

Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

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|-----------------------|---|
| Programme Name | : Diploma In Computer Technology / Computer Engineering / Computer Science & Engineering / Computer Hardware & Maintenance |
|-----------------------|---|

| | | | |
|-----------------------|----------------------------|---------------------------------------|------------------|
| Programme Code | : CM / CO / CW / HA | With Effect From Academic Year | : 2023-24 |
|-----------------------|----------------------------|---------------------------------------|------------------|

| | | | |
|------------------------------|---------------------|-----------------|-------------------|
| Duration Of Programme | : 6 Semester | Duration | : 16 WEEKS |
|------------------------------|---------------------|-----------------|-------------------|

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|----------|---|-------|------------------------|--------|---|---|
| Semester | : | Third | NCrF Entry Level : 3.5 | Scheme | : | K |
|----------|---|-------|------------------------|--------|---|---|

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|----------|---|-------|------------------------|--------|---|---|
| Semester | : | Third | NCrF Entry Level : 3.5 | Scheme | : | K |
|----------|---|-------|------------------------|--------|---|---|

| Sr No | Course Title | Abbreviation | Course Type | Course Code | Total IKS Hrs for Sem. | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | | | | | |
|-------|--------------|--------------|-------------|-------------|------------------------|--------------------------|----|----|---|-----------------------------|---------|-----------------------|--------|-------|-------|------------------|-----|------------------------|-------------|-------|-------|-----|-----|-----|-----|-----|-----|
| | | | | | | Actual Contact Hrs./Week | | | Self Learning (Activity/ Assignment /Micro Project) | Notional Learning Hrs /Week | | Paper Duration (hrs.) | Theory | | | Based on LL & TL | | Based on Self Learning | Total Marks | | | | | | | | |
| | | | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | Practical | | | | FA-PR | SA-PR | SLA | | | | | |
| | | | | | | | | | | | | | | | | Max | Min | Max | | | | | Min | Max | Min | Max | Min |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |

(All Compulsory)

| | | | | | | | | | | | | | | | | | | | | | | | |
|-------|---------------------------------------|-----|-----|--------|---|----|---|----|---|----|----|---|-----|-----|-----|----|-----|----|-----|----|-----|----|-----|
| 1 | DATA STRUCTURE USING C | DSU | DSC | 313301 | - | 3 | 1 | 4 | - | 8 | 4 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25# | 10 | - | - | 175 |
| 2 | DATABASE MANAGEMENT SYSTEM | DMS | DSC | 313302 | - | 3 | 1 | 4 | 2 | 10 | 5 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25# | 10 | 25 | 10 | 200 |
| 3 | DIGITAL TECHNIQUES | DTE | DSC | 313303 | - | 3 | - | 2 | 1 | 6 | 3 | 3 | 30 | 70 | 100 | 40 | 25 | 10 | 25# | 10 | 25 | 10 | 175 |
| 4 | OBJECT ORIENTED PROGRAMMING USING C++ | OOP | SEC | 313304 | - | 3 | 2 | 4 | 1 | 10 | 5 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25@ | 10 | 25 | 10 | 200 |
| 5 | COMPUTER GRAPHICS | CGR | DSC | 313001 | - | 1 | - | 2 | 1 | 4 | 2 | - | - | - | - | 25 | 10 | - | - | 25 | 10 | 50 | |
| 6 | ESSENCE OF INDIAN CONSTITUTION | EIC | VEC | 313002 | - | 1 | - | - | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 50 | 20 | 50 | |
| Total | | | | | 0 | 14 | 4 | 16 | 6 | | 20 | | 120 | 280 | 400 | | 200 | | 100 | | 150 | | 850 |

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-1H represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , Ability Enhancement Course (AEC) , Skill Enhancement Course (SEC) , Generic Elective (GE)

| | |
|------------------|---|
| Programme Name/s | : Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology |
| Programme Code | : BD/ CM/ CO/ CW/ HA/ IF/ IH |
| Semester | : Third |
| Course Title | : DATA STRUCTURE USING C |
| Course Code | : 313301 |

I. RATIONALE

One of the most important courses in information and communication technology is data structures. Data organization or structuring is essential for developing effective algorithms and programs. Students will get the ability to develop logic to solve problem using principles of data structure with the aid of this course.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Implement algorithm using relevant Data Structures.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Perform basic operations on Arrays.
- CO2 - Apply different Searching and Sorting methods.
- CO3 - Implement basic operations on Linked List.
- CO4 - Perform operations on Stack using Array and Linked List Implementations.
- CO5 - Perform operations on Queue using Array and Linked List Implementations.
- CO6 - Create and Traverse Tree to solve problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | |
|-------------|------------------------|------|-------------------|--------------------------|----|----|-----|-----|---------|-------------------|--------|-------|-------|-------|------------------|-------|-----|-----|-------------|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | Total Marks |
| | | | | | | | | | | | | | | | Practical | | | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | FA-PR | | SA-PR | | SLA | | | |
| | | | | | | | | | | | | | | Max | Min | Max | Min | Max | Min | Max | |
| 313301 | DATA STRUCTURE USING C | DSU | DSC | 3 | 1 | 4 | - | 8 | 4 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25# | 10 | - | - | 175 |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

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5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|---|--|
| 1 | TLO 1.1 Classify the given type of Data Structures based on their characteristics and space. TLO 1.2 Perform operations on the given type of Data Structure. | Unit - I Introduction to Data Structures 1.1 Introduction: Concept and Need of Data Structure, Definition, Abstract Data Type 1.2 Types of Data Structures: (i) Linear Data Structures (ii) Non-Linear Data Structures 1.3 Operations on Data Structures: (i) Traversing (ii) Insertion (iii) Deletion | Lecture Using Chalk-Board Presentations |
| 2 | TLO 2.1 Develop algorithm to search the given key using different Searching Techniques. TLO 2.2 Create algorithm to sort data using a given method. | Unit - II Searching and Sorting 2.1 Searching: Searching for an item in a data set using the following methods: (i) Linear Search (ii) Binary Search 2.2 Sorting: Sorting of data set in an order using the following methods: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort (iv) Quick Sort (v) Merge Sort | Lecture Using Chalk-Board Demonstration Presentations Hands-on |
| 3 | TLO 3.1 Differentiate between Static and Dynamic Memory Allocation. TLO 3.2 Create a suitable structure using a Linked List to represent a Node. TLO 3.3 Create Algorithm to add or remove a specified item from a Linear Linked List. | Unit - III Linked List 3.1 Difference between Static and Dynamic Memory Allocation. 3.2 Introduction to Linked List, Terminologies: Node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty List. 3.3 Type of Lists: Linear List, Circular List, Representation of Doubly Linked List. 3.4 Operations on a Singly Linked List: Creating a Linked List, Inserting a new node in a Linked List, Deleting a node from a Linked List, Searching a key in Linked List, Traversing a Singly Linked List. 3.5 Applications of Linked List. | Lecture Using Chalk-Board Demonstration Presentations Hands-on |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|---|
| 4 | TLO 4.1 Represent Stack using Array and Linked List. TLO 4.2 Create Algorithm to carry out the PUSH and POP operations in a Stack. TLO 4.3 Use Stack to transform the given expression from Infix to Postfix. TLO 4.4 Evaluate Postfix Expression. | Unit - IV Stack 4.1 Introduction to Stack: Definition, Stack as an ADT, Operations on Stack-(Push, Pop), Stack Operation Conditions – Stack Full / Stack Overflow, Stack Empty / Stack Underflow. 4.2 Stack Implementation using Array and representation using Linked List. 4.3 Applications of Stack: Reversing a List, Polish Notations, Conversion of Infix to Postfix Expression, Evaluation of Postfix Expression. 4.4 Recursion: Definition and Applications. | Lecture Using Chalk-Board Demonstration Presentations Hands-on |
| 5 | TLO 5.1 Represent Queue using Array and Linked List. TLO 5.2 Explain the characteristics of different types of Queue. TLO 5.3 Create Algorithm to carry out the INSERT and DELETE Operations on a Queue. | Unit - V Queue 5.1 Introduction to Queue: Queue as an ADT, Queue representation in memory using Array and representation using a Linked List. 5.2 Types of Queues: Linear Queue, Circular Queue, Concept of Priority Queue, Double-Ended Queue. 5.3 Queue Operations: INSERT, DELETE, Queue Operation Conditions: Queue Full, Queue Empty. 5.4 Applications of Queue. | Lecture Using Chalk-Board Demonstration Presentations Hands-on |
| 6 | TLO 6.1 Describe the given Tree Terminology. TLO 6.2 Create a Binary Search Tree based on the provided data. TLO 6.3 Create Algorithms to Traverse the Tree using the given method. TLO 6.4 Create an Expression Tree. TLO 6.5 Create Heap. | Unit - VI Tree 6.1 Introduction to Trees Terminologies: Tree, Degree of a Node, Degree of a Tree, Level of a node, Leaf Node, Depth / Height of a Tree, In-Degree and Out-Degree, Path, Ancestor and Descendant Nodes. 6.2 Tree Types and Traversal methods, Types of Trees: General Tree, Binary Tree, Binary Search Tree (BST). Binary Tree Traversal: In-Order Traversal, Preorder Traversal, Post-Order Traversal. 6.3 Expression Tree, Heap | Lecture Using Chalk-Board Demonstration Presentations Hands-on |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|---|----------------|--------------|
| LLO 1.1 Implement Array Operations. | 1 | * Write a 'C' program to perform following Operations on Array: Create, Insert, Delete, Display. | 4 | CO1 |
| LLO 2.1 Implement Linear Search Method on Numbers. | 2 | Write a 'C' Program to Search a particular data from the given Array of numbers using: Linear Search Method. | 2 | CO2 |
| LLO 3.1 Implement Linear Search Method on Strings. | 3 | * Write a 'C' Program to Search a particular data from the given Array of Strings using Linear Search Method. | 2 | CO2 |
| LLO 4.1 Implement Binary Search Method on Numbers. | 4 | * Write a 'C' program to Search a particular data from the given Array of numbers using Binary Search Method. | 2 | CO2 |
| LLO 5.1 Implement Binary Search Method on Strings. | 5 | Write a 'C' Program to Search a particular data from the given Array of Strings using Binary Search Method. | 2 | CO2 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|--|----------------|--------------|
| LLO 6.1 Apply Bubble Sort method for Sorting Numbers. | 6 | * Write a 'C' Program to Sort an Array of numbers using Bubble Sort Method. | 2 | CO2 |
| LLO 7.1 Apply Bubble Sort method for Sorting Strings. | 7 | Write a 'C' Program to Sort an Array of Strings using Bubble Sort Method. | 2 | CO2 |
| LLO 8.1 Apply Selection Sort for Sorting Numbers. | 8 | * Write a 'C' Program to Sort an Array of numbers using Selection Sort Method. | 2 | CO2 |
| LLO 9.1 Apply Selection Sort for Sorting Strings. | 9 | Write a 'C' Program to Sort an Array of Strings using Selection Sort Method. | 2 | CO2 |
| LLO 10.1 Apply Insertion Sort for Sorting Numbers. | 10 | * Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method. | 2 | CO2 |
| LLO 11.1 Apply Insertion Sort for Sorting Strings. | 11 | Write a 'C' Program to Sort an Array of Strings using Insertion Sort Method. | 2 | CO2 |
| LLO 12.1 Create Singly Linked List. | 12 | * Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at beginning, (ii) Search, (iii) Display | 2 | CO3 |
| LLO 13.1 Perform given Operations on Singly Linked List. | 13 | * Write a C Program to Implement Singly Linked List with Operations: (i) Insert at end, (ii) Insert After, (iii) Delete (iv) Display | 2 | CO3 |
| LLO 14.1 Create Polynomials using Linked List. | 14 | Write a C Program to Create Two Polynomials using a Linked List. | 2 | CO3 |
| LLO 15.1 Perform the Addition of Two Polynomials using a Linked List. | 15 | * Write a 'C' Program to add Two Polynomials using a Linked List. | 2 | CO3 |
| LLO 16.1 Perform Operations on the Stack using the Array. | 16 | * Write a 'C' Program to perform PUSH and POP Operations on Stack using an Array. | 2 | CO4 |
| LLO 17.1 Perform Operations on the Stack using a Linked List. | 17 | * Write a 'C' Program to perform PUSH and POP Operations on a Stack using a Linked List. | 2 | CO4 |
| LLO 18.1 Apply recursive procedure to multiply two numbers. | 18 | * Write a 'C' program to perform multiplication of two numbers using recursion. | 2 | CO4 |
| LLO 19.1 Apply recursive procedure to reverse the string. | 19 | Write a 'C' program to print given string in reverse using recursion. | 2 | CO4 |
| LLO 20.1 Apply recursive procedure to display linked list in reverse. | 20 | Write a 'C' program to create a Singly Linked List and traverse in reverse order using recursion. | 4 | CO3 CO4 |
| LLO 21.1 Perform Operations on Linear Queue using Array. | 21 | * Write a 'C' Program to perform INSERT and DELETE Operations on Linear Queue using an Array. | 2 | CO5 |
| LLO 22.1 Perform Operations on Linear Queue using Linked List. | 22 | * Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Linked List. | 2 | CO5 |
| LLO 23.1 Perform Operations on Circular Queue using Array. | 23 | * Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using an Array. | 2 | CO5 |
| LLO 24.1 Perform Operations on Circular Queue using a Linked List. | 24 | Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using a Linked List. | 2 | CO5 |
| LLO 25.1 Implement Priority Queue using Linked List. | 25 | Write a 'C' Program to Create a Priority Queue using a Linked List. | 4 | CO5 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|---|----------------|--------------|
| LLO 26.1 Implement Binary Search Tree and perform In-Order Traversal. | 26 | * Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order. | 2 | CO6 |
| LLO 27.1 Implement Tree Traversal Operations. | 27 | Write a 'C' Program to Traverse BST in Preorder, and Post-Order. | 2 | CO6 |
| Note : Out of above suggestive LLOs - <ul style="list-style-type: none">'*' Marked Practicals (LLOs) Are mandatory.Minimum 80% of above list of lab experiment are to be performed.Judicial mix of LLOs are to be performed to achieve desired outcomes. | | | | |

