

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Computer Science & Engineering

Semester - III

Scheme of Studies:

S. No	Board of Study	Course Code	Course Titles	Scheme of Studies (Hours/Week)			
				L	P	T	Credit L+T+(P/2)
1	CSE	2000351(022)	Operating System with Linux	3	0	0	3
2	CSE	2000352(022)	Scripting Language (Python)	2	0	0	2
3	CSE	2000353(022)	Data Structure	3	0	0	3
4	CSE	2000354(022)	E-Commerce	2	0	0	2
5	Electronics and Telecommunication	2000355(028)	Digital Electronics	2	0	1	3
6	CSE	2000361(022)	Operating System with Linux (Lab)	0	4	0	2
7	CSE	2000362(022)	Scripting Language (Python) (Lab)	0	4	0	2
8	CSE	2000363(022)	Data Structure (Lab)	0	4	0	2
9	Electronics and Telecommunication	2000364(028)	Digital Electronics (Lab)	0	2	0	1
10	-	-	NSS/SPORTS/YOGA/TECHNICAL PRESENTATION/ LIBRARY ACTIVITIES	AS PER CSVTU MINUTES 08 HOURS ARE ALLOCATED TO MENTIONED ACITIVITES			
Total				12	14	1	20

L - Lecture, T - Tutorial, P - Practical,

Legend:- Lecture (L) --> CI : Classroom Instruction (Includes different instructional strategies i.e. Lecture and others).

Practical (P) --> LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies.

Tutorial (T) --> SL : Self Learning.

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Scheme of Examination:

S. No	Board of Study	Course Code	Course Titles	Scheme of Examination					
				Theory			Practical		Total Marks
				ESE	CT	TA	ESE	TA	
1	CSE	2000351(022)	Operating System with Linux	70	30	30	0	0	130
2	CSE	2000352(022)	Scripting Language (Python)	70	30	30	0	0	130
3	CSE	2000353(022)	Data Structure	70	30	30	0	0	130
4	CSE	2000354(022)	E-Commerce	70	30	30	0	0	130
5	Electronics and Telecommunication	2000355(028)	Digital Electronics	70	30	30	0	0	130
6	CSE	2000361(022)	Operating System with Linux (Lab)	0	0	0	30	50	80
7	CSE	2000362(022)	Scripting Language (Python) (Lab)	0	0	0	30	50	80
8	CSE	2000363(022)	Data Structure (Lab)	0	0	0	30	50	80
9	Electronics and Telecommunication	2000364(028)	Digital Electronics (Lab)	0	0	0	30	50	80
10		-	Technical Presentation	0	0	0	0	30	30
Total				350	150	150	120	230	1000

ESE : End of Semester Exam, CT: Class Test, TA: Teachers Assessment

Legend :- PRA :Process Assessment, PDA : Product Assessment.

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- A) Course Code : 2000351(022)
B) Course Title : Operating System with Linux
C) Pre- requisite Course Code and Title : Computer Fundamentals and its Applications
D) Rationale:

This course will enable the students to use various services of an operating system. The students will comprehend the functions of structures, Processes and CPU scheduling, memory management, file system, mass storage structure etc. of an operating system. The students will also install Linux Operating System and various services, setup file system, and use shell programming for performing different tasks.

E) Course Outcomes

- CO-1 : Identify different types of operating System for various business and industrial applications.
CO-2 : Analyze various process and CPU management concepts of an OS.
CO-3 : Compare memory management concepts including logical memory, virtual memory and Physical memory.
CO-4 : Use files management and directory structure concepts to organize a disk.
CO-5 : Install and use Linux operating System.

F) Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Computer Science and Engineering	2000351(022)	Operating System with Linux	3	4	0	7	5

Legend: Lecture (L) and Tutorial (T) and Practical (P)

G) Scheme of Assessment:

Board of Study	Course code	Course Title	Scheme of Examination					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Computer Science and Engineering	2000351(022)	Operating System with Linux	70	30	30	30	50	210

ESE- End Semester Exam, CT- Class Test, TA- Teacher Assessment

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course. Convert unit of the given physical quantity from one unit system to other.

