



**ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM**  
**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**SEMESTER-I**

**COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL  
AND CHEMICAL SCIENCES**

Theory

Credits: 4

5 hrs/week

**Course Objective:**

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

**Learning outcomes:**

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.
2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations
3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.
- 5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

**UNIT I: ESSENTIALS OF MATHEMATICS:**

**Complex Numbers:** Introduction of the new symbol  $i$  – General form of a complex number – Modulus-Amplitude form and conversions

**Trigonometric Ratios:** Trigonometric Ratios and their relations – Problems on calculation of

angles **Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product

and problems **Statistical Measures:** Mean, Median, Mode of a data and problems

**UNIT II: ESSENTIALS OF PHYSICS:**

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe



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**UNIT III: ESSENTIALS OF CHEMISTRY:**

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

**UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:**

**Applications of Mathematics in Physics & Chemistry:** Calculus, Differential Equations & Complex Analysis

**Application of Physics in Industry and Technology:** Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

**Application of Chemistry in Industry and Technology:** Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

**UNIT V: ESSENTIALS OF COMPUTER SCIENCE:**

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

**Ethical and social implications:** Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

**Recommended books:**

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
- 3.Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
- 4.Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson



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**STUDENT ACTIVITIES**

**UNIT I: ESSENTIALS OF MATHEMATICS:**

**1: Complex Number Exploration**

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties

**2: Trigonometric Ratios Problem Solving**

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

**3: Vector Operations and Applications**

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors.

They will also calculate the scalar and vector products of given vectors.

**4: Statistical Measures and Data Analysis**

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyze the central tendencies and distribution of the data.

**UNIT II: ESSENTIALS OF PHYSICS:**

**1. Concept Mapping**

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

**2. Laboratory Experiment**

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.



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**UNIT III: ESSENTIALS OF CHEMISTRY**

**1: Chemistry in Daily Life Presentation**

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

**2: Periodic Table Exploration**

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

**3: Chemical Changes and Classification of Matter**

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

**4: Biomolecules Investigation**

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

**UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

**1: Interdisciplinary Case Studies**

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

**2: Design and Innovation Project**

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.



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**3: Laboratory Experiments**

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

**.4: Mathematical Modeling**

Present students with real-world problems that require mathematical modeling and analysis.

**UNIT V: ESSENTIALS OF COMPUTER SCIENCE:**

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of
2. your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.



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***Course – I & II Model Paper Time:3Hrs (70 Marks)***

**SECTION A (Multiple Choice Questions)**

***30 x 1 = 30 M***

***30 Multiple Choice Questions (Each Unit 6 Questions)***

**SECTION B (Fill in the blanks)**

***10 x 1 = 10 M***

***10 Fill in the Blanks (Each Unit 2 Questions)***

**SECTION C (Very short answer questions)**

***10 x 1 = 10 M***

***10 Very short answer questions (Each Unit 2 Questions)***

**SECTION D (Matching) (From 5 Units)**

***2 x 5 = 10 M***

***1 A***

***B***

***C***

***D***

***E***

***2 A***

***B***

***C***

***D***

***E***

**SECTION E (True or False)**

***10 x 1 = 10 M***

***10 True or False (Each Unit 2 Questions)***



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**Single Major (w.e.f. AY 2023-24)**

**SEMESTER-I**

**COURSE – 1 ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL & CHEMICAL SCIENCES**

**Time:3hrs**

**MAX MARKS: 70 M**

**I Multiple Choice Questions 3x10=30M**

1. If  $\text{Arg}(Z) < 0$  the  $\text{Arg}(-Z) - \arg(Z) =$  [      ]  
a)  $\pi$                       b)  $\frac{\pi}{4}$                       c)  $\frac{-\pi}{2}$                       d)  $\frac{\pi}{2}$
2. If  $\left| \frac{Z_1}{Z_2} \right| = 1$  and  $\text{Arg} \left( \frac{Z_1}{Z_2} \right) = 0$  then [      ]  
a)  $Z_1 = Z_2$               b)  $|Z_1|^2 = Z_1 Z_2$       c)  $Z_1 Z_2 = 1$               d) None of these
3. The value of  $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$  is equal to [      ]  
a) 1                      b) 0                      c)  $\frac{1}{2}$                       d) 2
4. If  $\vec{a} + m\vec{b} + 3\vec{c}$ ,  $-2\vec{a} + 3\vec{b} - 5\vec{c}$  and  $\vec{a} - 3\vec{b} - 5\vec{c}$  are coplanar  $m =$  \_\_\_\_\_ [      ]  
a) 2                      b) -1                      c) 1                      d) -9/7
5. If the vectors  $2\vec{i} + \lambda\vec{j} - \vec{k}$  and  $4\vec{i} - 2\vec{j} + 2\vec{k}$  are perpendicular to each other, then  $\lambda =$  \_\_\_\_\_ [      ]  
a) 2                      b) 5                      c) 3                      d) 1
6. Find the mode for the following data 0,0,1,1,2,2,2,4,5. [      ]  
a) 1                      b) 0                      c) 4                      d) 2
7. Newton – Second is the unit of [      ]  
a) Velocity                      b) Angular Momentum                      c) Momentum      d) Energy
8. If the force applied to a body is doubled and the mass is cut in half. What would be the acceleration ratio? [      ]  
a) 1:2                      b) 2:1                      c) 1:4                      d) 4:1
9. Which unit is used to measure angle the S.I system? [      ]  
a) Radian                      b) Steradian                      c) Degree                      d) Minute
10. The mass – Energy relation is given by [      ]  
a)  $E = mc^2$                       b)  $F = ma$                       c)  $P = mv$                       d)  $W = Fd$
11. How many types of Robots are there [      ]  
a) 7                      b) 10                      c) 6                      d) 8
12. Light energy emitted by stars is due to [      ]  
a) Breaking of nuclei                      b) Joining of nuclei  
c) Burning of nuclei                      d) Reflection of Solar Light
13. Organic chemistry is the study of \_\_\_\_\_. [      ]  
a) Nitrogen based compounds      b) Carbon based compounds  
c) Copper based compounds                      d) Chromium based compounds
14. Number of electrons present in outer shell of chlorine atom is \_\_\_\_ [      ]  
a) 5                      b) 6                      c) 7                      d) 8
15. Which of the following is a disaccharide \_\_\_\_\_ [      ]  
a) Sucrose                      b) Glucose                      c) Fructose                      d) Ribose
16. The Monomers present in proteins are \_\_\_\_\_ [      ]  
a) Alcohols                      b) Acids                      c) Amino acids                      d) Esters
17. Lipids composed mainly of \_\_\_\_\_ [      ]  
a) C, H, N                      b) C, H, O                      c) O, N, S                      d) N, S, Cl



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18. Vitamin by is also known as \_\_\_\_\_ [      ]  
 a) Vitamin – H      b) Vitamin – O      c) Vitamin – Bd) Vitamin – L
19. Who is introduced in Calculus \_\_\_\_\_. [      ]  
 a) Isaac Newton      b) Goff fried Leibniz  
 c) Both of the mentioned      d) None of the mentioned
20. How many systems does a robot have \_\_\_\_\_. [      ]  
 a) 2      b) 6      c) 4      d) 3
21. A place where power information (or) a result leaves a system. [      ]  
 a) Chassis b) Output c) Sensor      d) Input
22. The main electronic component used in first generation computers was [      ]  
 a) Transistors      b) Vacuum Tubes and Valves  
 c) Integrated Circuits      d) None of above
23. Magnetic disk is an example of [      ]  
 a) Secondary memory      b) Primary memory  
 c) Main memory      d) Both 1 & 2
24. http stands for [      ]  
 a) hypertext transfer protocol      b) hypertext transmission protocol  
 c) high transfer transport protocol      d) hyper transfer text protocol
25. What is the full form of WWW? [      ]  
 a) World Wide Web      b) World with Web  
 c) Work Wide Web      d) World Wide Wet
26. Which one of the following is a type of antivirus program? [      ]  
 a) Quick heal      b) McAfee  
 c) Kaspersky      d) All of the above
27. Hackers usually used the computer virus for \_\_\_\_\_ purpose. [      ]  
 a) To log, monitor each and every user's stroke  
 b) To gain access the sensitive information like user's Id and Passwords  
 c) To corrupt the user's data stored in the computer system  
 d) All of the above
28. Which of the following is an example of f BDD screening technique [      ]  
 a) U V spectroscopy      b) HPLC      c) NMR spectroscopy d) None
29. Fertilizers mainly consists of \_\_\_\_\_ [      ]  
 a) N, P, K      b) O, N, Cl      c) C, O, K      d) H, P, O
30. The substance that facilitate chemical reactions without being consumed is [      ]  
 a) Reactions      b) Product      c) Catalyst      d) Inhibin

**SECTION – B**

**II Fill in the Blanks**

**10x1=10M**

1. Find the value of  $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ$  is \_\_\_\_\_.
2. The area of the parallelogram whose diagonals are  $3i + j - 2k$  and  $i - 3j + 4k$  is \_\_\_\_\_.
3. \_\_\_\_\_ is the number of cycles made by a sounding body per unit time.
4. A light year is a unit of \_\_\_\_\_.
5. EXPAND SAR \_\_\_\_\_.
6. Peptide bond formula \_\_\_\_\_.
7. A robot is a \_\_\_\_\_.
8. Differential equations that \_\_\_\_\_ the definition of linear are nonlinear.
9. A string of 8 bits is \_\_\_\_\_
10. ROM stands for \_\_\_\_\_





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**SECTION – C**

**III Answer the following Short Questions**

**10x1=10M**

1. If  $3 \tan A = 5$  then Find Sin A and Cos A.
2. Find A.M from the following distribution.

Wages	100	120	140	160	180	200
No of workers	4	8	12	7	6	3

3. Write any two applications of Semi – Conductor?
4. Define Zeroth law of Thermodynamics? with example.
5. Expand FBDD.
6. What are fat soluble vitamins?
7. Define Newton's 1<sup>st</sup> Law.
8. Write any two application of Environmental monitoring?
9. What is E-mail?
10. What is a gateway?

**SECTION – D**

**III Match the following**

**10x1=10M**

1. A. Unit Vector in the direction  $\vec{a} = 3\vec{i} - 2\vec{j} + 6\vec{k}$  ( ) a) Angular Momentum
- B. Polar form  $-1 + \sqrt{3}i$  ( ) b) Glucose
- C. Joule x Sec ( ) c)  $\frac{1}{2} (3\vec{i} - 2\vec{j} + 6\vec{k})$
- D. Mass of a proton ( ) d)  $2 \left[ \cos \left( \frac{2\pi}{3} \right) + i \sin \left( \frac{2\pi}{3} \right) \right]$
- E. Reducing Sugar ( ) e)  $1.676 \times 10^{-24}$  grams
2. A. Vitamin – B12 ( ) a) Newton
- B. Force ( ) b) Newton second
- C. Impulse ( ) c) RBC formation
- D. Punch Card ( ) d) Computer games
- E. Joy Stick ( ) e) Hollerith code



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**SECTION – E**

**IV True (or) False**

**10x1=10M**

1. If  $Z$  is a complex number then  $Z\bar{Z}$  is purely real.
2. If  $Z$  is a complex number such that  $Z^2 = (\bar{Z})^2$  then purely real.
3. The Mass of a body is equivalent to the ratio of the force action on it to the acceleration it generates.
4. The region of the atmosphere above troposphere is known as Lithosphere.
5. Essential Amino acids can be synthesized by the human body
6. Electrons fill the lowest energy levels first
7. For every action in nature there is an unequal and opposite reaction.
8. The special theory of relativity is concerned with frames of reference that are not experiencing any acceleration.
9. A terabyte is equal to 1 million gigabytes
10. Remote browser access is used to avoid browser-based hacking.