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|---|---------------------|
| 1 | Computer System with all necessary Peripherals and Internet Connectivity. 'C' Compiler / GCC Compiler/ Online 'C' Compiler | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------------|------|---------------------------------|-------------|----------------|---------|---------|---------|-------------|
| 1 | I | Introduction to Data Structures | CO1 | 2 | 2 | 2 | 0 | 4 |
| 2 | II | Searching and Sorting | CO2 | 8 | 2 | 2 | 8 | 12 |
| 3 | III | Linked List | CO3 | 12 | 2 | 4 | 10 | 16 |
| 4 | IV | Stack | CO4 | 8 | 2 | 4 | 6 | 12 |
| 5 | V | Queue | CO5 | 6 | 2 | 2 | 6 | 10 |
| 6 | VI | Tree | CO6 | 9 | 2 | 4 | 10 | 16 |
| Grand Total | | | | 45 | 12 | 18 | 40 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous Assessment based on Process and Product related Performance Indicators. Each practical will be assessed considering 60% weightage to Process and 40% weightage to Product

Summative Assessment (Assessment of Learning)

- End semester Examination, Lab performance, Viva-Voce

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|--|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 2 | - | - | 1 | - | - | 1 | | | |
| CO2 | 2 | 2 | 2 | 1 | - | - | 1 | | | |
| CO3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | | |
| CO4 | 2 | 2 | 2 | 1 | - | 1 | 1 | | | |
| CO5 | 2 | 2 | 2 | 1 | - | 1 | 1 | | | |
| CO6 | 2 | 2 | 2 | 1 | - | 1 | 1 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|-------------------|--|--|
| 1 | Lipschutz | Data Structures with 'C' (SIE) (Schaum's Outline Series) | McGraw Hill Education, New Delhi ISBN: 978-0070701984 |
| 2 | Balgurusamy, E. | Data Structures using 'C' | McGraw Hill Education, New Delhi 2013, ISBN: 978-1259029547 |
| 3 | ISRD Group | Data Structures using 'C' | McGraw Hill Education, New Delhi 2013, ISBN: 978-12590006401 |
| 4 | Yashwant Kanetkar | Understanding Pointers in C | BPB ISBN 8170298911 |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|-----------------|
| 1 | https://www.javatpoint.com/data-structure-introduction | For All Content |
| 2 | https://www.geeksforgeeks.org/introduction-to-data-structures/ | For All Content |
| 3 | https://studytomorrow.com/data-structures/ | For All Content |
| 4 | https://www.tutorialspoint.com/data_structures_algorithms/ | For All Content |
| 5 | https://www.w3schools.in/data-structures/ | For All Content |
| 6 | https://www.mygreatlearning.com/blog/data-structure-tutorial-for-beginners/ | For All Content |
| 7 | https://byjus.com/gate/introduction-to-data-structure-notes/ | For All Content |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s

: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg.

Programme Code

: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ TE

Semester

: Third

Course Title

: DATABASE MANAGEMENT SYSTEM

Course Code

: 313302

I. RATIONALE

This course focuses on fundamentals of relational database management system and enables students to design and manage database for various software applications. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in Information Technology applications.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