CO-1 Identify different types of operating systems for various business and industrial applications.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Identify need of Operating System. SO1.2 Compare different structure of Operating System. SO1.3 List different types of Operating System SO1.4 List different services provided by Operating System	LE1.1 Identify various versions of Linux Operating System through web search. LE1.2 Compare basic working of Linux Operating System and Windows Operating System.	Unit – I :Operating System Concepts 1.1 Need of Operating System 1.2 Structure of Operating System 1.2.1 System Components 1.2.2 System Calls 1.2.3 System Structure 1.3 Operating System types 1.3.1 Batch 1.3.2 Multiprogramming 1.3.3 Multitasking 1.3.4 Multiuser 1.3.5 Time Sharing 1.3.6 Real Time 1.4 Operating System Services	1.1 Case study 1.1.1. Linux Operating System features 1.1.2.Windows Operating System features

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. What are the three main purposes of an operating system?
2. Describe need and structure of Operating System.
3. Compare different types of Operating System.

b. Mini Project:

1. Prepare a report on features of different operating system i.e. Linux and Windows

c. Other Activities (Specify):

1. Seminar on Different types of Linux Operating System and its purpose.

CO-2 Analyze various process and CPU management concepts of an OS.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify process states of Operating System. SO2.2 Compare CPU scheduling algorithms. SO2.3 Classify deadlock handling techniques in Operating System. SO2.4 Apply Deadlock Detection, Prevention and Avoidance Algorithm in given example.		Unit – II Process & CPU Management 2.1 Process Concept 2.1.1 Programmers view of Process 2.1.2 Process State 2.1.3 Process Control Block 2.1.4 Process Scheduling 2.2 CPU Scheduling 2.2.1 Schedulers 2.2.2 Scheduling Criteria 2.2.3 Scheduling Algorithms 2.3 Deadlock 2.3.1 Basic Concepts 2.3.2 Deadlock Detection 2.3.3 Deadlock Prevention 2.3.4 Deadlock Avoidance	2.1 Different operations on processes 2.2 Real time situations of deadlock

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Compare different processor scheduling algorithm.
2. Describe deadlock avoidance and recovery algorithms.

b. Mini Project: -

c. Other Activities (Specify):

1. Seminar on different processor scheduling algorithms in an O.S.
2. Seminar on different deadlock related algorithms in an O.S.

CO-3 Compare memory management concepts including logical memory, virtual memory and physical memory.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Classify various memory management techniques in Operating System. SO3.2 Differentiate contiguous and non-contiguous memory allocation. SO3.3 Differentiate physical and virtual memory.		Unit – III Memory Management 3.1 Need of Memory Management 3.2 Contiguous Allocation 3.2.1 Partitioned Memory Allocation 3.2.2 Fixed & Variable Partitioning 3.2.3 Swapping 3.2.4 Relocation 3.2.5 Protection and Sharing 3.3 Noncontiguous Allocation 3.3.1 Paging 3.3.2 Segmentation 3.4 Virtual Memory	3.1 Storage Structure 3.2 Storage Hierarchy

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Session Outcomes	Laboratory	Class room Instruction (CI)	Self Learning
SO3.4 Apply different Memory Replacement Algorithms in given example.		3.4.1 Demand Paging 3.4.2 Page Replacement Algorithms 3.4.3 Thrashing	

SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Describe different memory management strategies in an O.S.
2. Differentiate physical and virtual, primary memory of an OS.

b. Mini Project: -

c. Other Activities (Specify):

1. Seminar on different memory management strategies

CO- 4 Use file management and directory structure concepts to organize a disk.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Classify file management concepts in Operating System SO4.2 Illustrate directory structure of Operating System SO4.3 Classify disk organization mechanism of Operating System. SO4.4 Apply file system security mechanism in Operating System.		Unit – IV File Management 4.1 File Management 4.1.1 File Concept and Access Methods 4.1.2 User view of File System 4.1.3 Attributes and Operations 4.1.4 File System Design 4.1.5 Disk Space 4.2 Directory Structure 4.3 Disk Organization 4.3.1 Physical Structure 4.3.2 Logical Structure 4.3.3 Addressing 4.3.4 Disk Scheduling 4.4 Security and Protection Mechanism	4.1 LINUX File System 4.2 File-System Mounting

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe Directory Structure of Operating System.
2. Describe Disk Organization of Operating System.
3. Describe Implement file system security

b. Mini Project: -

c. Other Activities (Specify):