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**SEMESTER-I**

**COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES**

Theory

Credits: 4

5 hrs/week

**Course Objective:**

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

**Learning outcomes:**

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.
2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.
3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.
3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.
- 5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite).

**UNIT I: ADVANCES IN BASICS MATHEMATICS**

**Straight Lines:** Different forms – Reduction of general equation into various forms – Point of intersection of two straight lines

**Limits and Differentiation:** Standard limits – Derivative of a function –Problems on product rule and quotient rule

**Integration:** Integration as a reverse process of differentiation – Basic methods of integration



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**Matrices:** Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

**UNIT II: ADVANCES IN PHYSICS:**

**Renewable energy:** Generation, energy storage, and energy-efficient materials and devices.

**Recent advances in the field of nanotechnology:** Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

**UNIT III: ADVANCES IN CHEMISTRY:**

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

**UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

**Mathematical Modelling applications in physics and chemistry**

**Application of Renewable energy:** Grid Integration and Smart Grids,

**Application of nanotechnology:** Nanomedicine,

**Application of biophysics:** Biophysical Imaging, Biomechanics, Neurophysics,

**Application of medical physics:** Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

**UNIT V: Advanced Applications of computer Science**

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

**Recommended books:**

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.



## **STUDENT ACTIVITIES**

### **UNIT I: ADVANCES IN BASIC MATHEMATICS**

#### **1: Straight Lines Exploration**

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

#### **2: Limits and Differentiation Problem Solving**

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analyzing rates of change or optimizing functions.

#### **3: Integration Exploration**

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

#### **4: Matrices Manipulation**

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

### **UNIT II: ADVANCES IN PHYSICS:**

#### **1: Case Studies**

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field. They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.

#### **2: Experimental Design**

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.



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They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

### 3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

## **UNIT III: ADVANCES IN CHEMISTRY:**

### 1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

### 2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

### 3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of



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chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

**UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

**1: Mathematical Modelling Experiment**

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

**2: Case Studies and Group Discussions**

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

**3. Group Project**

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations. Encourage creativity, critical thinking, and collaboration throughout the project.

**UNIT V: Advanced Applications of computer Science**

Students must be able to convert numbers from other number system to binary number systems

1. Identify the networking media used for your college network
2. Identify all the networking devices used in your college premises.



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*Course – I & II Model Paper Time: 3Hrs (70 Marks)*

**SECTION A (Multiple Choice Questions)**

***30 x 1 = 30 M***

***30 Multiple Choice Questions (Each Unit 6 Questions)***

**SECTION B (Fill in the blanks)**

***10 x 1 = 10 M***

***10 Fill in the Blanks (Each Unit 2 Questions)***

**SECTION C (Very short answer questions)**

***10 x 1 = 10 M***

***10 Very short answer questions (Each Unit 2 Questions)***

**SECTION D (Matching) (From 5 Units)**

***2 x 5 = 10 M***

***1 A***

***B***

***C***

***D***

***E***

***2 A***

***B***

***C***

***D***

***E***

**SECTION E (True or False)**

***10 x 1 = 10 M***

***10 True or False (Each Unit 2 Questions)***





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**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**Single Major (w.e.f. AY 2023-24)**

**SEMESTER-I**

**Model Paper**

**COURSE -2 ADVANCES OF MATHEMATICAL, PHYSICAL & CHEMICAL SCIENCES**

**Time: 3Hrs**

**MAX MARKS: 70 M**

**I Multiple Choice Questions**

**3x10=30M**

**SECTION – A**

- The equation of the line passing through the point (1, 2) and perpendicular to the line  $x+y+1=0$  is  
 a)  $y-x+1=0$       b)  $y-x-1=0$       c)  $y-x+2=0$       d)  $y-x-2=0$       [      ]
- $\lim_{x \rightarrow 0} \frac{x}{x^2}$  is equal to  
 a) 0      b) 1      c) 2      d) 4      [      ]
- The derivative of  $\cos^{-1}(2x^2-1)$  w.r.to  $\cos^{-1}(x)$  is  
 a) 2      b)  $\frac{-1}{2\sqrt{1-x^2}}$       c)  $\frac{2}{x}$       d)  $1-x^2$       [      ]
- $\int e^{\tan x} \sec^2 x \, dx =$   
 a)  $e^{\tan x}$       b)  $e^{\sin x}$       c)  $\tan x$       d)  $\sin x$       [      ]
- If  $2x + y = \begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$  and  $2x - y = \begin{bmatrix} 3 & 4 \\ -1 & 2 \end{bmatrix}$  then X is equal to  
 a)  $\begin{bmatrix} 4 & 4 \\ -4 & 4 \end{bmatrix}$       b)  $\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$       c)  $\begin{bmatrix} -1 & -2 \\ -1 & 0 \end{bmatrix}$       d) None of these      [      ]
- If  $A = [a_{ij}]_{m \times n}$  such that  $a_{ij} = 0$  for  $i \neq j$  then A is  
 a) a row matrix      b) a column matrix  
 c) a diagonal matrix      d) a scalar matrix      [      ]
- Which of the following is an renewable energy source  
 a) Coal      b) Natural gas      c) Solar      d) Nuclear      [      ]
- What is the main purpose of Photovoltaic cells in solar panels  
 a) Heat generation      b) Electricity generation      c) Water purification      d) Carbon capture      [      ]
- Which renewable energy source is harnesses from the earth's Internal heat?  
 a) Solar      b) Wind      c) Geothermal      d) Hydro      [      ]
- What is the fundamental principle behind quantum mechanics  
 a) Classical Mechanics      b) Quantum Superposition      c) Newton law of motion      d) Maxwell's equation      [      ]
- What is the primary application of proton therapy in medical physics?  
 a) Diagnostic Imaging      b) Radiation therapy      c) Magnetic resonance Imaging      d) Computed Tomography (C.T)      [      ]
- What is the primary advantage of using quantum dot in solar cells?  
 a) Low cost      b) High efficiency  
 c) Fast charging      d) Large size      [      ]
- The Binding capacity between the drug and target is known as  
 a) Virtual Screening      b) Docking Score      c) ADMET      d) None      [      ]
- The Increased sensitivity of Nanosensors is due to  
 a) High Surface-to-volume ratio      b) Low surface-to-volume ratio      [      ]
- The green pigment chlorophyll is affected by  
 a)  $\text{CO}_2$       b)  $\text{NO}_2$       c)  $\text{SO}_2$       d)  $\text{CH}_4$       [      ]



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16. What is the Photo catalyst used in the dye removal catalysis method [      ]  
a) Oxygen                  b) Hydrogen                  c) Titanium Oxide                  d) Zinc
  17. Which phase of Shape memory alloy occurs at higher temperature & has a needle – like structure [      ]  
a) Martensite    b) Austenite                  c) Hysteresis                  d) None
  18. The Pollutant causing Global warming [      ]  
a) CO<sub>2</sub>                  b) SO<sub>2</sub>                  c) NO<sub>2</sub>                  d) O<sub>3</sub>
  19. In Quantum mechanics, the Schrodinger Equation is a fundamental Equation, used to model the behavior of particles. What does the Schrodinger Equation describe [      ]  
a) Stability                  b) Wave-Particle duality  
c) Degradity                  d) Massive
  20. What is the term used to describe the process of using nano particles to enhance imaging techniques for medical diagnostics [      ]  
a) Nano Scopy                  b) Nano Therapy                  c) Nano Diagnose                  d) None of these
  21. How can nano medicine contribute to personalized medicine? [      ]  
a) By increasing the cost of medical treatment.  
b) By using a one-size –fits all approach.  
c) By tailoring based on an individual's genetic make-up.  
d) By avoiding the use of advanced technologies.
  22. In radiation therapy, What does the term “brachytherapy” refer to [      ]  
a) External beam radiation therapy  
b) Radiation therapy using photons  
c) Internal radiation therapy involving the placement of radioactive sources directly within or close to the tumor.  
d) Radiation therapy without the use of imaging.
  23. What is the purpose of coagulation in the water treatment process? [      ]  
a) Removing dissolved minerals  
b) Disinfecting water  
c) Settling suspended particulates  
d) Adjusting pH levels
  24. What is the purpose of green building design and construction? [      ]  
a) maximizing energy consumption  
b) minimizing the use of sustainable materials  
c) Reducing the environmental impact of buildings  
d) Ignoring energy – efficient technologies
  25. Hybrid system combines which two types of signals? [      ]  
a) Analog and Digital    b) Digital and Digital    c) Analog and Digital    d) Continuous and Finite
  26. Which error detection technique can detect a wide range of errors including burst errors and most multiple bits.  
a) Hamming code                  b) Reed-Solomon code                  c) Parity check                  d) CRC
  27. Which layer of the OSI model does a router operate at [      ]  
a) Transport layer                  b) Network layer                  c) Transport layer                  d) Data link layer
  28. What technology allows DSL modems to separate voice and data signals.  
a) Dial-up modem                  b) DSL modem                  c) Wireless modem                  d) Cable modem  
**Ans b) DSL modem**
  29. What protocol do bridges use to prevent network loops? [      ]  
a) Internet Protocol                  b) Transmission Control Protocol (TCP)  
c) Simple Network Management Protocol (SNMP)    d) Spanning Tree Protocol (STP)
  30. The..... between two words is the number of differences between corresponding bits  
a) Hamming code                  b) Hamming distance [      ]  
c) Hamming rule                  d) Hamming data



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**SECTION – B**

**III Fill in the Blanks**

**10x1=10M**

1. Tidal energy is an Example for\_\_\_\_\_energy.
2. \_\_\_\_\_are the particles used in quantum dots.
3. Expand CADD \_\_\_\_\_
4. First step in the purification of water \_\_\_\_\_
5. \_\_\_\_\_ is an application for Medical Physics.
6. MRI stands for \_\_\_\_\_
7.  $\int e^x \sin x \cos x dx =$ \_\_\_\_\_.
8. Equation of the lines through the point (3, 2) and making an angle of  $45^\circ$  with the line  $x-2y = 3$  are \_\_\_\_\_.
9. A computer understands only .....code
10. converts audio and video into digital information

**SECTION – C**

**III Answer the following Questions**

**10x1=10M**

1. Give some Examples for renewable sources?
2. Information stored in quantum computer in the form of?
3. What is the difference between MRI and C.T. Scan?
4. Name two applications of Nanotechnology?
5. Solid waste Management? (SWM)
6. Expand ADMET
7.  $\lim_{x \rightarrow 0} \frac{ax + x \cos x}{b \sin x}$ ; Evaluate
8. Evaluate  $\int x(\log x)^2 dx$
9. What are the key design issues of the computer networks?
10. What is multiplexing?