To design database and use any RDBMS package as a backend for developing database applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain concept of database management system.
- CO2 - Design the database for given problem.
- CO3 - Manage database using SQL.
- CO4 - Implement PL/SQL codes for given application.
- CO5 - Apply security and backup methods on database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | | Credits | Assessment Scheme | | | | | | | | | | | |
|-------------|----------------------------|------|-------------------|--------------------------|----|----|----|----|-----|---------|-------------------|--------|-------|-------|-------|------------------|-------|-----|-----|-------------|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SL | H | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | Total Marks |
| | | | | | | | | | | | | | | | | Practical | | | | | | |
| | | | | CL | TL | LL | | | | | | FA-TH | SA-TH | Total | FA-PR | | SA-PR | | SLA | | | |
| | | | | | | | | | | | | | | | Max | Min | Max | Min | Max | Min | Max | |
| 313302 | DATABASE MANAGEMENT SYSTEM | DMS | DSC | 3 | 1 | 4 | 2 | 10 | 5 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25# | 10 | 25 | 10 | 200 | |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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|-------|---|---|---------------------------------------|
| 1 | TLO 1.1 Explain given database concept. TLO 1.2 Explain Overall structure of DBMS TLO 1.3 Describe architecture of database. | Unit - I Introduction To Database System 1.1 Database concepts:-Data, Database, Database management system, File system Vs DBMS, Applications of DBMS, Data Abstraction, Data Independence, Database Schema, The Codd's rules, Overall structure of DBMS 1.2 Architecture:- Two tier and Three tier architecture of database. 1.3 Data Models:- Hierarchical, Networking, Relational Data Models. | Presentations, Hands-on, Chalk-Board. |
| 2 | TLO 2.1 Explain relational structure of database. TLO 2.2 State types of keys with example. TLO 2.3 Draw ER diagrams for given problem. TLO 2.4 Explain different normalization forms. | Unit - II Relational Data Model 2.1 Relational Structure :- Tables (Relations), Rows (Tuples), Domains, Attributes, Entities 2.2 Keys :- Super Keys, Candidate Key, Primary Key, Foreign Key. 2.3 Data Constraints :- Domain Constraints ,Referential Integrity Constraints 2.4 Entity Relationship Model : - Strong Entity set, Weak Entity set, Types of Attributes, Symbols for ER diagram, ER Diagrams 2.5 Normalization:- Functional dependencies, Normal forms: 1NF, 2NF, 3NF | Presentations, Hands-on, Chalk-Board. |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|--|
| 3 | <p>TLO 3.1 Write SQL queries using DDL, DML, DCL and TCL.</p> <p>TLO 3.2 Write SQL queries to join relations.</p> <p>TLO 3.3 Write SQL queries for ordering and grouping data.</p> <p>TLO 3.4 Use various class of operators in SQL. .</p> <p>TLO 3.5 Create schema objects for performance tuning.</p> | <p>Unit - III Interactive SQL and Performance Tuning</p> <p>3.1 SQL: -Data-types, Data Definition Language (DDL), Data Manipulation language (DML), Data Control Language (DCL), Transaction Control Language (TCL).</p> <p>3.2 Clauses & Join:- Different types of clauses - Where, Group by ,Order by, Having. Joins: Types of Joins, Nested queries.</p> <p>3.3 Operators:- Relational, Arithmetic, Logical, Set operators.</p> <p>3.4 Functions:- Numeric , Date and time, String functions, Aggregate Functions.</p> <p>3.5 Views, Sequences, Indexes: -Views : Concept ,Create ,Update, Drop Views. Sequences :- Concept ,Create, Alter , Drop, Use of Sequence in table, Index: Concept ,Types of Index , Create ,Drop Indexes</p> | <p>Presentations, Hands-on, Chalk-Board.</p> |
| 4 | <p>TLO 4.1 Use control Structures in PL-SQL.</p> <p>TLO 4.2 Handle different types of exceptions.</p> <p>TLO 4.3 Explain various types of cursors.</p> <p>TLO 4.4 Create Procedure, Function on given problem.</p> <p>TLO 4.5 Explain types of triggers with examples</p> | <p>Unit - IV PL/SQL Programming</p> <p>4.1 Introduction of PL/SQL: -Advantages of PL/SQL, The PL/SQL Block Structure, PL/SQL Data Types, Variable , Constant</p> <p>4.2 Control Structure:- Conditional Control, Iterative Control, Sequential Control.</p> <p>4.3 Exception handling: -Predefined Exception, User defined Exception.</p> <p>4.4 Cursors:- Implicit and Explicit Cursors, Declaring, opening and closing cursor, fetching a record from cursor ,cursor for loops, parameterized cursors</p> <p>4.5 Procedures:- Advantages, Create, Execute and Delete a Stored Procedure</p> <p>4.6 Functions:- Advantages, Create, Execute and Delete a Function</p> <p>4.7 Database Triggers :- Use of Database Triggers, Types of Triggers, Create Trigger, Delete Trigger</p> | <p>Presentations, Hands-on, Chalk-Board.</p> |
| 5 | <p>TLO 5.1 Implement SQL queries for database administration.</p> <p>TLO 5.2 Explain concept of various types database backup processes.</p> <p>TLO 5.3 Describe various terms related to advanced database concepts.</p> | <p>Unit - V Database Administration</p> <p>5.1 Introduction to database administration:- Types of database users, Create and delete users, Assign privileges to users</p> <p>5.2 Transaction: Concept, Properties & States of Transaction</p> <p>5.3 Database Backup: Types of Failures, Causes of Failure, Database backup introduction, types of database backups: Physical & Logical</p> <p>5.4 Data Recovery – Recovery concepts , recovery techniques- roll forward ,Rollback</p> <p>5.5 Overview of Advanced database concepts:- Data Warehouse ,Data lakes , Data mining, Big data ,Mongo DB , DynamoDB,</p> | <p>Presentations, Hands-on, Chalk-Board.</p> |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|--|----------------|--------------|
| LLO 1.1 Install database software | 1 | * Install the provided database software | 2 | CO1 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|--------------|--|-----------------------|---------------------|
| LLO 2.1 Create Database schema for given application | 2 | *Note :- Ensure to Carry out following activities before creating database: - Draw ER diagram for given problem - Normalize the relation up to 3NF 1) Create Database for given application 2) Create tables for the given application 3)Assign Primary key for created table 4) Modify the table as per the application needs | 4 | CO1 |
| LLO 3.1 Execute DDL Commands to manage database using SQL | 3 | * Write queries using DDL Statements for following operations – 1)Create, alter, truncate, drop ,rename table 2) Apply Key Constraints for suitable relation. | 2 | CO3 |
| LLO 4.1 Execute DML Commands to manipulate data using SQL | 4 | * Write queries using DML Statements for following operations – 1) Select, Insert, delete, update, table 2) Apply Key Constraints for suitable relation. | 2 | CO3 |
| LLO 5.1 Execute DCL Commands to control the access to data using SQL . | 5 | * Write queries using DCL Statements for following operations – 1)Grant, Revoke | 2 | CO3 |
| LLO 6.1 Execute TCL Commands to control transactions on data using SQL . | 6 | * Write queries using TCL Statements for following operations – 1) Commit, Rollback, Savepoint | 2 | CO3 |
| LLO 7.1 Implement Queries using Arithmetic operators | 7 | Write Queries using built-in Arithmetic operators. | 2 | CO3 |
| LLO 8.1 Implement Logical operators to apply various conditions in query. | 8 | Apply built-in Logical operators on given data | 2 | CO3 |
| LLO 9.1 Implement Relational operators to apply various conditions in query. | 9 | Apply built-in relational operators on given data | 2 | CO3 |
| LLO 10.1 Write Queries to implement SET operations using SQL . | 10 | * Use following Set operators to perform different operations. | 2 | CO3 |
| LLO 11.1 Execute queries using String functions | 11 | Write SQL Queries using built-in String functions | 2 | CO3 |
| LLO 12.1 Execute queries using Arithmetic functions | 12 | Write SQL Queries using built-in Arithmetic functions | 2 | CO3 |
| LLO 13.1 Implement queries using Date and Time functions | 13 | Write Queries using built-in Date and Time functions | 4 | CO3 |
| LLO 14.1 Implement queries using Aggregate functions | 14 | Write Queries using SQL built-in Aggregate functions | 2 | CO3 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|---|----------------|--------------|
| LLO 15.1 Execute Queries for ordering and grouping data. | 15 | * Implement Queries Using different Where, Having, Group by, & Order by clauses . | 2 | CO3 |
| LLO 16.1 Execute the queries based on Inner & outer join | 16 | * Implement SQL queries for Inner and Outer Join | 2 | CO3 |
| LLO 17.1 Create and manage Views for faster access on relations. | 17 | * Create and Execute Views ,Sequence and Index in SQL. | 4 | CO3 |
| LLO 18.1 Implement PL/SQL program using Conditional Statements | 18 | * Write a PL/SQL program using Conditional Statements- if, if then else ,nested if, if elseif else | 2 | CO4 |
| LLO 19.1 Implement PL/SQL program using Iterative Statements | 19 | * Write a PL/SQL program using Iterative Statements- loop,for, do-while, while | 2 | CO4 |
| LLO 20.1 Implement PL/SQL program using Sequential Control | 20 | Write a PL/SQL program using Sequential Control-switch, continue,goto | 2 | CO4 |
| LLO 21.1 Create implicit & explicit cursors | 21 | * Write a PL/SQL code to implement implicit & explicit cursors | 2 | CO4 |
| LLO 22.1 Implement PL/SQL program based on Exception Handling (Pre-defined exceptions) | 22 | * Write a PL/SQL program based on Exception Handling (Pre-defined exceptions) | 2 | CO4 |
| LLO 23.1 Implement PL/SQL program based on Exception Handling (user defined exceptions) | 23 | * Write a PL/SQL program based on Exception Handling (user defined exceptions) | 2 | CO4 |
| LLO 24.1 Create Procedures and stored procedures for modularity. | 24 | * Write a PL/SQL code to create Procedures and stored procedures | 2 | CO4 |
| LLO 25.1 Create function for given database | 25 | * Write a PL/SQL code to create functions. | 2 | CO4 |
| LLO 26.1 Implement triggers for given database. | 26 | * Write a PL/SQL code to create triggers for given database. | 2 | CO4 |
| LLO 27.1 Implement SQL queries for database administration. | 27 | Execute DCL commands using SQL 1) Create Users 2) Grant Privileges to users 3)Revoke Privileges to users | 2 | CO5 |

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

- Implement PL/SQL code for relevant topics suggested by the teacher.
- Complete any one course related to Database Management System on Infosys Springboard platform.

Assignment

- Solve an assignment on any relevant topic given by the teacher.

Micro project

- Develop a database for restaurant management system. The restaurant maintain catalogue for the list of food items and generate bill for the ordered food.
- Prepare Invoice management system for electricity bill generation. Accept meter reading as inputs and generate respective bill amount for the same.
- Design a database for registration and admission of patient for Hospital management system, draw ER diagram and normalize the database up to 3NF.
- Any topic suggested by teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | Computer system - (Any computer system with basic configuration) | All |
| 2 | Any RDBMS software (MySQL/Oracle/SQL server/ or any other) | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|--|-------------|----------------|-----------|-----------|-----------|-------------|
| 1 | I | Introduction To Database System | CO1 | 6 | 4 | 6 | 2 | 12 |
| 2 | II | Relational Data Model | CO2 | 8 | 2 | 4 | 6 | 12 |
| 3 | III | Interactive SQL and Performance Tuning | CO3 | 12 | 2 | 6 | 10 | 18 |
| 4 | IV | PL/SQL Programming | CO4 | 12 | 4 | 4 | 10 | 18 |
| 5 | V | Database Administration | CO5 | 7 | 2 | 4 | 4 | 10 |
| Grand Total | | | | 45 | 14 | 24 | 32 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|--|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | - | - | - | 1 | - | 1 | | | |
| CO2 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | | | |
| CO3 | 1 | 2 | 2 | 2 | - | 2 | 1 | | | |
| CO4 | 1 | 3 | 3 | 2 | 1 | 3 | 2 | | | |
| CO5 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|----------------|--|---|
| 1 | Henry F. Korth | Database System Concepts | McGraw Hill Education ISBN : 9780078022159 |
| 2 | Ivan Bayross | SQL, PL/SQL – The Programming Language of Oracle | BPB Publication ISBN 10: 8170298997 BPB Publication ISBN 13: 9788170298991 |
| 3 | ISRD Group | Introduction to Database Management Systems | McGraw Hill Education ISBN 10: 0070591199 McGraw Hill Education ISBN-13 : 978-0070591196 |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|-----------------------------|
| 1 | https://nptel.ac.in/courses/106105175 | Data Base Management System |
| 2 | https://www.w3schools.com/sql/ | SQL Tutorial |
| 3 | https://www.tutorialspoint.com/sql/index.htm | SQL Programming Language |

| | | |
|--|--|--|
| Note : <ul style="list-style-type: none"> Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students | | |
|--|--|--|

Programme Name/s

Programme Code

Semester

Course Title

Course Code

: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.