1. Seminar on Directory structure and Disk organization mechanism of Operating System.

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CO- 5 Install and use Linux operating System.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Perform Installation and administration of LINUX OS SO5.2 Perform different LINUX commands. SO5.3 Apply different features of vi editor for creating document. SO5.4 Construct shell scripts for a given purpose.	LE5.1 Install and Configure Linux Operating System. LE5.2 Execute Linux commands: who, who am i, tty, pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, wc, split, cmp, comm, diff, head, tail, grep, sort, ln, chmod, chown, chgrp, pr, lp, expr, man, help, pipes and I/O redirectors, tee, ps. LE5.3 Prepare a documents using 'vi' editor. LE5.4 Develop shell scripts for a given purpose.	Unit – V: Linux Basics 5.1 Overview of Linux 5.2 Installation and Upgrade 5.3 System Administration 5.4 Introduction to Shell and Commands: who, who am i, tty, pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, wc, split, cmp, comm, diff, head, tail, grep, sort, ln, chmod, chown, chgrp, pr, lp, expr, man, help, pipes and I/O redirectors, tee, ps. 5.5 Edit files with “vi” editor 5.6 Linux 5.6.1 Shell Concept 5.6.2 Basic Shell Scripts	5.1 Features of Linux 5.2 Various LINUX Shells

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Describe different basic Linux commands.
2. Describe different shell commands in a script.

b. Mini Project:

c. Other Activities (Specify):

1. Seminar based presentation on basic Linux commands and shell commands in a script.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Title	Total Marks
I	Operating System Concepts	10
II	Process & CPU Management	16
III	Memory Management	14
IV	File Management	14
V	Linux Basics	16
Total		70

J) Suggested Specification Table (For ESA of Laboratory Instruction*):

Note: The student at the end of semester examination of **30Marks**; has to undertake any **ONE** of the listed practical's.

Laboratory Instruction Number	Short Laboratory Experiment Title	Marks
1	a) Install & test different types of Operating System & compare its features. b) Execute who, who am i, tty, pwd, cd commands c) Modes of vi editor	30 Marks are allocated for performance under ESA
2	a) Execute mkdir, rmdir, ls, cat, cp, rm, mv, wc commands b) Creating and saving files using vi editor c) Create a shell script to print "Hello". d) Create a Shell script to read and display content of a file.	
3	a) Execute split, cmp, comm, diff, head, tail, grep, sort commands b) perform Cursor movement commands in vi editor c) Create a Shell script to read from command line.	
4	a) Execute chmod, man, help commands b) Create a Shell script to append content of one file to another c) Cut and paste commands in vi editor.	
5	a) Execute Commands using pipes and I/O redirectors b) Find and replace commands in vi editor c) Create a Shell script to accept a string in lower case letters from a user, & convert to upper case letters.	
6	a) Execute ps command with all options b) Create a Shell script to find numbers of characters, words & lines of a given input file.	
7	a) execute apt-get install, apt-get remove commands b) Create a Script to reverse a string and display it. c) Create a Script to reverse a string and display it.	
8	a) Create a Script to check a string is palindrome. b) Create a Shell script to add, subtract, multiply and division of two numbers. c) Create a shell script to reverse the digits of a given 5-digit number. (foreg. , if the no. is 57429 then answer is 92475).	

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practical's

Legend: PRA: Process Assessment, PDA: Product Assessment

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration

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11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Operating System Concepts	James Peterson Wesley Abraham Silberschatz	JOHN WILEY & SONS. INC	2017 or latest
2	Unix Concepts And Application	Sumitabha Das	MGH	2017 or latest
3	Operating systems	Dhamdhare	MGH	2017 or latest
4	Modern Operating System	Andrew Tanenbaum	PHI	2017 or latest
5	Operating Systems	SibsankarHaldar	Pearson Education	2017 or latest
6	Operating System	Milan Milenkovic	MGH	2017 or latest
7	Operating Systems concept based approach (3rd Edition)	Dhananjay M.	MGH	2017 or latest
8	Linux –Application and administration,	Ashok Kumar Harnal	TMH	2017 or latest

(b) Open source software and website address:

1. Operating System concepts: http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-ANG/Operating%20Systems/New_index1.html .
2. Linux basics: www.freeos.com/guides/lsst .
3. Linux basics: www.linuxcommand.org/writing_asell_scripts.php .
4. Linux basics: www.distro.ibiblio.org/damnsmall/current/dsl-4.4.10-embedded.zip

(c) Others:

1. Learning Packages.
2. Lab Manuals.
3. Manufacturers' Manual
4. Users' Guide

M) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Linux based Host machines	Free & Open Source Software or Open source	LE1.1-LE1-2 LE5.1-LE5-4
2	Computers	latest hardware configuration	LE1.1-LE1-2 LE5.1-LE5-4