**SECTION – D**

**III Match the following**

**10x1=10M**

- |    |  |     |  |
|----|--|-----|--|
| 1. | A. Wind energy   | ( ) | a) Orthodontic applications                                  |
|    | B. Solar energy  | ( ) | b) Non invasive imaging                                      |
|    | C. Minamata  | ( ) | c) Harness the kinetic energy of wind to produce electricity |
|    | D. Ni-Ti wire  | ( ) | d) Convert sunlight into electricity                         |
|    | E. Magnetic Resonance Imaging  | ( ) | e) Mercury   |
| 2. | A. Fluoroscene microscopy  | ( ) | a) 3   |
|    | B. $\begin{bmatrix} 3 & -4 \\ m & 5 \end{bmatrix} = 3$ then m value is | ( ) | b) Moniterity cellular                                       |
|    | C. $\frac{d}{dx} [\log(\sec x + \tan x)]$                              | ( ) | c) F1  |
|    | D. 11110001  | ( ) | d) Guided media  |
|    | E. Ethernet cable  | ( ) | e) (secx)  |



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**SECTION – E**

**IV True (or) False**

**10x1=10M**

1. Quantum dots are the nano particles, are primarily used for structural Reinforced cement in medical implants?
2. Quantum mechanics is a branch of physics Extensively used mathematical Models, to describe the behavior of particles at atomic and subatomic level.
3. The Mass of a body is equivalent to the ratio of the force action on it to the acceleration it generates.
4. The region of the atmosphere above troposphere is known as Lithosphere.
5. Essential Amino acids can be synthesized by the human body
6. Electrons fill the lowest energy levels first
7. The equation of a line with slope m and making an intercept c on y axis is  $y=mx$
8. Intercept form of a line which cuts a and b respectively on the x and y axis  
Then  $\frac{x}{a} + \frac{y}{b} = 1$
9. A university would use a CAN to convert its composition in two cities.
10. Gateway device is operated at transport layer.



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**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**II Semester**

**Course 3: Problem Solving using C**

Credits -3

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**Course Objectives**

1. To explore basic knowledge on computers
2. Learn how to solve common types of computing problems.
3. Learn to map problems to programming features of C.
4. Learn to write good portable C programs.

**Course Outcomes**

Upon successful completion of the course, a student will be able to:

1. Understand the working of a digital computer and Fundamental constructs of Programming
2. Analyze and develop a solution to a given problem with suitable control structures
3. Apply the derived data types in program solutions
4. Use the 'C' language constructs in the right way
5. Apply the Dynamic Memory Management for effective memory utilization

**UNIT-I**

**Introduction to computer and programming:** Introduction, Basic block diagram and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high-level programming, Flowcharts and Algorithms

**Fundamentals of C:** History of C, Features of C, C Tokens-variables and keywords and identifiers, constants and Data types, Rules for constructing variable names, Operators, Structure of C program, Input /output statements in C-Formatted and Unformatted I/O

**UNIT-II**

**Control statements:** Decision making statements: if, if else, else if ladder, switch statements. Loop control statements: while loop, for loop and do-while loop. Jump Control statements: break, continue and goto.

**UNIT-III**

**Derived data types in C: Arrays:** One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation.

**Strings:** Declaring & Initializing string variables; String handling functions, Character handling functions

**UNIT-IV**

**Functions:** Function Prototype, definition and calling. Return statement. Nesting of functions. Categories of functions. Recursion, Parameter Passing by address & by value. Local and Global variables. **Storage classes:** automatic, external, static and register.

**Pointers:** Pointer data type, Pointer declaration, initialization, accessing values using pointers. Pointer arithmetic. Pointers and arrays, pointers and functions.

**UNIT-V**

**Dynamic Memory Management:** Introduction, Functions-malloc, calloc, realloc, free **Structures:** Basics of structure, structure members, accessing structure members, nested structures, array of

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structures, structure and functions, structures and pointers. **Unions** - Union definition; difference between Structures and Unions.

**Text Books:**

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 6<sup>th</sup> Edn, ISBN-13: 978-1-25-90046-2
2. Herbert Schildt, —Complete Reference with C, Tata McGraw Hill, 4th Edn., ISBN- 13: 9780070411838, 2000
3. Computer fundamentals and programming in C, REEMA THAREJA, OXFORD UNIVERSITY PRESS

**Reference Books**

1. E Balagurusamy, COMPUTING FUNDAMENTALS & C PROGRAMMING – Tata McGraw-Hill, Second Reprint 2008, ISBN 978-0-07-066909-3.
2. Ashok N Kamthane, Programming with ANSI and Turbo C, Pearson Edition Publ, 2002.
3. Henry Mullish&Huubert L.Cooper: The Spirit of C An Introduction to modern Programming, Jaico Pub. House,1996.
4. Y kanithkar, let us C BPB, 13<sup>th</sup> edition-2013, ISBN:978-8183331630,656 pages.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Quiz on computer hardware and software concepts

**Evaluation Method:** Objective-based quiz assessing knowledge and understanding

**Unit 2: Activity:** Problem-solving using Decision-Making Statements

**Evaluation Method:** Correctness of decision-making logic

**Unit 3: Activity:** Array and String Program Debugging

**Evaluation Method:** Identification and correction of errors in code

**Unit 4: Activity:** Pair Programming Exercise on Functions

**Evaluation Method:** Collaboration and Code Quality

**Unit 5: Activity:** Structured Programming Assignment

**Evaluation Method:** Appropriate use of structures and nested structures



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**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**II Semester**

**Course 3: Problem Solving using C**

Credits -1

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**List of Experiments**

1. A. Write a program to calculate simple & compound interest  
B. Write a C program to interchange two numbers.
  2. Find the biggest of three numbers using C.
  3. Write a c program to find the sum of individual digits of a positive integer.
  4. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
  5. Write a c program to check whether a number is Armstrong or not.
  6. Write a c program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
  7. Write a c program that implements searching of given item in given list
  8. Write a c program that uses functions to perform the following: Addition of two matrices. Multiplication of two matrices.
  9. Write a program for concatenation of two strings.
  10. Write a program for length of a string with and without String Handling functions
  11. Write a program to demonstrate Call by Value and Call by Reference mechanism
  12. Write a Program to find GCD of Two numbers using Recursion
  13. Write a c program to perform various operations using pointers.
  14. Write a c program to read data of 10 employees with a structure of 1.employee id 2.address no, 3.title, 4.joined date, 5.salary, 6.date of birth, 7.gender, 8.department.
  15. Write a Program to demonstrate dynamic arrays using Dynamic Memory Management functions
-



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**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**II Semester**  
**Course 4: Digital Logic Design**  
Credits -3

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**Course Objectives**

To familiarize with the concepts of designing digital circuits.

**Course Outcomes**

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

1. Understand how to Convert numbers from one radix to another radix and perform arithmetic operations.
2. Simplify Boolean functions using Boolean algebra and k- maps
3. Design adders and subtractors circuits
4. Design combinational logic circuits such as decoders, encoders, multiplexers and demultiplexers.
5. Use flip flops to design registers and counters.

**UNIT – I**

**Number Systems:** Binary, octal, decimal, hexadecimal number systems, conversion of numbers from one radix to another radix,  $r$ 's,  $(r-1)$ 's complements, signed binary numbers, addition and subtraction of unsigned and signed numbers, weighted and unweighted codes.

**UNIT – II**

**Logic Gates and Boolean Algebra:** NOT, AND, OR, universal gates, X-OR and X-NOR gates, Boolean laws and theorems, complement and dual of a logic function, canonical and standard forms, two level realization of logic functions using universal gates, minimizations of logic functions (POS and SOP) using Boolean theorems, K-map (up to four variables), don't care conditions.

**UNIT – III**

**Combinational Logic Circuits – 1:** Design of half adder, full adder, half subtractor, full subtractor, ripple adders and subtractors, ripple adder / subtractor.

**UNIT – IV**

**Combinational Logic Circuits – 2:** Design of decoders, encoders, priority encoder, multiplexers, demultiplexers, higher order decoders, demultiplexers and multiplexers, realization of Boolean functions using decoders, multiplexers.

**UNIT – V**

**Sequential Logic Circuits:** Classification of sequential circuits, latch and flip-flop, RS- latch using NAND and NOR Gates, truth tables, RS, JK, T and D flip-flops, truth and excitation tables, conversion of flip- flops, flip-flops with asynchronous inputs (preset and clear).

Design of registers, shift registers, bidirectional shift registers, universal shift register, design of ripple counters, synchronous counters and variable modulus counters.

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**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**Text Books:**

1. M. Morris Mano, Michael D Ciletti, “Digital Design”, 5th edition, PEA.

**Reference Books**

1. Kohavi, Jha, “Switching and Finite Automata Theory”, 3rd edition, Cambridge.
2. 2. Leach, Malvino, Saha, “Digital Principles and Applications”, 7th edition, TMH.
3. 3. Roth, “Fundamentals of Logic Design”, 5th edition, Cengage.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** JAM (Just a Minute) Session: Explaining Radix Conversion

**Evaluation Method:** Communication Skills and Knowledge Presentation

**Unit 2: Activity:** Boolean Algebra Assignment

**Evaluation Method:** Assignment Completion and Correctness

**Unit 3: Activity:** Hands-on Lab Activity: Building Adder and Subtractor Circuits

**Evaluation Method:** Lab Performance and Correctness of Circuit Implementation

**Unit 4: Activity:** Group Discussion: Applications of Decoders, Encoders, Multiplexers

**Evaluation Method:** Participation and Critical Thinking

**Unit 5: Activity:** Quiz on Flip-Flops and Register-Counter Design

**Evaluation Method:** Quiz Performance and Knowledge Retention

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**ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM**  
**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**II Semester**  
**Course 4: Digital Logic Design**  
Credits -1

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**List of Experiments**

The laboratory work can be done by using physical gates and necessary equipment or simulators.

**Simulators:** <https://sourceforge.net/projects/gatesim/> or <https://circuitverse.org/> or any free open-source simulator

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
  2. Implementation of the given Boolean functions using logic gates in both SOP and POS forms
  3. Realization of basic gates using universal gates.
  4. Design and implementation of half and full adder circuits using logic gates.
  5. Design and implementation of half and full subtractor circuits using logic gates.
  6. Verification of stable tables of RS, JK, T and D flip-flops using NAND gates.
  7. Verification of stable tables of RS, JK, T and D flip-flops using NOR gates.
  8. Implementation and verification of Decoder and encoder using logic gates.
  9. Implementation of 4X1 MUX and DeMUX using logic gates.
  10. Implementation of 8X1 MUX using suitable lower order MUX.
  11. Implementation of 7-segment decoder circuit.
  12. Implementation of 4-bit parallel adder.
  13. Design and verification of 4-bit synchronous counter.
  14. Design and verification of 4-bit asynchronous counter.
-



**BLUE PRINT OF MODEL QUESTION PAPER (Sem-End. Examinations)**

**COURSE NAME**

MODEL QUESTION PAPER - THEORY

Semester: ...