: AI/ AN/ AO/ CM/ CO/ CW/ DE/ DS/ EJ/ ET/ EX/ HA/ IC/ IE/ IS/ MU/ TE

: Third

: DIGITAL TECHNIQUES

: 313303

I. RATIONALE

Digitization implies use of digital circuits in most of automation and industrial systems. The knowledge of logic gates, combinational and sequential circuits using discrete gates and digital ICs will enable students to interpret working of digital equipment and test their functionality.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences:
Student will able to test the functionality of the digital circuits/system.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

- Students will be able to achieve & demonstrate the following COs on completion of course based learning
- CO1 - Apply number system and codes concept to interpret working of digital systems.
 - CO2 - Apply Boolean laws to minimize complex Boolean function.
 - CO3 - Develop combinational logic circuits for given applications.
 - CO4 - Develop sequential logic circuits using Flip-flops.
 - CO5 - Interpret the functions of data converters and memories in digital electronic systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | |
|-------------|--------------------|------|-------------------|--------------------------|----|----|----|----|---------|-------------------|-----------|-------|-------|-----|------------------|-----|-------|-----|-------------|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SL | NH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | Total Marks |
| | | | | CL | TL | LL | | | | | Practical | | | | SLA | | | | | | |
| | | | | | | | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | | | Max | Min | Max | Min | Max | Min | Max | Min | |
| 313303 | DIGITAL TECHNIQUES | DTE | DSC | 3 | - | 2 | 1 | 6 | 3 | 3 | 30 | 70 | 100 | 40 | 25 | 10 | 25# | 10 | 25 | 10 | 175 |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|--------------------------------|
| 1 | <p>TLO 1.1 Convert the given number from one number system to another number system.</p> <p>TLO 1.2 Perform arithmetic operations on binary numbers.</p> <p>TLO 1.3 Subtract given binary numbers using 1's and 2's complement method.</p> <p>TLO 1.4 Convert the given coded number into the other specified code.</p> <p>TLO 1.5 Write the application of the given code.</p> <p>TLO 1.6 Perform BCD addition and subtraction for the given Decimal numbers .</p> | <p>Unit - I Number Systems</p> <p>1.1 Number Systems: Types of Number Systems (Binary, Octal, Decimal, Hexadecimal), conversion of number systems</p> <p>1.2 Binary Arithmetic: Addition, Subtraction, Multiplication and Division</p> <p>1.3 Subtraction using 1's and 2's complement method</p> <p>1.4 Codes: BCD, Gray code, Excess-3 and ASCII code, Code conversions, Applications of codes.</p> <p>1.5 BCD Arithmetic: BCD Addition, Subtraction using 9's and 10's complement</p> | Lecture Using Chalk-Board |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|---|
| 2 | <p>TLO 2.1 Define the given characteristics parameters of the digital logic families.</p> <p>TLO 2.2 Draw symbol and truth table of given logic gates.</p> <p>TLO 2.3 Explain the concept of Buffer and Tristate logic .</p> <p>TLO 2.4 Implement basic gates and other gates with the help of universal gate.</p> <p>TLO 2.5 Simplify the given expression using Boolean laws and develop logic circuits .</p> | <p>Unit - II Logic Gates and Boolean Algebra</p> <p>2.1 Logic Families: Characteristics Parameters of logic Families- Noise margin, Power dissipation, Figure of merit ,Fan in, Fan out, Speed of operation, maximum clock frequency supply voltage requirement ,power per gate , Comparison of TTL, CMOS and ECL logic family</p> <p>2.2 Introduction to positive and negative logic systems, Logic Gates: Symbol ,Truth table of Basic logic gates(AND,OR,NOT),Universal gates(NAND,NOR) and Special purpose gates(EX-OR,EX-NOR)</p> <p>2.3 Buffer: Tristate logic, Unidirectional and Bidirectional</p> <p>2.4 Boolean algebra : Laws of Boolean algebra, Duality Theorem ,De-Morgan's theorem</p> | Flipped Classroom Lecture Using Chalk-Board |
| 3 | <p>TLO 3.1 Develop logic circuits for standard SOP/POS form of the given logic expression.</p> <p>TLO 3.2 Minimize the given logic expression using K-map (up to 4 variables).</p> <p>TLO 3.3 Design Adder and subtractor using K-map.</p> <p>TLO 3.4 Describe working of specified Encoder and Decoder with help of block diagram and truth table.</p> <p>TLO 3.5 Describe the working of Multiplexer and Demultiplexer.</p> | <p>Unit - III Combinational Logic Circuits</p> <p>3.1 Standard Boolean expression: Sum of products [SOP] and Products of Sum [POS], Min-term and Max-term, SOP-POS form conversion, realisation using NAND/NOR gates</p> <p>3.2 Boolean Expression reduction using K-map: Minimization of Boolean expressions (upto 4 variables) using SOP and POS form</p> <p>3.3 Arithmetic circuits : design Half and Full Adder using K-maps, design Half and Full Subtractor using K-maps , n bit adder and n bit subtractor .</p> <p>3.4 Encoder and Decoder: Functions of Encoder and Decoder, Block Diagram and Truth table, Priority Encoder (4:2, 8:3), BCD to 7 segment Decoder/Driver, Keyboard Encoder / decoder</p> <p>3.5 Multiplexer and Demultiplexer: Working, Truth table and applications of MUX and DEMUX. MUX tree, DEMUX tree, DEMUX as Decoder</p> | Flipped Classroom Presentations Lecture Using Chalk-Board |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|--|
| 4 | <p>TLO 4.1 Differentiate between Latch and Flip Flop.</p> <p>TLO 4.2 Explain basic memory cell and use relevant triggering technique for the given digital circuit.</p> <p>TLO 4.3 Describe the truth tables for the given Flip flops, applications of Flip flops.</p> <p>TLO 4.4 Use the given type of flip flop and its excitation table to design specific type of counter.</p> <p>TLO 4.5 Describe the working of specified shift register with the help of timing diagram.</p> <p>TLO 4.6 Design specified modulo-N counter using Flip flops</p> <p>TLO 4.7 Design Ring /Twisted ring counter using given Flip-Flop.</p> | <p>Unit - IV Sequential Logic Circuits</p> <p>4.1 Difference between Combinational and Sequential Logic circuits, Time independent (un-clocked)and Time dependent (Clocked) logic system , Flips- Flops and Latch, Basic memory cell ,RS-Latch using NAND and NOR, Triggering methods- Edge trigger and Level Trigger</p> <p>4.2 Flip-Flops: S-R, J-K, T and D, Truth table and logic circuits of each flip-flop, Excitation table, applications</p> <p>4.3 Race around condition in JK flip-flop, Master- Slave JK Flip Flop</p> <p>4.4 Shift registers- Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out ,Parallel In Parallel Out,Bi-directional Shift register, 4-bit Universal Shift register</p> <p>4.5 Counters- Synchronous and Asynchronous counters, Modulus of counter, Ripple counter, Ring Counter, Twisted Ring Counter, Up – down counter, Decade Counter, MOD-N counter, Timing Diagram</p> | <p>Video Demonstrations Lecture Using Chalk-Board Simulation</p> |
| 5 | <p>TLO 5.1 Describe the working of the given type of DAC.</p> <p>TLO 5.2 Calculate the output voltage for the given digital input for specified DAC.</p> <p>TLO 5.3 Describe the working of the given type of ADC.</p> <p>TLO 5.4 Compare working of ROM,EPROM, EEPROM and Flash Memory .</p> | <p>Unit - V Data Converters and Memories</p> <p>5.1 Digital to Analog Data Converter (DAC)- circuit diagram and working of Weighted resistor DAC and R-2R Ladder DAC, DAC Specification/Selection factors</p> <p>5.2 Analog to Digital Data Converter (ADC) : Block Diagram, Types and Working of Dual Slope ADC, Successive Approximation, Flash Type ADC, ADC selection factors/ specifications</p> <p>5.3 Memories: Types- Primary memory , Secondary Memory, Organization, Dimension, Memory Bank, Features , Applications: RAM (SRAM, DRAM), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash Memory, Comparison of RAM and ROM,EPROM and Flash Memory, SIMM: Features, SSD memory: Features,</p> | <p>Video Demonstrations Lecture Using Chalk-Board</p> |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|--|----------------|--------------|
| <p>LLO 1.1 Test the functionality of basic gates.</p> <p>LLO 1.2 Test the functionality of special purpose gates.</p> | 1 | * Test the functionality of AND, OR, NOT, Ex-OR and EX-NOR logic Gates using equivalent 74 series or CMOS Devices [CD] series. | 2 | CO1 CO2 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|--|----------------|--------------|
| LLO 2.1 Test the functionality of NAND and NOR gate using breadboard. | 2 | * Test the functionality of the given Universal Gates using equivalent 74 series /CD series. | 2 | CO2 |
| LLO 3.1 Test the functionality of the constructed Basic gates using universal gates. | 3 | * Construct Basic Gates using Universal Gates. | 2 | CO2 |
| LLO 4.1 Construct Ex-OR, EX-NOR gates using universal gates. | 4 | Construct Exclusive Gates using Universal Gates. | 2 | CO2 |
| LLO 5.1 Build the logic circuit on breadboard to verify the De - Morgan's theorems. | 5 | * Verify De-Morgan's Theorem (1 and 2). | 2 | CO2 |
| LLO 6.1 Verify the truth table of Half and Full adder circuits for the given input. | 6 | * Implement 2 input, 3 input Adder Circuit. | 2 | CO3 |
| LLO 7.1 Verify the truth table of Half and Full subtractor using Boolean expressions. | 7 | Implement 2 input, 3 input Subtractor Circuit. | 2 | CO3 |
| LLO 8.1 Construct and test BCD to 7 segment decoder using Digital IC. | 8 | Test the output of BCD to 7 Segment Decoder using Digital IC for the given inputs. | 2 | CO3 |
| LLO 9.1 Build/Test 2 or 4 bit Magnitude comparator using Digital IC. | 9 | Check the output of comparator circuit consisting of Digital IC. | 2 | CO3 |
| LLO 10.1 Build / test function of MUX Digital IC. | 10 | * Build and test the functionality of 4:1/8:1 Multiplexer. | 2 | CO3 |
| LLO 11.1 Build / test function of DEMUX Digital IC. | 11 | Build and test the functionality of 1:4/1:8 De-Multiplexer. | 2 | CO3 |
| LLO 12.1 Test functionality of RS flip flop using NAND Gate . | 12 | Implement and verify the truth table of RS Flip flop. | 2 | CO4 |
| LLO 13.1 Test functionality of Master Slave (MS) JK flip-flop using Digital IC. | 13 | Implement and test the functionality of master slave- JK Flip Flop using Digital IC. | 2 | CO4 |
| LLO 14.1 Test functionality and truth table for D and T Flip flop. | 14 | Use Digital IC to construct and test the functionality of D and T flip flop. | 2 | CO4 |
| LLO 15.1 Interpret timing diagram of 4 bit Universal Shift Register. | 15 | Build 4- bit Universal Shift register and observe the timing diagram. | 2 | CO4 |
| LLO 16.1 Interpret timing diagram of 4-bit ripple counter using Digital IC. | 16 | Implement Ripple Counter using Digital IC. | 2 | CO4 |
| LLO 17.1 Interpret timing diagram of Decade counter (Mod-10). | 17 | * Implement Decade Counter Using Digital IC. | 2 | CO4 |
| LLO 18.1 Build R-2R resistive network on breadboard to convert given digital data into analog. | 18 | * Test the output of given R-2R type Digital to Analog Converter for the given input. | 2 | CO5 |

