition, Cambridge University Press (2024)
- 2.Introduction to Electrodynamics, Griffiths D. J., 4th edition, Cambridge University Press(2020)



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- 3.Principles of Quantum Mechanics, Shankar, R., 2nd edition, Springer (2014)
- 5.Quantum Information Science – Manenti R., Motta M., 1st Edition, Oxford University Press (2023)
- 6.Quantum computation and quantum information – Nielsen M. A., and Chuang I. L., 10<sup>th</sup> Anniversary edition, Cambridge University Press (2010)
- 7.A Pathak, Elements of Quantum Computation and Quantum Communication, Boca Raton, CRC Press (2015)
- 8.Information Theory, Robert B. Ash, Dover Publications (2003)
- 9.Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage India Pvt. Ltd.(2014)
10. Statistical Mechanics, Pathria R. K., Paul D. Beale, 4th edition, Academic Press, (2021)



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**The Syllabus of the following courses will be communicated soon.**

- Basic Programming Lab
- Basic Laboratory Course For Quantum Technologies
- Introduction To Quantum Computation
- Introduction To Quantum Communication
- Introduction To Quantum Sensing
- Introduction To Quantum Materials
- Engineering Foundations Of Quantum Technologies
- Solid State Physics For Quantum Technologies
- Quantum Optics
- Quantum Cyber Security
- Quantum Machine Learning



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## **Honor in CSE**



| PRINCIPLES OF SECURE CODING | L | T | P | C |
|-----------------------------|---|---|---|---|
|                             | 3 | 0 | 0 | 3 |

**Course Objectives:** The main objectives of the course are to

- Introduce various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
- Outline the techniques for developing a secure application.
- Recognize opportunities to apply secure coding principles.

**UNIT-I:**

Introduction- Need for secure systems, Proactive security development process, Security principles to live by and threat modeling.

**UNIT-II:**

Secure Coding in C- Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities

**UNIT-III:**

Secure Coding in C++ and Java- Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double-free vulnerabilities, Integer security, Mitigation strategies

**UNIT-IV:**

Database and Web Specific Input Issues- Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies

**UNIT-V:**

Software Security Engineering- Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design

**Text Book:**

1. Writing Secure Code, 2nd Edition, Michael Howard, David LeBlanc, Microsoft Press, 2003

**Reference Books:**

1. Secure Coding in C and C++, Robert C. Seacord, 2nd edition, Pearson Education, 2013
2. Software Security Engineering: A guide for Project Managers, 1st ed, Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Addison-Wesley Professional, 2008



| 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. , FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1<sup>st</sup> ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1<sup>st</sup> ed.

**Reference Books:**

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



| BLOCKCHAIN TECHNOLOGY | L | T | P | C |
|-----------------------|---|---|---|---|
|                       | 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to

1. Describe the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. Understand public block chain system, Private block chain system and consortium block chain.
3. 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, Meena Karthikeyan , Universities Press.

**Reference Books:**

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



| 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, 2<sup>nd</sup> 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, 1<sup>st</sup> Edition, Breck Baldwin, Atlantic Publisher, 2015.



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2. Natural Language Processing with Java, 2<sup>nd</sup> Edition, Richard M Reese, OReilly Media, 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, 3<sup>rd</sup> Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.



| 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. AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2<sup>nd</sup> 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

### 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



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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