Paper: ....., Title of the paper

Time: 3 Hours.

Max Marks: 70

**SECTION – A**

**Answer any 5 questions. Each question carries 4 marks (5 X 4 = 20M)**

(Total 8 questions, questions 1-5 from Units 1-5 & questions 6-8 from any of the units)

1. Unit -I
2. Unit-II
3. Unit-III
4. Unit-IV
5. Unit-V
6. From any Unit
7. From any Unit
8. From any Unit

**SECTION – B**

**Answer all the questions. Each question carries 10 marks. (5 X 10 = 50M)**

(Each question (both 'A' or 'B') from each Unit.

9. from Unit I

**(OR)**

from Unit I

10. from Unit II

**(OR)**

from Unit II

11. from Unit III

**(OR)**

from Unit III

12. from Unit IV

**(OR)**

from Unit IV

13. from Unit V

**(OR)**

from Unit V



### III Semester

#### Course 5: Object Oriented Programming using Java

Credits -3

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#### Course Objectives

To introduce the fundamental concepts of Object-Oriented programming and to design & implement object-oriented programming concepts in Java.

#### Course Outcomes

Upon successful completion of the course, a student will be able to:

1. Understand the basic concepts of Object-Oriented Programming and Java Program Constructs
2. Implement classes and objects and analyze Inheritance and Dynamic Method Dispatch
3. Demonstrate various classes in different packages and can design own packages
4. Manage Exceptions and Apply Threads
5. Create GUI screens along with event handling

#### UNIT-I

**OOPs Concepts and Java Programming:** Introduction to Object-Oriented concepts, procedural and object-oriented programming paradigm

**Java programming:** An Overview of Java, Java Environment, Data types, Variables, constants, scope and life time of variables, operators, type conversion and casting, Accepting Input from the Keyboard, Reading Input with Java.util.Scanner Class, Displaying Output with System.out.printf(), Displaying Formatted Output with String.format(), Control Statements

#### UNIT-II

Arrays, Command Line Arguments, Strings-String Class Methods

**Classes & Objects:** Creating Classes, declaring objects, Methods, parameter passing, static fields and methods, Constructors, and 'this' keyword, overloading methods and access

**Inheritance:** Inheritance hierarchies, super and subclasses, member access rules, 'super' keyword, preventing inheritance: final classes and methods, the object class and its methods; **Polymorphism:** Dynamic binding, method overriding, abstract classes and methods;

#### UNIT-III

**Interface:** Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface;

**Packages:** Defining, creating and accessing a package, understanding CLASSPATH, importing packages.

**Exception Handling:** Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes.

#### UNIT-IV

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**Multithreading:** Differences between multiple processes and multiple threads, thread states, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.

**Stream based I/O (java.io)** – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, The Console class, Serialization

**UNIT-V**

**GUI Programming with Swing-** Introduction, MVC architecture, components, containers. Understanding Layout Managers - Flow Layout, Border Layout, Grid Layout, Card Layout, GridBag Layout.

**Event Handling-** The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

**Text Books:**

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

**Reference Books**

1. Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11 th Edition, Prentice Hall, 2018.
2. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
3. S. Malhotra, S. Chudhary, Programming in Java, 2nd edition, Oxford Univ. Press.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Quiz on Object-Oriented Programming Concepts and Java Constructs

**Evaluation Method:** Quiz Performance and Knowledge Retention

**Unit 2: Activity:** Object-Oriented Programming Assignment: Class Implementation

**Evaluation Method:** Assignment Completion and Correctness

**Unit 3: Activity:** Hands-on Lab Activity: Creating and Using Custom Java Packages

**Evaluation Method:** Lab Performance and Correctness of Code Implementation

**Unit 4: Activity:** Case Study Discussion on where multi-threading is crucial

**Evaluation Method:** Critical thinking, problem-solving, and presentation skills.

**Unit 5: Activity:** GUI design contest using Java Swings

**Evaluation Method:** GUI design, Visual appearance and user friendliness, usability, and adherence to event handling principles.



**III Semester**

**Course 5: Object Oriented Programming using Java Lab**

Credits -1

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**List of Experiments**

1. Write a Java program to print Fibonacci series using for loop.
2. Write a Java program to calculate multiplication of 2 matrices.
3. Create a class Rectangle. The class has attributes length and width. It should have methods that calculate the perimeter and area of the rectangle. It should have read Attributes method to read length and width from user.
4. Write a Java program that implements method overloading.
5. Write a Java program for sorting a given list of names in ascending order.
6. Write a Java program that displays the number of characters, lines and words in a text file.
7. Write a Java program to implement various types of inheritance
  - i. Single
  - ii. Multi-Level
  - iii. Hierarchical
  - iv. Hybrid
8. Write a java program to implement runtime polymorphism.
9. Write a Java program which accepts withdraw amount from the user and throws an exception “In Sufficient Funds” when withdraw amount more than available amount.
10. Write a Java program to create three threads and that displays “good morning”, for every one second, “hello” for every 2 seconds and “welcome” for every 3 seconds by using extending Thread class.
11. Write a Java program that creates three threads. First thread displays “OOPS”, the second thread displays “Through” and the third thread Displays “JAVA” by using Runnable interface.
12. Implement a Java program for handling mouse events when the mouse entered, exited, clicked, pressed, released, dragged and moved in the client area.
13. Implement a Java program for handling key events when the key board is pressed, released, typed.
14. Write a Java swing program that reads two numbers from two separate text fields and display sum of two numbers in third text field when button “add” is pressed.
15. Write a Java program to design student registration form using Swing Controls. The form which having the following fields and button SAVE

Form Fields are: Name, RNO, Mailid, Gender, Branch, Address.

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III Semester  
Course 6: Data Structures using C  
Credits -3

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### Course Objectives

To introduce the fundamental concept of data structures and to emphasize the importance of various data structures in developing and implementing efficient algorithms.

### Course Outcomes

Upon successful completion of the course, a student will be able to:

1. Understand various Data Structures for data storage and processing.
2. Realize Linked List Data Structure for various operations
3. Analyze step by step and develop algorithms to solve real world problems by implementing Stacks, Queues data structures.
4. Understand and implement various searching & sorting techniques.
5. Understand the Non-Linear Data Structures such as Binary Trees and Graphs

### UNIT-I

**Basic Concepts:** Pointers and dynamic memory allocation, Algorithm-Definition and characteristics, Algorithm Analysis-Space Complexity, Time Complexity, Asymptotic Notation **Introduction to Data structures:** Definition, Types of Data structure, Abstract Data Types (ADT), Difference between Abstract Data Types, Data Types, and Data Structures.

**Arrays-**Concept of Arrays, Single dimensional array, Two dimensional array, Operations on arrays with Algorithms (searching, traversing, inserting, deleting)

### UNIT-II

**Linked List:** Concept of Linked Lists, Representation of linked lists in Memory, Comparison between Linked List and Array, Types of Linked Lists - Singly Linked list, Doubly Linked list, Circularly Singly Linked list, Circularly Doubly Linked list;

**Implementation of Linked List ADT:** Creating a List, Traversing a linked list, Searching linkedlist, Insertion and deletion into linked list (At first Node, Specified Position, Last node), Application of linked lists

### UNIT-III

**Stacks:** Introduction to stack ADT, Representation of stacks with array and Linked List, Implementation of stacks, Application of stacks - Polish Notations - Converting Infix to Post Fix Notation - Evaluation of Post Fix Notation - Tower of Hanoi, Recursion: Concept and Comparison between recursion and Iteration

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**Queues:** Introduction to Queue ADT, Representation of Queues with array and Linked List, Implementation of Queues, Application of Queues Types of Queues- Circular Queues, De-queues, Priority Queue

**UNIT-IV**

**Searching:** Linear or Sequential Search, Binary Search and Indexed Sequential Search

**Sorting:** Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort

**UNIT-V**

**Binary Trees:** Concept of Non- Linear Data Structures, Introduction Binary Trees, Types of Trees, Basic Definition of Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Operations on a Binary Search Tree, Binary Tree Traversal, Applications of Binary Tree.

**Graphs:** Introduction to Graphs, Terms Associated with Graphs, Sequential Representation of Graphs, Linked Representation of Graphs, Traversal of Graphs (DFS, BFS), Application of Graphs.

**Text Books:**

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publications Pvt Ltd Delhi India.
2. A.K. Sharma ,Data Structure Using C, Pearson Education India.
3. “Data Structures Using C” Balagurusamy E. TMH

**Reference Books**

1. “Data Structures through C”, Yashavant Kanetkar, BPB Publications
2. Rajesh K. Shukla, “Data Structure Using C and C++” Wiley Dreamtech Publication.
3. Lipschutz, “Data Structures” Schaum’s Outline Series, Tata Mcgraw-hill Education (India)Pvt. Ltd .
4. Michael T. Goodrich, Roberto Tamassia, David M. Mount “Data Structures and Algorithms in C++”, Wiley India.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Algorithm analysis exercises

**Evaluation Method:** Programming Assignment and Correctness

**Unit 2: Activity:** Presentations on real-life applications of linked lists

**Evaluation Method:** Presentation skills or reports

**Unit 3: Activity:** Role-playing activities for stack operations

**Evaluation Method:** Problem-solving skills, communication and collaboration abilities.

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**Unit 4: Activity:** Sorting algorithm analysis and comparison activities

**Evaluation Method:** Performance analysis and presentation.

**Unit 5: Activity:** Case Study on Applications of Graphs

**Evaluation Method:** Critical thinking, problem-solving, and presentation skills

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**III Semester**  
**Course 6: Data Structures Using C**  
Credits -1

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**List of Experiments:**

1. Write a program to read 'N' numbers of elements into an array and also perform the following operation on an array
    - a. Add an element at the beginning of an array
    - b. Insert an element at given index of array
    - c. Update an element using a values and index
    - d. Delete an existing element
  2. Write Program to implement Single Linked List with insertion, deletion and traversal operations
  3. Write Program to implement Circular doubly Linked List with insertion, deletion and traversal operations
  4. Write Programs to implement the Stack operations using an array
  5. Write a program using stacks to convert a given infix expression to postfix
  6. Write Programs to implement the Stack operations using Lined List.
  7. Write Programs to implement the Queue operations using an array.
  8. Write Programs to implement the Queue operations using Lined List.
  9. Write a program for Binary Search Tree Traversals
  10. Write a program to search an item in a given list using the following Searching Algorithms
    - a. Linear Search
    - b. Binary Search.
  11. Write a program for implementation of the following Sorting Algorithms
    - a. Bubble Sort
    - b. Insertion Sort
    - c. Quick Sort
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**III Semester**  
**Course 7: Computer Organization**  
Credits -3

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**Course Objectives**

To familiarize with organizational aspects of memory, processor and I/O.