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Implement 1:8 DEMUX using 1:4 /1:2 DE-MUX.
- Build a circuit to implement 4 Bit adder.
- Build a 4bit parity generator and parity tester.
- Implement 16:1 MUX using 8:1/4:1 MUX.
- Build a circuit to test 7 bit segment display.
- Build a LED display bar.
- Develop a project on Burglar alarm.
- Light Detector circuit using NAND gate.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | Digital Storage Oscilloscope 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace CRT / TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe | 15,16,17 |
| 2 | Trainer kit for 4 bit Counter using Flip Flops 4 bit ripple counter synchronous counter IC 7476 based circuit, Input given by switches and output indicated on LED, Facility to select MOD 8 or MOD 16 mode, Built in DC power supply and manual pulser with indicator | 16,17 |
| 3 | Trainer kit IC DAC IC 0800 Trainer based on IC 0800, 8 bit digital input selected by switches and provision for measurement of analog output. Facility to study effect of change in reference voltage, Built in buffer amplifier, Built in DC power supply | 18 |
| 4 | Digital multimeter 3.5 digit with R , V, I measurements, diode and BJT testing | All |
| 5 | Digital IC Tester Tests a wide range of Analog and Digital ICs such as 74 series /CD series | All |
| 6 | Bread Board Development System Bread Board system with DC power output 5V,+/-12V and 0-5V variable , digital voltmeter ,ammeter , LED indicators 8 no , logic input switches 8 no, 7 segment display 2 no, clockgenerator | All |
| 7 | Trainer kits for digital ICs Trainer kit should consists of digital ICs for logic gates, flop flop, shift registers, counter alongwith toggle switches for inputs and bi-colourLED at outputs, built in power supply | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|---------------------------------|-------------|----------------|-----------|-----------|-----------|-------------|
| 1 | I | Number Systems | CO1 | 5 | 2 | 4 | 2 | 8 |
| 2 | II | Logic Gates and Boolean Algebra | CO2 | 8 | 2 | 4 | 6 | 12 |
| 3 | III | Combinational Logic Circuits | CO3 | 12 | 4 | 6 | 8 | 18 |
| 4 | IV | Sequential Logic Circuits | CO4 | 12 | 4 | 6 | 8 | 18 |
| 5 | V | Data Converters and Memories | CO5 | 8 | 4 | 6 | 4 | 14 |
| Grand Total | | | | 45 | 16 | 26 | 28 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two unit test marks will be consider for out of 30 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- For formative assessment of laboratory learning 25 marks

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester summative assessment of 25 marks for laboratory learning

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|--|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 2 | - | 1 | - | - | - | 3 | | | |
| CO2 | 2 | - | 2 | - | - | - | 2 | | | |
| CO3 | 3 | 2 | 3 | 2 | - | 1 | 2 | | | |
| CO4 | 3 | 2 | 3 | 2 | - | 1 | 2 | | | |
| CO5 | 2 | - | 2 | 2 | 1 | 1 | 2 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|-------------------------------|----------------------------------|---|
| 1 | Jain R.P | Modern Digital Electronics | McGraw-Hill Publishing, New Delhi,2009 ISBN:9780070669116 |
| 2 | Anand Kumar | Fundamentals of Digital Circuits | PHI learning Private limited, ISBN:978-81-203-5268-1 |
| 3 | Salivahanan S, Arivazhagan S. | Digital Circuits and Design | Vikas Publishing House, New Delhi,2013 ISBN: 9789325960411 |

| Sr.No | Author | Title | Publisher with ISBN Number |
|--------------|---------------------------------|--|---|
| 4 | Puri.V.K | Digital Electronics | McGraw-Hill Publishing, New Delhi,2016 ISBN:97800746331751 |
| 5 | Malvino A.P Donald .P. Leach | Digital Principles | McGraw-Hill Education, New Delhi ISBN:9789339203405 |
| 6 | Anil.K.Maini | Digital Electronics: Principles, Devices and Applications | Wiley India, Delhi, 2007, ISBN:9780470032145 |
| 7 | Floyd, Thomas | Digital Fundamentals | Pearson Education India, Delhi 2014,ISBN:9780132737968 |
| 8 | G.K.Kharate | Digital Electronics | Publisher: Oxford University Press, ISBN: 9780198061830 |

XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|--------------|---|--|
| 1 | https://studytronics.weebly.com/digital-electronics.html | Basics of Digital Electronics |
| 2 | https://www.udemy.com/course/basics-of-digital-techniques/ | Introduction To Digital Number System & Logic Gates |
| 3 | https://www.geeksforgeeks.org/synchronous-sequential-circuits-in-digital-logic/ | Boolean Algebra and Logic Gates, Combinational and Sequential Logic Circuits |
| 4 | https://onlinecourses.nptel.ac.in/noc19_ee51/preview | Digital Circuits |
| 5 | https://de-iitr.vlabs.ac.in/ | Virtual Labs for Digital Systems |
| 6 | https://www.tutorialspoint.com/digital_circuits/digital_circuits_sequential_circuits.htm | Sequential Circuits |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

| | |
|------------------|--|
| Programme Name/s | : Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures |
| Programme Code | : AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ TC/ TE/ TR/ TX |
| Semester | : Third |
| Course Title | : ESSENCE OF INDIAN CONSTITUTION |
| Course Code | : 313002 |

I. RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

- Students will be able to achieve & demonstrate the following COs on completion of course based learning
- CO1 - List salient features and characteristics of the constitution of India.
 - CO2 - Follow fundamental rights and duties as responsible citizen of the country.
 - CO3 - Analyze major constitutional amendments in the constitution.
 - CO4 - Follow procedure to cast vote using voter-id.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | | Total Marks |
|-------------|--------------------------------|------|-------------------|--------------------------|----|----|-----|-----|---------|-------------------|-----------|-------|-------|-----|------------------|-----|-------|-----|-------------|-----|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | | |
| | | | | CL | TL | LL | | | | | Practical | | | | | | | | | | | |
| | | | | | | | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | | |
| | | | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | Max | |
| 313002 | ESSENCE OF INDIAN CONSTITUTION | EIC | VEC | 1 | - | - | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 50 | 20 | 50 | | |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|---|
| 1 | TLO 1.1 Explain the meaning of preamble of the constitution. TLO 1.2 Explain the doctrine of basic structure of the constitution. TLO 1.3 List the salient features of constitution. TLO 1.4 List the characteristics of constitution. | Unit - I Constitution and Preamble 1.1 Meaning of the constitution of India. 1.2 Historical perspectives of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble of the Constitution of India. | Presentations Blogs Hand-outs Modules Flipped classrooms Case studies |
| 2 | TLO 2.1 Enlist the fundamental rights. TLO 2.2 . Identify fundamental duties in general and in particular with engineering field. TLO 2.3 Identify situations where directive principles prevail over fundamental rights. | Unit - II Fundamental Rights and Directive Principles 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance under part-IV-A. 2.3 Relevance of Directive Principles of State Policy under part-IV A. | Presentations Blogs Hand-outs Modules Case Study Flipped Classroom |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|---|--|
| 3 | TLO 3.1 Enlist the constitutional amendments. TLO 3.2 Elaborate the elements of Centre-State Relationship TLO 3.3 Analyze the purposes of various amendments. | Unit - III Governance and Amendments 3.1 3.1 Amendment procedure of the Constitution and their types - simple and special procedures. 3.2 The Principle of Federalism and its contemporary significance along with special committees that were setup. 3.3 Major Constitutional Amendment procedure - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd | Cases of Federal disputes with relevant Supreme court powers and Judgements Presentations Blogs Hand-outs Problem based learning |
| 4 | TLO 4.1 Explain the importance of electoral rights. TLO 4.2 Write the step by step procedure for process of registration TLO 4.3 Explain the significance of Ethical electoral participation TLO 4.4 Explain the steps to motivation and facilitation for electoral participation TLO 4.5 Enlist the features of the voter's guide TLO 4.6 Explain the role of empowered voter TLO 4.7 Write the steps of voting procedure TLO 4.8 Write steps to create voter awareness TLO 4.9 Fill the online voter registration form TLO TLO 4.10 Follow procedure to cast vote using voter-id. | Unit - IV Electoral Literacy and Voter's Education 4.1 Electoral rights , Electoral process of registration 4.2 Ethical electoral participation 4.3 Motivation and facilitation for electoral participation 4.4 Voter's guide 4.5 Prospective empowered voter 4.6 Voting procedure 4.7 Voter awareness 4.8 Voter online registration https://www.ceodelhi.gov.in/ELCdetails.aspx | Presentations Hand-outs Modules Blogs Problem based Learning |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Outline the procedure to submit application for Voter-id
- Assignments are to be provided by the course teacher in line with the targeted COs.

A1. Prepare an essay on Constitution of India .

A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

- Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies. LGBTQIA+

Micro project

- 1. Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country
- 2. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
- 3. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- 1 Differences in the ideals of Social democracy and Political democracy.
- 2 Democracy and Women's Political Participation in India.
- 3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
- 4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

-
- Art 356 and its working in Post-Independent India.
- Women's Reservation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

- Arrange Mock Parliament debates.
- Prepare collage/posters on current constitutional issues.
- i. National (Art 352) & State Emergencies (Art 356) declared in India.
 - ii. Seven fundamental rights.
 - iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

Cases: Suggestive cases for usage in teaching:

- A.K. Gopalan Case (1950) : SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.
- Shankari Prasad Case (1951) : This case dealt with the amendability of Fundamental Rights (the First Amendment's validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
- Minerva Mills case (1980) : This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
- Maneka Gandhi case (1978) : A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."

Other cases:

1. Kesavananda Bharati Case (1973) : In this case the Hon. SC laid down a new doctrine of the 'basic structure' (or 'basic features') of the Constitution. It ruled that the constituent power of Parliament under Article 368 does not enable it to alter the 'basic structure' of the Constitution. This means that the Parliament cannot abridge or take away a Fundamental Right that forms a part of the 'basic structure' of the Constitution.
2. Mathura Rape Case (1979) : A tribal woman Mathura (aged 14 to 16 years) was raped in Police Custody. The case raised the questions on the idea of 'Modesty of Woman' and here it was a tribal woman who succumbs to multiple patriarchies. Custodial rape was made an offence and was culpable with the detainment of 7 years or more under Section 376 of Indian Penal Code. The weight of proving the allegations moved from the victim to the offender, once sexual intercourse is established. The publication of the victim's identity was banned and it was also held that rape

trials should be conducted under the cameras.

3. **Puttswamy vs Union of India (2017)** : In this landmark case which was finally pronounced by a 9-judge bench of the Supreme Court on 24th August 2017, upholding the fundamental right to privacy emanating from Article 21. The court stated that Right to Privacy is an inherent and integral part of Part III of the Constitution that guarantees fundamental rights. The conflict in this area mainly arises between an individual's right to privacy and the legitimate aim of the government to implement its policies and a balance needs to be maintained while doing the same.

4. **Navtej Singh Johar & Ors. v. Union of India (2018)** : Hon. SC Decriminalised all consensual sex among adults, including homosexual sex by scrapping down section 377 of the Indian penal code (IPC). The court ruled that LGBTQ community are equal citizens and underlined that there cannot be discrimination in law based on sexual orientation and gender.

5. **Anuradha Bhasin Judgement (2020)** : The Supreme Court of India ruled that an indefinite suspension of internet services would be illegal under Indian law and that orders for internet shutdown must satisfy the tests of necessity and proportionality. The Court reiterated that freedom of expression online enjoyed Constitutional protection, but could be restricted in the name of national security. The Court held that though the Government was empowered to impose a complete internet shutdown, any order(s) imposing such restrictions had to be made public and was subject to judicial review.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|---|-------------|----------------|----------|----------|----------|-------------|
| 1 | I | Constitution and Preamble | CO1 | 4 | 0 | 0 | 0 | 0 |
| 2 | II | Fundamental Rights and Directive Principles | CO2 | 4 | 0 | 0 | 0 | 0 |
| 3 | III | Governance and Amendments | CO3 | 4 | 0 | 0 | 0 | 0 |
| 4 | IV | Electoral Literacy and Voter's Education | CO4 | 3 | 0 | 0 | 0 | 0 |
| Grand Total | | | | 15 | 0 | 0 | 0 | 0 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|---|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 1 | - | - | - | 2 | - | - | | | |
| CO2 | 1 | - | - | - | 2 | - | - | | | |
| CO3 | 1 | 2 | - | - | 2 | - | 1 | | | |
| CO4 | - | - | - | 1 | - | - | - | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - | | | | | | | | | | |
| *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--------------|---|--|
| 1 | P.M.Bakshi | The Constitution of India | Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition) |
| 2 | D.D.Basu | Introduction to Indian Constitution | Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X |
| 3 | B. K. Sharma | Introduction to Constitution of India | PHI, New Delhi, 6th edition, 2011, ISBN:8120344197 |
| 4 | MORE READS : | Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal. | Extra Read |
| 5 | B.L. Fadia | The Constitution of India | Sahitya Bhawan, Agra, 2017, ISBN:8193413768 |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|-------------------------------|
| 1 | http://www.legislative.gov.in/constitution-of-india | Constitution overview |
| 2 | https://en.wikipedia.org/wiki/Constitution_of_India | Parts of constitution |
| 3 | https://www.india.gov.in/my-government/constitution-india | Constitution overview |
| 4 | https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/ | Fundamental rights and duties |
| 5 | https://main.sci.gov.in/constitution | Directive principles |

| Sr.No | Link / Portal | Description |
|--------------|---|-----------------------|
| 6 | https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf | Parts of constitution |
| 7 | https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm | Parts of constitution |
| 8 | https://constitutionnet.org/v1/item/basic-structure-indian-constitution | Parts of constitution |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

| | |
|------------------|--|
| Programme Name/s | : Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg./ |
| Programme Code | : BD/ CM/ CO/ CW/ HA/ IF/ IH/ TE |
| Semester | : Third |
| Course Title | : OBJECT ORIENTED PROGRAMMING USING C++ |
| Course Code | : 313304 |