**Course Outcomes**

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

1. Identify different types of instructions
2. Differentiate between micro-programmed and hard-wired control units.
3. Analyse the performance of hierarchical organization of memory.
4. Summarize different data transfer techniques.
5. Demonstrate arithmetic operations on fixed- and floating-point numbers and illustrate concepts of parallel processing.

**UNIT – I**

**Register Transfer Language and Micro Operations:** Introduction- Functional units, computer registers, register transfer language, register transfer, bus and memory transfers, arithmetic, logic and shift micro-operations, arithmetic logic shift unit.

**Basic Computer Organization and Design:** Instruction codes, instruction cycle.  
Register reference instructions, Memory – reference instructions, input – output and interrupt.

**UNIT – II**

**CPU and Micro Programmed Control:** Central Processing unit: Introduction, instruction formats, addressing modes. Control memory, address sequencing, design of control unit - hard wired control, micro programmed control.

**UNIT – III**

**Memory Organization:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache Memory and mappings.

**UNIT – IV**

**Input-Output Organization:** Peripheral Devices, input-output interface, asynchronous data transfer, modes of transfer- programmed I/O, priority interrupt, direct memory access, Input – Output Processor (IOP).

**UNIT – V**

**Computer Arithmetic and Parallel Processing:** Data representation- fixed point, floating point, addition and subtraction, multiplication and division algorithms.

Parallel Processing-Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline.

**Text Books:**

1. M. Moris Mano, “Computer Systems Architecture”, 3rd edition, Pearson/ PHI.
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**ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM**  
**Single Major B.Sc Computer Science (w.e.f:2023-24A.B)**

**Reference Books:**

1. Carl Hamacher, ZvonksVranesic, SafeaZaky, “Computer Organization”, 5th edition, McGraw Hill.
2. William Stallings, “Computer Organization and Architecture”, 8th edition, Pearson/PHI.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Quiz competition on micro-operations.

**Evaluation Method:** Accuracy and speed in answering quiz questions.

**Unit 2: Activity:** Instruction Format Puzzle: Solving a puzzle to decode and understand instruction formats.

**Evaluation Method:** Accuracy and speed in completing the puzzle.

**Unit 3: Activity:** Memory Hierarchy Poster: Creating informative posters or infographics on memory hierarchy.

**Evaluation Method:** Clarity of information, presentation and creativity of visual design.

**Unit 4: Activity:** I/O Troubleshooting Challenge

**Evaluation Method:** problem identification, feasibility of proposed solutions, and clarity of explanations.

**Unit 5: Activity:** Case Study on Parallel processing architecture.

**Evaluation Method:** Understanding of parallel processing concepts and architectures.

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**III Semester**  
**Course 3: Computer Organization**  
Credits -1

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**Lab Experiments**

1. Implement a C program to convert a Hexadecimal, octal, and binary number to decimal number vice versa.
2. Implement a C program to perform Binary Addition & Subtraction.
3. Implement a C program to perform Multiplication of two binary numbers.
4. Implement arithmetic micro-operations using logic gates.
5. Implement logic and shift micro-operations using logic gates.
6. Implement a C program to perform Multiplication of two binary numbers (signed) using Booth's Algorithms.
7. Implement a C program to perform division of two binary numbers (Unsigned) using restoring division algorithm.
8. Implement a C program to perform division of two binary numbers (Unsigned) using non-restoring division algorithm.
9. Write assembly language code for  $A+B*(C-D)$  using various instruction formats in MASM or any open-source assembler.
10. Write assembly language code for  $A+B*C$  using various addressing modes in MASM or any open-source assembler.



**III Semester**  
**Course 8: Operating Systems**  
Credits -3

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**Course Objectives**

To gain knowledge about various functions of an operating system like memory management, process management, device management, etc.

**Course Outcomes:**

Upon successful completion of the course, a student will be able to:

1. Demonstrate knowledge and comprehension of operating system functions.
2. Analyze different process scheduling algorithms and apply them to manage processes and threads effectively
3. Create strategies to prevent, detect, and recover from deadlocks, and design solutions for inter-process communication and synchronization problems.
4. Compare and contrast different memory allocation strategies and evaluate their effectiveness
5. Evaluate disk scheduling algorithms while implementing OS security measures

**UNIT- I**

What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.

**UNIT- II**

Processor and User Modes, Kernels, System Calls and System Programs, System View of the Process and Resources, Process Abstraction, Process Hierarchy, Threads, Threading Issues, Thread Libraries; Process Scheduling- Non-Preemptive and Preemptive Scheduling Algorithms.

**UNIT III**

**Process Management:** Deadlock, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery.

Concurrent and Dependent Processes, Critical Section, Semaphores, Methods for Inter process Communication; Process Synchronization, Classical Process Synchronization Problems: Producer-Consumer, Reader-Writer.

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**UNIT IV**

Memory Management: Physical and Virtual Address Space; Memory Allocation Strategies–Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory.

**UNIT V**

**File and I/O Management, OS security:** Directory Structure, File Operations, File Allocation Methods, Device Management, Pipes, Buffer, Shared Memory, Disk Scheduling algorithms.

**Text Books:**

1. Operating System Principles by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne (7th Edition) Wiley India Edition.

**Reference Books**

1. Operating Systems: Internals and Design Principles by Stallings (Pearson)
2. Operating Systems by J. Archer Harris (Author), Jyoti Singh (Author) (TMH)

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Case Study on a specific Operating System: highlighting its functions and key features.

**Evaluation Method:** Case study presentation, depth of understanding of operating system functions, and ability to articulate key concepts.

**Unit 2: Activity:** Comparison Poster on Scheduling Algorithms

**Evaluation Method:** Assessment of posters based on content accuracy, clarity of information, visual presentation, and ability to convey key insights.

**Unit 3: Activity:** Assignment on Dead Lock prevention techniques

**Evaluation Method:** Understanding, Completion and report.

**Unit 4: Activity:** Debate on various Memory allocation schemes

**Evaluation Method:** Debate arguments, ability to counter opposing viewpoints, logical reasoning, and presentation skills.

**Unit 5: Activity:** Comparative study of various disk scheduling algorithms using real world datasets

**Evaluation Method:** Analysis methodology, accuracy of results, and presentation of findings and conclusions.

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**III Semester**  
**Course 8: Operating Systems**  
Credits -1

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**List of Experiments:**

1. Illustrate the LINUX commands
    - a) pwd
    - b) mkdir
    - c) rmdir
    - d) grep
    - e) chmod
    - f) ls
    - g) rm
    - h) cp
  2. Write a program to calculate average waiting time and turn around time of each process using the following CPU Scheduling algorithm for the given process schedules.
    - a) FCFS
    - b) SJF
    - c) Priority
    - d) Round Robin
  3. Simulate MVT and MFT memory management techniques
  4. Write a program for Bankers Algorithm for Dead Lock Avoidance
  5. Implement Bankers Algorithm Dead Lock Prevention.
  6. Write a program to simulate Producer-Consumer problem.
  7. Simulate all Page replacement algorithms.
    - e) FIFO
    - f) LRU
    - g) LFU
    - h) Optimal
  8. Simulate Paging Techniques of memory management
  9. Simulate the following disk scheduling algorithms
    - a) FCFS
    - b) SSTF
    - c) SCAN
    - d) CSCAN
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IV Semester  
Course 9: Database Management Systems  
Credits -3

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**Learning Objectives:**

To familiarize with concepts of database design

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Differentiate between database systems and file based systems
2. Design a database using ER model
3. Use relational model in database design
4. Use SQL commands for creating and manipulating data stored in databases.
5. Write PL/SQL programs to work with databases.

**UNIT- I**

**Overview of Database Management System:** Introduction to data, information, database, database management systems, file-based system, Drawbacks of file-Based System, database approach, Classification of Database Management Systems, advantages of database approach, Various Data Models, Components of Database Management System, three schema architecture of data base, costs and risks of database approach.

**UNIT - II**

**Entity-Relationship Model:** Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, **IS A** relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modeling.

**UNIT - III**

**Relational Model:** Introduction, CODD Rules, relational data model, concept of key, relational integrity, relational algebra, relational algebra operations, advantages of relational algebra,

limitations of relational algebra, relational calculus, tuple relational calculus, domain relational Calculus (DRC), Functional dependencies and normal forms upto 3<sup>rd</sup> normal form.

**UNIT - IV**

**Structured Query Language:** Introduction, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

**UNIT - V**

**PL/SQL:** Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create a PL/SQL, Program, Iterative Control, Procedure, Function, Database Triggers, Types of Triggers.

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**Text Books:**

1. Operating System Principles by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne (7th Edition) Wiley India Edition.

**Reference Books**

1. Database Management Systems by Raghu Ramakrishnan, McGrawhill
2. Principles of Database Systems by J. D. Ullman
3. Fundamentals of Database Systems by R. Elmasri and S. Navathe
4. SQL: The Ultimate Beginners Guide by Steve Tale.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Seminar Presentation on Database Management Systems

**Evaluation Method:** Depth of research, clarity of explanations, ability to address questions and engage the audience.

**Unit 2: Activity:** Case Study on EER model

**Evaluation Method:** Identification of inheritance relationships, effective use of generalization and specialization, and adherence to constraints.

**Unit 3: Activity:** Exercise on Normalization: Assign students a set of unnormalized tables and have them normalize the tables to third normal form

**Evaluation Method:** Normalized table designs, identification of functional dependencies, adherence to normalization rules, and elimination of anomalies.

**Unit 4: Activity:** Competition on SQL Query Writing

**Evaluation Method:** Query correctness, efficiency, proper use of SQL commands, ability to handle complex scenarios, and creativity in query formulation.

**Unit 5: Activity:** Peer Review of PL/SQL code

**Evaluation Method:** Peer evaluation of code quality, adherence to coding standards, proper use of language elements, and logic.

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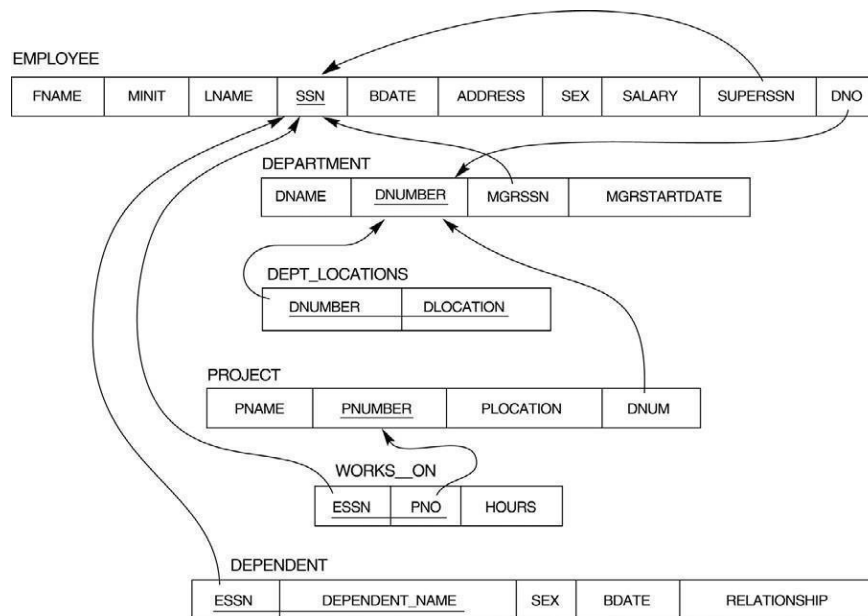


IV Semester  
Course 9: Database Management Systems  
Credits -1

### List of Experiments:

1. Draw ER diagram for hospital administration
2. Creation of college database and establish relationships between tables
3. Relational database schema of a company is given in the following figure.