I. RATIONALE

In the modern world of Information Technology, Object Oriented Programming provides the most preferred approach for software development. It offers a powerful way to cope up with real world problems. C++ helps to develop fundamental understanding of object oriented concepts. This course enables to implement object oriented approach to solve a given programming problem.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using concepts of OOP in C++.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Write C++ programs using classes and objects.
- CO2 - Develop C++ programs using constructors.
- CO3 - Implement Inheritance in C++.
- CO4 - Implement Polymorphism in C++.
- CO5 - Develop C++ programs to perform file operations.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | |
|-------------|---------------------------------------|------|-------------------|--------------------------|----|----|-----|-----|---------|-------------------|-----------|-------|-------|-----|------------------|-----|-------|-----|-------------|-----|-------------|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | Total Marks |
| | | | | CL | TL | LL | | | | | Practical | | | | | | | | | | |
| | | | | | | | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | |
| 313304 | OBJECT ORIENTED PROGRAMMING USING C++ | OOP | SEC | 3 | 2 | 4 | 1 | 10 | 5 | 3 | 30 | 70 | 100 | 40 | 50 | 20 | 25@ | 10 | 25 | 10 | 200 |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|---|
| 1 | <p>TLO 1.1 Compare POP vs OOP approach of programming.</p> <p>TLO 1.2 Describe the different features of Object Oriented Programming.</p> <p>TLO 1.3 Write programs to solve arithmetic expressions.</p> <p>TLO 1.4 Write programs to demonstrate use of special operators in C++.</p> <p>TLO 1.5 Develop C++ program to show the use of Classes and Objects.</p> | <p>Unit - I Principles of Object Oriented Programming</p> <p>1.1 Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP)</p> <p>1.2 Features of Object Oriented Programming, Examples of Object Oriented languages, Applications of OOP</p> <p>1.3 Data types, Type compatibility, Declaration of variable, Dynamic initialization of variable, Reference variable, Type casting</p> <p>1.4 Special Operators in C++: Scope resolution operator, Memory management operators, Manipulators</p> <p>1.5 Structure of C++ program, Basic Input /Output operators and functions in C++, Simple C++ Program</p> <p>1.6 Class & Object: Introduction, Specifying a class, Access specifiers, Defining member functions: Inside class and Outside class, Creating objects, Memory allocations for objects</p> | Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom. |
| 2 | <p>TLO 2.1 Develop a program using inline function.</p> <p>TLO 2.2 Develop friend function to solve given problem.</p> <p>TLO 2.3 Write C++ programs using array of objects.</p> <p>TLO 2.4 Write C++ program to initialize the object using constructor.</p> <p>TLO 2.5 Write C++ program to delete object using destructor.</p> | <p>Unit - II Functions and Constructors</p> <p>2.1 Inline function, Static data members, Static member function, Friend function: Using two different classes , Using non-member function</p> <p>2.2 Array of Objects, Object as function arguments</p> <p>2.3 Concepts of Constructors, Types of constructors</p> <p>2.4 Constructor overloading and Constructors with default arguments</p> <p>2.5 Destructors</p> | Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom. |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|--|---|
| 3 | TLO 3.1 Explain the given type of inheritance based on its characteristics. TLO 3.2 Implement given type of inheritance in C++ program. TLO 3.3 Write C++ program using virtual base class. TLO 3.4 Use constructor in given derived class. | Unit - III Extending classes using Inheritance 3.1 Introduction to Inheritance, Defining a derived class, Visibility modes and effects 3.2 Types of Inheritance : Single, Multilevel, Multiple, Hierarchical, Hybrid 3.3 Virtual base class, Abstract class, Constructor in derived class | Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom. |
| 4 | TLO 4.1 Create C++ program to perform given arithmetic operations using pointers. TLO 4.2 Use 'pointer to object' to solve the given problem. TLO 4.3 Use compile time polymorphism to solve the given problem. TLO 4.4 Use run time polymorphism to solve the given problem. | Unit - IV Pointers and Polymorphism in C++ 4.1 Concept of Pointer: Pointer declaration, Pointer operator, Address operator, Pointer arithmetic 4.2 Pointer to Object: Pointer to object, 'this' pointer, Pointer to derived class 4.3 Introduction of Polymorphism, Types of polymorphism 4.4 Compile time Polymorphism: Function overloading, Revision of constructor overloading, Operator overloading: Rules for operator overloading, Overloading of unary and binary operators 4.5 Run time polymorphism: Virtual function, Rules for virtual function, Pure virtual function | Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom. |
| 5 | TLO 5.1 Identify relevant class to perform the given file operations. TLO 5.2 Describe different file modes. TLO 5.3 Develop C++ program to perform read/write operations from/to the given file. | Unit - V File operations 5.1 C++ stream classes, Classes for file stream operations 5.2 Detection of end of file, File modes 5.3 Opening files: Using constructors and open(), Closing files, Reading from and writing to files, Formatted Input/output functions in file 5.4 Types of file: Random access, Sequential access | Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom. |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|--|----------------|--------------|
| LLO 1.1 Develop program to evaluate expressions using various operators and Input/output functions. | 1 | *Write programs to evaluate any expression using Input / Output functions | 2 | CO1 |
| LLO 2.1 Develop C++ program using special type of operators. | 2 | *Write programs using- <ul style="list-style-type: none"> • Scope resolution operator • Memory management operator • Manipulators | 4 | CO1 |
| LLO 3.1 Develop programs to implement type casting. | 3 | Write programs to demonstrate use of- <ul style="list-style-type: none"> • Implicit type casting • Explicit type casting | 2 | CO1 |
| LLO 4.1 Implement classes and objects to define the function inside class. | 4 | Write programs to show use of classes and objects to define the function inside the class | 2 | CO1 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|--|----------------|--------------|
| LLO 5.1 Implement classes and objects to define the function outside class. | 5 | *Write programs to define the function outside the class | 2 | CO1 |
| LLO 6.1 Implement programs using inline function. | 6 | *Write programs to implement inline function | 2 | CO2 |
| LLO 7.1 Implement friend function using different classes. LLO 7.2 Implement friend function using external function. | 7 | *Write programs to implement friend function using- <ul style="list-style-type: none"> Two different classes External function | 2 | CO2 |
| LLO 8.1 Develop program using static data member. LLO 8.2 Develop program using static member function. | 8 | *Write programs to implement- <ul style="list-style-type: none"> Static data member Static member function | 2 | CO2 |
| LLO 9.1 Implement programs to show the use of array of objects. | 9 | *Write programs to create array of objects | 2 | CO2 |
| LLO 10.1 Implement the concept of constructor and destructor. | 10 | *Write programs for- <ul style="list-style-type: none"> Default constructor Parameterized constructor Copy constructor Multiple constructor in one class | 4 | CO2 |
| LLO 11.1 Implement Single level inheritance. LLO 11.2 Implement multilevel inheritance. | 11 | Write programs using- <ul style="list-style-type: none"> Single level inheritance Multilevel inheritance | 2 | CO3 |
| LLO 12.1 Develop program using multiple inheritance. | 12 | *Write programs to implement multiple inheritance | 2 | CO3 |
| LLO 13.1 Develop program using hierarchical inheritance. | 13 | Write programs to implement hierarchical inheritance | 2 | CO3 |
| LLO 14.1 Implement virtual base class in a program. | 14 | *Write programs to implement virtual base class. | 2 | CO3 |
| LLO 15.1 Implement constructors in derived class in a program. | 15 | Write programs which show the use of constructors in derived class | 2 | CO3 |
| LLO 16.1 Implement pointer arithmetic in a program. LLO 16.2 Implement pointer to object in a program. LLO 16.3 Implement 'this' pointer in a program. | 16 | *Write programs to implement- <ul style="list-style-type: none"> Pointer to object 'this' pointer | 2 | CO4 |
| LLO 17.1 Implement program to use pointer to derived class. | 17 | *Write programs for- <ul style="list-style-type: none"> Pointer to derived class in single inheritance Pointer to derived class in multilevel inheritance | 4 | CO4 |
| LLO 18.1 Implement function overloading in a program. | 18 | Write programs which show the use of function overloading | 2 | CO4 |

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|--|----------------|--------------|
| LLO 19.1 Implement unary operator overloading using member function. LLO 19.2 Implement unary operator overloading using friend function. | 19 | *Write programs to overload unary operator using- <ul style="list-style-type: none"> Member function Friend function | 4 | CO4 |
| LLO 20.1 Implement binary operator overloading using member function. LLO 20.2 Implement binary operator overloading using friend function. | 20 | Write programs to overload binary operator using- <ul style="list-style-type: none"> Member function Friend function | 2 | CO4 |
| LLO 21.1 Develop program using virtual function. | 21 | *Write programs to implement virtual function | 2 | CO4 |
| LLO 22.1 Develop program using pure virtual function. | 22 | Write programs to implement pure virtual function | 2 | CO4 |
| LLO 23.1 Implement read and write operations from/to file using constructor. LLO 23.2 Implement read and write operations from/to file using open(). | 23 | *Write programs to read and write from/to file using- <ul style="list-style-type: none"> Constructor open() | 2 | CO5 |
| LLO 24.1 Use formatted Input / Output functions to format the contents. | 24 | *Write programs to copy the content of one file into another file using formatted input/output functions | 2 | CO5 |
| LLO 25.1 Implement get() and put() functions on file. | 25 | Write file programs to implement sequential input and output operations on file | 2 | CO5 |
| LLO 26.1 Implement input/ output operations on binary file. | 26 | Write programs to perform input / output operations on binary files | 2 | CO5 |
| Note : Out of above suggestive LLOs - <ul style="list-style-type: none"> *' Marked Practicals (LLOs) Are mandatory. Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes. | | | | |

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop Student Grading System. Accept student data and marks for 5 subjects for 5 students. Calculate the percentage and finalize grade awarded to the student. Write the records in to file.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in file along with student credentials.
- Develop advanced calculator for the following function: Binary to Decimal, Decimal to Binary etc..
- Develop Hotel Management Application. It should accept room reservation for 10 rooms. Find number of empty rooms. Display relevant information and write maximum 5 records into file.
- Develop Employee Management System using Inheritance. Collect following information from user: Employee_ID ,Employee_Name, Basic_Salary, Leave taken in the month Calculate Net Salary assuming applicable deductions and display. Write maximum 5 records into file.
- Any other micro project as suggested by subject faculty.

Assignment

- Solve assignment covering all COs given by teacher

Other

- Complete the course object oriented concepts using C++ on Infosys Springboard

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | Computer System (Any computer system with basic configuration) | All |
| 2 | “C++” Compiler (Any) | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|---|-------------|----------------|----------|-----------|-----------|-------------|
| 1 | I | Principles of Object Oriented Programming | CO1 | 8 | 2 | 4 | 6 | 12 |
| 2 | II | Functions and Constructors | CO2 | 12 | 2 | 4 | 10 | 16 |
| 3 | III | Extending classes using Inheritance | CO3 | 9 | 2 | 4 | 10 | 16 |
| 4 | IV | Pointers and Polymorphism in C++ | CO4 | 10 | 2 | 4 | 10 | 16 |
| 5 | V | File operations | CO5 | 6 | 0 | 4 | 6 | 10 |
| Grand Total | | | | 45 | 8 | 20 | 42 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process and 40% weightage to product
- A continuous assessment-based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|--|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | | | |
| CO2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | | | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | | | |
| CO4 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | | | |
| CO5 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|-----------------|--------------------------------------|--|
| 1 | E Balaguruswamy | Object Oriented Programming with C++ | McGraw-Hill Education ISBN-10:0070669074, ISBN-13:9780070669079 |
| 2 | D Ravichandran | Programming with C++ | McGraw-Hill Education ISBN-10: 0070681899, ISBN-13: 978-0070681897 |
| 3 | Stroustrup B. | The C++ Programming Language | Pearson Education New Delhi ISBN-10: 0275967301, ISBN-13: 978-0275967307 |
| 4 | Robert Lafore | Object Oriented Programming in C++ | Pearson Education India ISBN-10: 8131722821, ISBN-13: 978-8131722824 |

XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|-----------------------------|
| 1 | https://www.w3schools.com/cpp/ | C++ Tutorial for all topics |
| 2 | https://www.javatpoint.com/cpp-tutorial | C++ Tutorial for all topics |
| 3 | https://www.javatpoint.com/cpp-files-and-streams | C++ File Streams |
| 4 | https://www.programiz.com/cpp-programming | Inheritance in C++ |
| 5 | https://www.programiz.com/cpp-programming/online-compiler/ | Online Compiler for C++ |
| 6 | https://www.onlinegdb.com/online_cplusplus_compiler | Online compiler for C++ |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : Computer Technology/ Computer Engineering/ Computer Science & Engineering/
Computer Hardware & Maintenance/

Programme Code : CM/ CO/ CW/ HA

Semester : Third

Course Title : COMPUTER GRAPHICS

Course Code : 313001

I. RATIONALE

Computer Graphics is the discipline of generating images with the aid of computers. This course provides an introduction to the principles of Computer Graphics. In particular, the course will consider methods for Object Design, Transformation, Scan Conversion, Visualization and Modelling of real world and enables student to create impressive graphics easily and efficiently.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain following Industry Identified Competency through various Teaching Learning Experiences:
Develop programs using Graphics concepts.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

- Students will be able to achieve & demonstrate the following COs on completion of course based learning
- CO1 - Manipulate Visual and Geometric information of Images.
 - CO2 - Develop programs in C applying standard graphics algorithms.
 - CO3 - Perform and Demonstrate basic and composite graphical transformations on given object.
 - CO4 - Implement various Clipping algorithms.
 - CO5 - Develop programs to create Curves.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | |
|-------------|-------------------|------|-------------------|--------------------------|----|----|-----|-----|---------|-------------------|--------|-------|-------|------------------|-------|----|-------|-------------|-----|-------------|-----|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | Based on LL & TL | | | | Based on SL | | Total Marks | |
| | | | | | | | | | | | | | | Practical | | | | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | | | | | | | | | | | Max |
| 313001 | COMPUTER GRAPHICS | CGR | DSC | 1 | - | 2 | 1 | 4 | 2 | - | - | - | - | - | 25 | 10 | - | - | 25 | 10 | 50 |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|--|---|
| 1 | TLO 1.1 Describe coordinate system. TLO 1.2 Select and use various graphics file formats. TLO 1.3 Use different graphics functions and standards. | Unit - I Basics of Computer Graphics 1.1 Coordinate system 1.2 Graphics file formats: Basics, advantages, disadvantages – BMP – GIF – JPEG – TIFF – PCX 1.3 Graphics functions & standards: Text mode, Graphic mode, Shapes, Colors, Graphics standards. | Lecture Using Chalk-Board Demonstration Hands-on |
| 2 | TLO 2.1 Apply Line Drawing algorithms to generate Line. TLO 2.2 Apply Circle Drawing algorithms to generate Circle. TLO 2.3 Apply Polygon Filling algorithms to Fill Polygon. | Unit - II Raster Scan Graphics 2.1 Line Drawing Algorithms : Digital Differential Analyzer algorithm, Bresenham's algorithm. 2.2 Circle Generation- Symmetry of Circle, Bresenham's algorithm 2.3 Polygon Filling : Seed Fill algorithms- Flood Fill algorithm, Boundary Fill algorithm. | Lecture Using Chalk-Board Demonstration Hands-on |
| 3 | TLO 3.1 Perform various transformations on given graphics object. TLO 3.2 Use composite transformations. TLO 3.3 Write need of homogeneous coordinates. | Unit - III Overview of 2D And 3D Transformations 3.1 Basic Transformations: Translation, Scaling, Rotation. 3.2 Matrix representations & homogeneous coordinates. 3.3 Composite transformations. 3.4 Three-dimensional transformation. 3.5 Other transformations: Reflection, Shear. | Lecture Using Chalk-Board Demonstration Hands-on |
| 4 | TLO 4.1 Define: Windowing and Clipping. TLO 4.2 Apply Clipping algorithms for Line and Polygon. | Unit - IV Windowing and Clipping Techniques 4.1 Windowing concepts. 4.2 Line Clipping: Cohen Sutherland Line Clipping algorithm, Mid-Point Subdivision Line clipping algorithm. 4.3 Polygon Clipping: Sutherland Hodgeman Polygon clipping algorithm. | Lecture Using Chalk-Board Demonstration Hands-on |

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|--|--|
| 5 | TLO 5.1 Draw various Curves using Curve generation algorithms. TLO 5.2 Identify different types of Projections. | Unit - V Introduction to Curves and Projections 5.1 Bezier and B-Spline Curves. 5.2 Projections: Perspective and Parallel Projection and its types. | Lecture Using Chalk-Board Demonstration Hands-on |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|-------|--|----------------|--------------|
| LLO 1.1 Implement a C program using different graphics functions. | 1 | *Write a C program to draw various graphics objects (Pixel, Circle, Line, Ellipse, Rectangle, Triangle, Polygon) using graphics functions. | 2 | CO1 |
| LLO 2.1 Implement a C program to draw line using DDA algorithm. | 2 | *Write a C program to draw line using DDA algorithm. | 2 | CO2 |
| LLO 3.1 Implement a C program to draw line using Bresenham's algorithm. | 3 | Write a C program to draw line using Bresenham's algorithm. | 2 | CO2 |
| LLO 4.1 Implement a C program to draw circle using Bresennham's algorithm. | 4 | *Write a C program to draw circle using Bresenham's algorithm. | 2 | CO2 |
| LLO 5.1 Implement a C program for Flood fill algorithm. | 5 | *Write a C program for Flood fill algorithm of polygon filling. | 2 | CO2 |
| LLO 6.1 Implement a C program for Boundary fill algorithm. | 6 | Write a C program for Boundary fill algorithm of polygon filling. | 2 | CO2 |
| LLO 7.1 Implement a C program for 2D Translation and Scaling | 7 | *Write a C program for 2D Translation and Scaling. | 4 | CO3 |
| LLO 8.1 Implement a C program for 2D Rotation. | 8 | Write a C program for 2D Rotation. | 2 | CO3 |
| LLO 9.1 Implement a C program for 2D Reflection and Shear. | 9 | *Write a C program for 2D Reflection and Shear. | 4 | CO3 |
| LLO 10.1 Implement a C program for 3D Translation and Scaling. | 10 | *Write a C program for 3D Translation and Scaling . | 4 | CO3 |
| LLO 11.1 Implement a C program for 3D Rotation | 11 | Write a C program for 3D Rotation. | 2 | CO3 |
| LLO 12.1 Implement a C program for Line Clipping using Cohen-Sutherland algorithm. | 12 | *Write a C program for Line Clipping using Cohen-Sutherland algorithm. | 2 | CO4 |
| LLO 13.1 Implement a C program for Line Clipping using Midpoint Subdivision algorithm. | 13 | Write a C program for Line Clipping using Midpoint Subdivision algorithm. | 2 | CO4 |
| LLO 14.1 Implement C program for Sutherland Hodgeman Polygon Clipping. | 14 | Write a C program for Sutherland Hodgeman Polygon Clipping. | 2 | CO4 |
| LLO 15.1 Implement a C program for Bezier Curve. | 15 | Write a C program for Bezier Curve. | 2 | CO5 |

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Implement Snake Game
- Design Smile Face
- Design Digital Clock
- Any other micro projects suggested by subject teacher.
- Develop program for moving Car

Self learning

- Develop C language code for relevant topics suggested by the teacher
- Any computer graphics course suggested by teacher (NPTEL, MOOCs courses etc.)

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|---|---------------------|
| 1 | Computer System with basic configuration. | All |
| 2 | 'C' Compiler | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------------|------|--|-------------|----------------|---------|---------|---------|-------------|
| 1 | I | Basics of Computer Graphics | CO1 | 2 | 0 | 0 | 0 | 0 |
| 2 | II | Raster Scan Graphics | CO2 | 4 | 0 | 0 | 0 | 0 |
| 3 | III | Overview of 2D And 3D Transformations | CO3 | 4 | 0 | 0 | 0 | 0 |
| 4 | IV | Windowing and Clipping Techniques | CO4 | 3 | 0 | 0 | 0 | 0 |
| 5 | V | Introduction to Curves and Projections | CO5 | 2 | 0 | 0 | 0 | 0 |
| Grand Total | | | | 15 | 0 | 0 | 0 | 0 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous Assessment based on Process and Product related performance indicators. Each practical will be assessed considering

60% weightage to Process
40% weightage to Product

Summative Assessment (Assessment of Learning)

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XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|--|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | | |
| CO2 | 2 | 2 | 2 | 2 | - | 1 | 1 | | | |
| CO3 | 2 | 2 | 2 | 2 | - | 1 | 1 | | | |
| CO4 | 2 | 2 | 2 | 2 | - | 1 | 1 | | | |
| CO5 | 2 | 2 | 2 | 2 | - | 1 | 1 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level | | | | | | | | | | |

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--|---|---|
| 1 | Donald Hearn , M Pauline Baker | Computer Graphics | Prentice-Hall • ISBN-10 : 0131615300 • ISBN-13 : 978-0131615304 |
| 2 | William M. Newman Robert F. Sproull | Principles of Interactive Computer Graphics | McGraw-Hill • ISBN: 978-0-07-046338-7 |
| 3 | Zhigang Xiang, Roy Plastock | Computer Graphics | Schaum O Series • ISBN: 9789389538847 • ISBN: 938953884X |
| 4 | Atul P. Godse, Dr. Deepali A. Godse | Computer Graphics | Technical Publications ISBN 933322338X, 9789333223386 |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|------------------------------|
| 1 | https://www.javatpoint.com/computer-graphics-programs | Basic graphics programs |
| 2 | https://www.tutorialspoint.com/computer_graphics/index.htm | Basics of computer graphics |
| 3 | https://www.educba.com/line-drawing-algorithm/ | Line drawing algorithm |
| 4 | https://www.javatpoint.com/computer-graphics-clipping | Clipping Algorithms |
| 5 | https://www.tutorialspoint.com/computer_graphics/computer_graphics_curves.htm | Curves in computer graphics |
| 6 | https://www.tutorialspoint.com/computer_graphics/2d_transformation.htm | 2D and 3D Transformation |
| 7 | https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384200894190387210361_shared/overview | Project on Computer Graphics |

| Sr.No | Link / Portal | Description |
|--|---------------|-------------|
| Note : | | |
| <ul style="list-style-type: none">Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students | | |