### Relational Database Schema - COMPANY



### Questions to be performed on above schema

1. Create above tables with relevant Primary Key, Foreign Key and other constraints
2. Populate the tables with data
3. Display all the details of all employees working in the company.
4. Display ssn, lname, fname, address of employees who work in department no 7.
5. Retrieve the Birthdate and Address of the employee whose name is 'Franklin T. Wong'
6. Retrieve the name and salary of every employee
7. Retrieve all distinct salary values
8. Retrieve all employee names whose address is in 'Bellaire'
9. Retrieve all employees who were born during the 1950s
10. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)



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11. Retrieve the names of all employees who do not have supervisors
  12. Retrieve SSN and department name for all employees
  13. Retrieve the name and address of all employees who work for the 'Research' department
  14. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.
  15. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
  16. Retrieve all combinations of Employee Name and Department Name
  17. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan' either as a worker or as a manager of the department that controls the project.
  18. Increase the salary of all employees working on the 'Product X' project by 15%. Retrieve employee name and increased salary of these employees.
  19. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
  20. Select the names of employees whose salary does not match with salary of any employee in department 10.
  21. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.
  22. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.
  23. Find the sum of the salaries and number of employees of all employees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
  24. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
  25. Delete all dependents of employee whose ssn is '123456789'.
  26. Perform a query using alter command to drop/add field and a constraint in Employee table.
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**IV Semester**

**Course 10: Object Oriented Software Engineering**

Credits -3

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**Course Objective:**

To introduce Object-oriented software engineering (OOSE) - which is a popular technical approach to analyzing, designing an application, system, or business by applying the object- oriented paradigm and visual modeling.

**Course Outcomes:**

Upon successful completion of the course, a student will be able to:

1. Understand and apply the fundamental principles of Object-Oriented Programming (OOP) concepts and Unified Modeling Language (UML) basics, in the development of software solutions.
2. Analyze and specify software requirements, develop use cases and scenarios, apply object-oriented analysis and design (OOAD) principles
3. Familiar with the concept of test-driven development (TDD) and its practical implementation
4. Analyze and Evaluate Software Maintenance and Evolution Strategies
5. Apply Advanced Object-Oriented Software Engineering Concepts

**UNIT-I**

Introduction to Object-Oriented Programming: Overview of software engineering, Introduction to Object-Oriented Programming (OOP) concepts (classes, objects, inheritance, polymorphism), Unified Modelling Language (UML) basics, Introduction to software development process and software development life cycle (SDLC).

**UNIT-II**

Requirements Analysis and Design: Requirements analysis and specification, Use cases and scenarios, Object-oriented analysis and design (OOAD), Design patterns, UML modelling techniques (class diagrams, sequence diagrams, state machine diagrams, activity diagrams)

**UNIT-III**

Software Construction and Testing: Software construction basics, Object-oriented design principles, Object-oriented programming languages (Java, C++, Python), Software testing basics (unit testing, integration testing, system testing), Test-driven development (TDD)

**UNIT-IV**

Software Maintenance and Evolution: Software maintenance basics, refactoring techniques Software version control, Code review and inspection, Software evolution and reengineering

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### **UNIT-V**

Advanced Topics in Object-Oriented Software Engineering: Model-driven engineering (MDE), Aspect-oriented programming (AOP), Component-based software engineering (CBSE), Service-oriented architecture (SOA), Agile software development and Scrum methodologies.

#### **Text Book(s)**

1. An Introduction to Object-Oriented Analysis and Design and the Unified Process, 3rd Edition, Craig Larman, Prentice-Hall.
2. Programming in Java by Sachin Malhotra, Oxford University Press

#### **Reference Books**

1. Requirements engineering: processes and techniques, G.Kotonya and, I.Sommerville, 1998, Wiley
2. Design Patterns, E.Gamma, R. Helm, R. Johnson, and J. Vlissides
3. The Unified Modeling Language Reference Manual, J. Rumbaugh, I.Jacobson and G. Booch, Addison Wesley

### **SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Group Activity: Design and implement a small OOP project

**Evaluation Method:** Presentation evaluation rubric, Project evaluation based on OOP principles.

**Unit 2: Activity:** Use Case Scenario Presentation & Peer Activity: Review and provide feedback on each other's use case diagrams

**Evaluation Method:** Presentation evaluation rubric, Peer feedback assessment.

**Unit 3: Activity:** Poster Presentation: Illustrate TDD principles and benefits

**Evaluation Method:** Poster presentation evaluation

**Unit 4: Activity:** Peer Activity: Analyze and discuss different maintenance strategies

**Evaluation Method:** Peer discussion participation evaluation

**Unit 5: Activity:** Seminar on Design Patterns

**Evaluation Method:** Depth of research, clarity of explanations, ability to address questions and engage the audience.

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**IV Semester**  
**Course 10: Object Oriented Software Engineering**  
Credits -1

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**Suggested Software Tools:** StarUML/UMLGraph/Topcased/Umberollo/ArgoUML/ Eclipse IDE, Visual Paradigm for UML/Rational Software Architect/Any other Open Source Tool

**List of Experiments:**

Select domain of interest (e.g. College Management System) and identify multi-tier software application to work on (e.g. Online Fee Collection). Analyze, design and develop this application using OOSE approach:

1. Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
  2. Understanding of System modeling: Data model i.e. ER – Diagram and draw the ER Diagram with generalization, specialization and aggregation of specified problem statement
  3. Understanding of System modeling: Functional modeling: DFD level 0 i.e. Context Diagram and draw it
  4. Understanding of System modeling: Functional modeling: DFD level 1 and DFD level 2 and draw it.
  5. Identify use cases and develop the use case model.
  6. Identify the business activities and develop an UML Activity diagram.
  7. Identify the conceptual classes and develop a domain model with UML Class diagram.
  8. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
  9. Draw the state chart diagram.
  10. Identify the user interface, domain objects, and technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
  11. Implement the technical services layer.
  12. Implement the domain objects layer.
  13. Implement the user interface layer.
  14. Draw component and deployment diagrams.
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**IV Semester**

**Course 11: Data Communication and Computer Networks**

Credits -3

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**Course Objectives**

To provide students with a comprehensive understanding of networking principles, protocols, and technologies, enabling them to design, analyze, and evaluate efficient and reliable network solutions.

**Course Outcomes**

Upon successful completion of the course, a student will be able to:

1. Understand and apply network applications, hardware, software, and reference models for network communication.
2. Design and analyze data link layer protocols, multiple access protocols, and wireless LAN technologies.
3. Design routing algorithms, congestion control algorithms, and evaluate network layer protocols for internetworking.
4. Analyze transport service, transport protocols, and evaluate UDP and TCP in the internet.
5. Understand and evaluate application layer protocols, including DNS, email, WWW, and network management protocols.

**UNIT-I**

**INTRODUCTION:** Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay.

**THE PHYSICAL LAYER:** Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

**UNIT-II**

**THE DATA LINK LAYER:** Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer on the internet.

**THE MEDIUM ACCESS SUBLAYER:** Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth.

**UNIT-III**

**THE NETWORK LAYER:** Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

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**UNIT-IV**

**THE TRANSPORT LAYER:** Transport service, elements of transport protocol, SimpleTransport Protocol, Internet transport layer protocols: UDP and TCP.

**UNIT-V**

**THE APPLICATION LAYER:** Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http.

**APPLICATION LAYER PROTOCOLS:** Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

**Text Book(s)**

1. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India

**Reference Books**

2. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
3. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Hands-on exercises to configure network applications

**Evaluation Method:** Practical skills in configuring network applications, hardware, and software.

**Unit 2: Activity:** Protocol Design and Simulation using simulation tools like NS-3 or Cisco Packet Tracer.

**Evaluation Method:** Students' ability to design and simulate data link layer protocols and multiple access protocols

**Unit 3: Activity:** Guest Lectures and Workshops on routing algorithms, congestion control, and network layer protocols.

**Evaluation Method:** Students' participation and understanding demonstrated in guest lectures and workshop

**Unit 4: Activity:** Network Monitoring and Traffic Analysis using tools like Wireshark

**Evaluation Method:** Understanding of transport protocols through their analysis of network traffic and identification of UDP and TCP behavior

**Unit 5: Activity:** Group Projects on Network Application Development

**Evaluation Method:** Group Project Presentations

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**ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM**  
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**IV Semester**

**Course 11: Data Communication and Computer Networks**

Credits -1

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**List of Experiments:**

1. Understanding various network tools in Windows and Linux
  2. Study different types of Network devices and Cables
  3. Building a Local Area Network
  4. Concept of Network IP Address
  5. Introduction to Network Simulator – Packet Tracer (PT)
  6. Configuration of a Router using Packet Tracer
  7. Implementation of a Network using Packet Tracer
  8. Implementation of Static Routing using Packet Tracer
  9. Implementation of RIP using Packet Tracer
  10. Implementation of OSPF using Packet Tracer
  11. Implement DNS using packet tracer
  12. Implementation of a VLAN using Packet Tracer
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**V Semester**

**Course 12: Web Interface Designing Technologies**

Credits -3

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**Learning Objectives:**

To enable students to understand web architecture, develop aesthetic websites, create static and dynamic web pages, implement user interactivity, and gain proficiency in installing and utilizing WordPress and plugins

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Understand and appreciate the web architecture and services along with its basic building blocks
2. Gain knowledge about various components of a website related to aesthetics
3. Demonstrate skills regarding creation of a static website and addition of dynamic behavior to a website
4. Get experience on making user-interactive web pages.
5. Learn how to install word press and gain the knowledge of installing various plugins to use in their websites.

**UNIT - I**

**HTML:** Introduction to web designing, difference between web applications and desktop applications, introduction to HTML, HTML structure, elements, attributes, headings, paragraphs, images, tables, lists, blocks, symbols, embedding multi-media components in HTML, HTML forms

**UNIT – II**

**CSS:** CSS home, introduction, syntax, CSS combinators, colors, background, borders, margins, padding, height/width, text, fonts, tables, lists, position, overflow, float, pseudo class, pseudo elements, opacity, tool tips, image gallery, CSS forms, CSS counters.

**UNIT – III**

**Java Script:** What is DHTML, JavaScript, basics, variables, operators, statements, string manipulations, mathematical functions, arrays, functions. objects, regular expressions, exception handling.

**UNIT-IV**

**Client-Side Scripting:** Accessing HTML form elements using Java Script object model, basic data validations, data format validations, generating responsive messages, opening windows using java script, different kinds of dialog boxes, accessing status bar using java script, embedding basic animative features using different keyboard and mouse events.

**UNIT – V**

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**Word press:** Introduction to word press, features, and advantages, installing and configuring word press and understanding its admin panel (demonstration only), working with posts, managing pages, working with media - Adding, editing, deleting media elements, working with widgets, using menus, working with themes, defining users, roles and profiles, adding external links, extending word press with plug-ins.

**Text Book(s)**

1. Chris Bates, Web Programming Building Internet Applications, Second Edition, Wiley (2007)
2. Paul S.WangSanda S. Katila, an Introduction to Web Design plus Programming, Thomson (2007).

**Reference Books**

1. Head First HTML and CSS, Elisabeth Robson, Eric Freeman, O'Reilly Media Inc.
2. An Introduction to HTML and JavaScript: for Scientists and Engineers, David R. Brooks. Springer, 2007
3. Schaum's Easy Outline HTML, David Mercer, Mcgraw Hill Professional.
4. Word press for Beginners, Dr.Andy Williams.
5. Professional word press, Brad Williams, David damstra, Hanstern.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Infographic explaining the necessity to have a web site for each of the agencies such as hotels, hospitals, supermarkets, and educational institutions.

**Evaluation Method:** Assess the accuracy, visual design, clarity, creativity, use of visual elements, presentation of the infographic explaining the necessity of a website for different agencies.

**Unit 2: Activity:** Seminar through PPT on various Look and Feel components that websites related to different agencies

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visual aids, audience engagement

**Unit 3: Activity:** Code snippets Challenge.

**Evaluation Method:** Accuracy, functionality, efficiency, code readability, and problem-solving approach of the JavaScript code snippets

**Unit 4: Activity:** Group discussion on different kinds of web forms that take and validate user input using java script validations

**Evaluation Method:** Active participation, knowledge sharing, critical thinking, and demonstration of different web forms and JavaScript validations

**Unit 5: Activity:** Creation of Personal website using wordpress

**Evaluation Method:** Design aesthetics, functionality, user interactivity, content organization, and utilization of plugins.

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**List of Experiments:**

1. Create an HTML document with the following formatting options:
  - (a) Bold, (b) Italics, (c) Underline, (d) Headings (Using H1 to H6 heading styles), (e) Font (Type, Size and Color), (f) Background (Colored background/Image in background), (g) Paragraph, (h) Line Break, (i) Horizontal Rule, (j) Pre tag
2. Create an HTML document which consists of:
  - (a) Ordered List (b) Unordered List (c) Nested List (d) Image
3. Create a Table with four rows and five columns. Place an image in one column.
4. Using “table” tag, align the images as follows:



5. Create a menu form using html.
6. Style the menu buttons using CSS.
7. Create a form using HTML which has the following types of controls:
  - (a) Text Box (b) Option/radio buttons (c) Check boxes (d) Reset and Submit buttons
8. Embed a calendar object in your web page.
9. Create a form that accepts the information from the subscriber of a mailing system.

**Word press:**

10. Installation and configuration of word press
  11. Access admin panel and manage posts
  12. Access admin panel and manage pages
  13. Add widgets and menus
-



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14. Create users and assign roles
  15. Create a site and add a theme to it
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V Semester

Course 13: Web Applications Development using PHP & MYSQL

Credits -3

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**Learning Objectives:**

To enable students to understand open-source tools to create dynamic web pages, implement user interactivity, and gain proficiency in developing web sites

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Write simple programs in PHP.
2. Understand how to use regular expressions, handle exceptions, and validate data using PHP.
3. Apply In-Built functions and Create User defined functions in PHP programming.
4. Write PHP scripts to handle HTML forms.
5. Know how to use PHP with a MySQL database and can write database driven web pages.

**UNIT-I**

**The building blocks of PHP:** Variables, Data Types, Operators and Expressions, Constants. **Flow Control Functions in PHP:** Switching Flow, Loops, Code Blocks and Browser Output. **Working with Functions:** Creating functions, Calling functions, Returning the values from User- Defined Functions, Variable Scope, Saving state between Function calls with the static statement, arguments of functions

**UNIT-II**

**Working with Arrays:** Creating Arrays, Some Array-Related Functions.

**Working with Objects:** Creating Objects, Accessing Object Instances, **Working with Strings, Dates and Time:** Formatting strings with PHP, Manipulating Strings with PHP, Using Date and Time Functions in PHP.

**UNIT-III**

**Working with Forms:** Creating Forms, Accessing Form Input with User defined Arrays, Combining HTML and PHP code on a single Page, Using Hidden Fields to save state, Redirecting the user, Sending Mail on Form Submission, and **Working with File Uploads**, Managing files on server, **Exception handling.**

**UNIT-IV**

**Working with Cookies and User Sessions:** Introducing Cookies, setting a Cookie with PHP, Session Function Overview, starting a Session, working with session variables, passing session IDs in the Query String, Destroying Sessions and Unsetting Variables, Using Sessions in an Environment with Registered Users.

**UNIT-V**

**Interacting with MySQL using PHP:** MySQL Versus MySQLi Functions, connecting to MySQL with PHP, Working with MySQL Data. Planning and Creating Database Tables, Creating Menu, Creating Record Addition Mechanism, Viewing Records, Creating the Record Deletion Mechanism.

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**Text Book(s)**

1. Julie C. Meloni, SAMS Teach yourself PHP MySQL and Apache, Pearson Education (2007).
2. Steven Holzner, PHP: The Complete Reference, McGraw-Hill

**Reference Books**

1. Robin Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, Third Edition O'reilly, 2014
2. Xue Bai Michael Ekedahl, The web warrior guide to Web Programming, Thomson (2006).

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Infographic explanation of client-server architecture and different server-side scripting languages.

**Evaluation Method:** Assess the accuracy, visual design, clarity, creativity, use of visual elements, presentation of the infographic explaining the benefits of server-side scripting languages.

**Unit 2: Activity:** Presentation on various open-source frameworks available in LAMP model

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visual aids, audience engagement

**Unit 3: Activity:** Code snippets Challenge.

**Evaluation Method:** Accuracy, functionality, efficiency, code readability, and problem-solving approach of the PHP code snippets

**Unit 4: Activity:** Group discussion on Session Management in PHP

**Evaluation Method:** Active participation, knowledge sharing, critical thinking, and demonstration of Session Management

**Unit 5: Activity:** Hands-on Lab Session on MYSQL Queries

**Evaluation Method:** Lab Performance and Correctness of solution Implementation

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**V Semester**

**Course 13: Web Applications Development using PHP & MYSQL**

Credits -1

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**List of Experiments:**

1. Write a PHP program to Display “Hello”
  2. Write a PHP Program to display the today’s date.
  3. Write a PHP program to display Fibonacci series.
  4. Write a PHP Program to read the employee details.
  5. Write a PHP program to prepare the student marks list.
  6. Create student registration form using text box, check box, radio button, select, submit button. And display user inserted value in new PHP page.
  7. Create Website Registration Form using text box, check box, radio button, select, submit button. And display user inserted value in new PHP page.
  8. Write PHP script to demonstrate passing variables with cookies.
  9. Write a PHP script to connect MySQL server from your website.
  10. Write a program to keep track of how many times a visitor has loaded the page.
  11. Write a PHP application to perform CRUD (Create, Read, Update and Delete) operations on a database table.
  12. Create a web site using any open-source framework built on PHP and MySQL – It is a team activity wherein students are divided into multiple groups and each group comes up with their own website with basic features.
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V Semester  
Course 14 A: Internet of Things  
Credits -3

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**Learning Objectives:**

To enable students to understand basic IoT constructs, create IoT solutions to real world problems using IoT

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Understand various concepts, terminologies and applications of IoT
2. Learn how to build IoT devices with development boards
3. Understand various Wireless protocols for IoT
4. Learn how to use various sensors and actuators & develop IoT solutions using Arduino
5. Develop and Connect IoT with Cloud Platforms.

**UNIT - I**

**Fundamentals of IoT:** Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

**Applications of IoT:** Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

**UNIT - II**

**Sensors Networks :** Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

**Unit - III**

**Wireless Technologies for IoT:** WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet and Modbus.

**IP Based Protocols for IoT:** IPv6, 6LowPAN, LoRA, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols.

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### **Unit - IV**

**Arduino Simulation Environment:** Arduino Uno Architecture, Setting up the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD.

**Sensor & Actuators with Arduino:** Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensors with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino.

### **Unit - V**

**Developing IOT's:** Implementation of IoT with Arduino, Connecting and using various IoT Cloud Based Platforms such as Blynk, Thingspeak, AWS IoT, Google Cloud IoT Core etc. Cloud Computing, Fog Computing, Privacy and Security Issues in IoT.

### **Text Book(s)**

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
2. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press.
3. Internet of Things- Dr Surya Durbha & Dr Jyoti Joglekar, Oxford University Press

### **Reference Books**

1. Daniel Minoli, — “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press

### **SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Seminar on various applications of IoT through PPT

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visualaids, audience engagement

**Unit 2: Activity:** Hands-on Lab activity on Arduino Development

**Evaluation Method:** Lab Performance and Correctness of Circuit Implementation

**Unit 3: Activity:** Group discussion on Future Wireless Technologies.

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**Evaluation Method:** Active participation, knowledge sharing, critical thinking, and demonstration of different wireless technologies for IoT

**Unit 4: Activity:** Peer activity on different types of Sensors

**Evaluation Method:** Peer evaluation of working principle of Sensor, use-cases of sensors.

**Unit 5: Activity:** Guest Lecture or Expert talk on Cloud based IoT platforms

**Evaluation Method:** Active Participation, Post Talk report presentation

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**V Semester**  
**Course 14 A: Internet of Things**  
Credits -1

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**List of Experiments:**

1. Understanding Arduino UNO Board and Components
2. Installing and work with Arduino IDE
3. Blinking LED sketch with Arduino
4. Simulation of 4-Way Traffic Light with Arduino
5. Using Pulse Width Modulation
6. LED Fade Sketch and Button Sketch
7. Analog Input Sketch (Bar Graph with LEDs and Potentiometre)
8. Digital Read Serial Sketch (Working with DHT/IR/Gas or Any other Sensor)
9. Working with Adafruit Libraries in Arduino
10. Spinning a DC Motor and Motor Speed Control Sketch
11. Working with Shields
12. Design APP using Blink App or Things peak API and connect it LED bulb.
13. Design APP Using Blynk App and Connect to Temperature, magnetic Sensors.



**V Semester**  
**Course 14 B: Foundations of Data Science**  
Credits -3

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**Learning Objectives:**

To enable students to develop IoT solutions for real-world problems

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Identify the need for data science and understand various data collection strategies
2. Understand about NoSQL and Descriptive Statistics
3. Apply Numpy methods to process the data in an array.
4. Summarize and Compute Descriptive Statistics using Pandas.
5. Apply powerful data manipulations visualization using Pandas

**UNIT-I**

**Introduction to Data Science:** Need for Data Science – What is Data Science - Evolution of Data Science, Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required. Applications of Data Science in various fields – Data Security Issues.

**Data Collection Strategies,** Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization, Data Munging, Filtering

**UNIT-II**

**Descriptive Statistics** – Mean, Standard Deviation, Skewness and Kurtosis; Box Plots – Pivot Table – Heat Map – Correlation Statistics –ANOVA.

**No-SQL:** Document Databases, Wide-column Databases and Graphical Databases.

**UNIT-III**

**Python for Data Science** –Python Libraries, Python integrated Development Environments (IDE)for Data Science, **NumPy Basics:** Arrays and Vectorized Computation- The NumPy ndarray-

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Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes.

**Universal Functions:** Fast Element-Wise Array Functions- Mathematical and Statistical Methods- Sorting- Unique and Other Set Logic.

#### **UNIT-IV**

**Introduction to pandas Data Structures:** Series, Data Frame and Essential Functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.

Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

#### **UNIT-V**

**Data Cleaning and Preparation:** Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers-

**Plotting with pandas:** Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

#### **Text Book(s)**

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson, 2012.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly, 2nd Edition, 2018.

#### **Reference Books**

1. Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, ‘Fundamentals of Data Science, CRC Press, 1st Edition, 2022
  2. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, 2017.
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**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Seminar on Role of Data Science in Politics

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visualaids, audience engagement

**Unit 2: Activity:** Exercises on Descriptive Statistics

**Evaluation Method:** Problem Solving, Accuracy

**Unit 3: Activity:** Hands-on Lab using Numpy

**Evaluation Method:** Lab Performance and Correctness of solution Implementation

**Unit 4: Activity:** Hands-on Lab Activity on Pandas

**Evaluation Method:** Lab Performance and Correctness of solution Implementation.

**Unit 5: Activity:** Group Activity to visualize college performance records using various plots

**Evaluation Method:** Active Participation, Post Talk report presentation

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**V Semester**  
**Course 14 B : Foundations of Data Science**  
Credits -1

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**List of Experiments:**

1. Study on various python IDEs for Data Science
  2. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
  3. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
  4. Computation on NumPy arrays using Universal Functions and Mathematical methods.
  5. Create Pandas Series and Data Frame from various inputs.
  6. Import any CSV file to Pandas Data Frame and perform the following:
    - a. Visualize the first and last 10 records
    - b. Get the shape, index and column details
    - c. Select/Delete the records (rows)/columns based on conditions.
    - d. Perform ranking and sorting operations.
    - e. Do required statistical operations on the given column
  7. Import any CSV file to Pandas Data Frame and perform the following:
    - a. Handle missing data by detecting and dropping/ filling missing values.
    - b. Transform data using apply () and map() method.
    - c. Detect and filter outliers.
    - d. Perform Vectorized String operations on Pandas Series.
    - e. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
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V Semester

Course 15 A: IoT Applications Development and Programming

Theory

03 hours /Week

Credits -3

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**Learning Objectives:**

To enable students to develop IoT solutions for real-world problems

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Understand the Basic Concepts of Internet of Things
2. Learn various Sensors and their associative protocols
3. Learn the Single Board Computers for development of IoT
4. Build the IoT devices with the Node-RED without Complex coding
5. Develop various IoT real-time applications

**UNIT-I**

**Overview of the Internet of Things (IoT) and Sensors:** Sensors - Energy-based, Signal Output, Mode of Operation, Electronic Sensors. Connectivity - Bluetooth, Zigbee, Wi-Fi, LoRa, Wired Communication. Machine Intelligence, Active Management, Sensor Fusion, Smart Devices- Human-Computer Interaction, Context Awareness, Actuators, IoT and Smart City Applications- Automobile Sensors, Smart Home Sensors, Smart Transportation Sensors.

**UNIT-II**

**IoT Sensors and Their Interfacing Protocols: Vision and Imaging Sensors-** Line Scan Cameras, 3D Depth Cameras, **Sensors That Measure Temperature-**Thermocouples, Resistance Temperature Detector (RTD), Temperature Thermistor Sensors, Semiconductor Temperature Sensors, Radiation Sensors; Proximity Sensors, Pressure Sensors, Position Sensors, Photoelectric Sensors, Particle Sensors, Types of Particle Sensors-Metal Detectors, Level Sensors, Leak Detectors, Humidity Sensors, Gas and Chemical Sensors, Gas Detectors, Carbon Monoxide (MQ7) Detectors, Flame Detectors, **Sensor Communication Protocols**



### UNIT-III

**Programming Single Board Computers:** Arduino Programming, Raspberry Pi-Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, Basics of Linux and its use, Introduction to Raspberry Pi GPIO Access, Interfacing DHT, Interfacing Picanto Raspberry Pi zero w, Pi Camera Specifications, Pi Camera Access, Interfacing PIR Sensor **Python:** File Concepts, Spreadsheet Concepts, Communication Concepts, Wired and Wireless Programming Concepts

### UNIT-IV

**Node-RED:** Node-RED Features, Installation of Node-RED, Node-RED Architecture, Node-RED Flow Editor, Basic Function Nodes, Node-RED Library, Node-RED Applications; MQTT Protocols, Google Sheets Programming (gsread), Firebase Programming, Matplotlib- Getting Started, Bar Graphs, Scatter Plot, Spectrum Representation, Coherence of Two Signals, Cross- Correlation Graph, Autocorrelation Graph, Changing Figure Size in Different Units, Scale Pie Charts, Style Sheets- FiveThirtyEight Style Sheet, Solarized Light Style Sheet.

### UNIT-V

**Wireless Connectivity in IoT:** Introduction, Low-Power Wide-Area Networks (LPWANs),RFID Protocol, XBEE Radios with Arduino, Bluetooth with Arduino, Arduino with a GSMModem, Arduino with Firebase Cloud Connectivity

**The Internet of Things through the Raspberry Pi:** Introduction, Cluster Computing with Raspberry Pi Zero W-Message Passing Interface (MPI), Networking with RP is for Simple MPI Scripts, Simple MPI Programming

#### Text Book(s)

1. **Internet of Things Using Single Board Computers**, *G. R. Kanagachidambaresan*, Apress, 2022.
2. **Practical Node-RED Programming**, *Taiji Hagino*, Packt Publishing, 2021

#### Reference Books

1. **Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python**, *Colin Dow*, Packt Publishing, 2021
  2. **Programming the Internet of Things: An Introduction to Building Integrated, Device-to-Cloud IoT Solutions**, *Andy King*, O'Reilly Media, 2021
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**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Case Study Presentation on Smart City IoT realization

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visual aids, audience engagement

**Unit 2: Activity:** Poster Presentation for various kinds of Sensors

**Evaluation Method:** Creative & informative posters or infographics on Sensors

**Unit 3: Activity:** Hands-on Lab using RPi.

**Evaluation Method:** Lab Performance and Correctness of solution Implementation

**Unit 4: Activity:** Hands-on Lab Activity on Node-RED

**Evaluation Method:** Lab Performance and Correctness of solution Implementation.

**Unit 5: Activity:** Guest Lecture or Expert talk on Cloud based IoT platforms

**Evaluation Method:** Active Participation, Post Talk report presentation

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**V Semester**

**Course 15 A: IoT Applications Development and Programming**

Credits -1

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**List of Experiments:**

1. Write a program to switch light on when the input is 1 and switch the light off when the input is 0 using Raspberry pi
2. Install Node-RED and Flow-based Programming Development Environment
3. Create Basic Flows with Major Nodes
4. Develop a Node-Red Flow for various Case Studies
5. Implement Node-RED in the Cloud Calling a Web API from Node-RED
6. Create a To Do Application with Node-RED Handling Sensor Data on the Raspberry Pi
7. Develop a Dashboard with various 2D Graphs with Matplotlib
8. Install MySQL database in Raspberry pi.
9. Write a program to work with basic MySQL queries by fetching data from database in Raspberry pi.
10. Arduino with Firebase Cloud Connectivity
11. Visualize Data by Creating a Server-side Application in the Firebase



**Learning Objectives:**

To enable students to develop IoT solutions for real-world problems

**Learning Outcomes:** On successful completion of the course, students will be able to

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Web Programming and GUI in Python
5. Apply concepts of Python programming in various fields related to IOT, Web Services and Databases in Python.

**UNIT-I**

**Python basics, Objects-** Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types

**Numbers** - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules

**Sequences** - Strings, Lists, and Tuples, Dictionaries and Set Types

Control Flow, Truthiness, Sorting, List Comprehensions, Generators and Iterators

**UNIT-II**

**Files:** File Objects, File Built-in Function [ open() ], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution

**Exceptions:** Exceptions in Python, Detecting and Handling Exceptions, Context Management, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Creating Exceptions, Why Exceptions (Now)?, Why Exceptions at All?, Exceptions and the sys Module, Related Modules

**Modules:** Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules

**UNIT-III**

**Regular Expressions:** Introduction, Special Symbols and Characters, Res and Python

**Multithreaded Programming:** Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

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**UNIT-IV**

**GUI Programming:** Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs

**Web Programming:** Introduction, Web Surfing with Python, Creating Simple Web Clients, Advanced Web Clients, CGI-Helping Servers Process Client Data, Building CGI Application, Advanced CGI, Web (HTTP) Servers

**UNIT-V**

**Database Programming:** Introduction, Python Database Application Programmer's Interface (DBAPI), Object Relational Managers (ORMs), Related Modules

**Text Book(s)**

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
2. Think Python, Allen Downey, Green Tea Press.

**Reference Books**

1. Introduction to Python, Kenneth A. Lambert, Cengage.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
3. Learning Python, Mark Lutz, O' Really.

**SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:**

**Unit 1: Activity:** Hands-on Lab exercise on Python Control Statements

**Evaluation Method:** Lab Performance and Correctness of solution Implementation

**Unit 2: Activity:** Assignment of Files in Python

**Evaluation Method:** Problem Solving, Accuracy

**Unit 3: Activity:** Exercises on Regular expressions

**Evaluation Method:** Solutions, Accuracy of Validation

**Unit 4: Activity:** Poster Presentation on various GUI components in Python

**Evaluation Method:** Content knowledge, organization, clarity, presentation skills, visual aids.

**Unit 5: Activity:** Group Project

**Evaluation Method:** Project effectiveness, User interface, Solution to the Problem



**List of Experiments:**

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. Write a python program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :

Grade A: Percentage  $\geq 80$  Grade B: Percentage  $\geq 70$  and  $< 80$

Grade C: Percentage  $\geq 60$  and  $< 70$  Grade D: Percentage  $\geq 40$  and  $< 60$  Grade E: Percentage  $< 40$

3. Demonstrate various methods of Sequence Data Types
  4. Write a python program to display the first n terms of Fibonacci series.
  5. Write a python program to calculate the sum and product of two compatible matrices.
  6. Write a function that takes a character and returns True if it is a vowel and False otherwise.
  7. Write a program to implement exception handling.
  8. Write a program to implement Multithreading
  9. Develop a Python GUI calculator using Tkinter
  10. Write a Python program to read last 5 lines of a file.
  11. Design a simple database application that stores the records and retrieve the same
  12. Design a database application to search the specified record from the database.
  13. Design a database application to that allows the user to add, delete and modify the records.
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