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N) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Teamwork PO-8	Communication PO-9	Life Long learning PO-10	PSO-1 Modern Information Technology Usage	PSO-2 Manage Information Technology Process
CO-1: Identify different types of operating System for various business and industrial applications.	3	3	1	1	2	1	1	2	1	1	2	1
CO-2: Analyze various process and CPU management concepts of an OS.	3	3	1	1	2	1	1	2	1	1	2	2
CO-3: Compare memory management concepts including logical memory, virtual memory and physical memory.	3	3	1	1	2	1	1	2	1	1	2	2
CO-4: Use files management and directory structure concepts to organize a disk.	3	3	1	1	2	1	1	2	1	1	2	2
CO-5: Install and use Linux operating System.	3	3	3	3	3	1	1	3	2	2	3	3

Legend: 0- No correlation, 1- Low, 2- Medium, 3- High

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O) Course Curriculum Map:

POs & PSOs No.	COs No.& Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO1-PO5, PO8-PO10 PSO1-PSO2	CO-1 Identify different types of Operating Systems for various business and industrial applications.	SO1.1 - SO1.4	LE1.1 - LE1.2	Unit 1.0 Operating System Concepts	SL1.1
PO1-PO2, PO5,PO8-PO10 PSO1-PSO2	CO-2 Analyze various process management concepts including scheduling, deadlocks used for effective management of system.	SO.2.1 - SO2.4	-	Unit 2.0 Process & CPU Management	SL2.1, SL2.2
PO1-PO2, PO5,PO8-PO10 PSO1-PSO2	CO-3 Demonstrate memory management concept including logical memory, virtual memory and physical memory	SO.3.1 - SO3.4	-	Unit 3.0Memory Management	SL3.1,SL3.2
PO1-PO2, PO5,PO8-PO10 PSO1-PSO2	CO-4 Apply file management and Directory structure concept to organize disk	SO4.1 - SO4.4	-	Unit 4.0File Management	SL4.1, SL4.2
PO1-PO5, PO8-PO10 PSO1-PSO2	CO-5 Execute Linux commands and shell script effectively.	SO5.1 - SO5.4	LE5.1 - LE5.4	Unit 5.0 Linux Basics	SL5.1,SL5.2

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vii.Course Curriculum Detailing (Semester- III)

- A) Course Code : 2000352(022)
 B) Course Title : Scripting Language (Python)
 C) Pre-requisite Course Code and Title : Programming in C
 D) Rationale :

This Course imparts problem solving skills in the students, using a general-purpose interpreted, interactive, object-oriented, and high-level programming language 'Python'. The course is crafted to help the students to develop logical ability to identify the best solution for a given problem. The programming skills thus acquired using 'Python' language can be used for acquiring necessary programming skill to work with advance level programming languages. This will be helpful in developing programs for the scientific, research and business purposes.

E) **Course Outcomes:** The course content should be taught and implemented with the aim to develop the following outcomes in the students.

- CO-1 Write a Python program using interactive and script mode.
 CO-2 Develop program in Python using decision making and loop statements.
 CO-3 Develop programs in Python using sequence and built in function.
 CO-4 Develop programs in Python using modules, user defined function and exception handling.
 CO-5 Develop programs in Python using GUI.

F) **Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Computer Science & Engineering	2000352 (022)	Scripting Language (Python)	2	4	0	6	4

Legend: Lecture (L) and Tutorial (T) and Practical(P)

G) **Scheme of Assessment:**

Board of Study	Course Code	Course Title	Scheme of examination					
			Total Marks					
			Theory			Practical		Total Marks
ESE	CT	TA	ESE	TA				
Computer Science & Engineering	2000352 (022)	Scripting Language (Python)	70	30	30	30	50	210

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1:Write a Python program using interactive and script mode.(Approx. Hrs: 8+8)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Describe the feature of Python SO1.2 Classify different data type ,operator and input output of Python program	LI1.1 Write a Program to display your name using interactive mode function. LI1.2 Create variable which hold your name. LI1.3 Write a program for sum of two numbers using script mode	Unit 1.0 Introduction to Python Programming 1.1 Features of Python 1.2 Working Mode 1.2.1 Interactive Mode 1.2.2 Script Mode 1.3 Variable and Data Types 1.3.1 Numbers 1.3.2 Sequences 1.4 Keywords 1.5 Operator 1.5.1 Relational 1.5.2 Logical 1.5.3 Assignment 1.6 Input and Output 1.6.1 raw input, input 1.6.2 print	1.1 List company name which use Python in real product generation. 1.5 use of Arithmetic Operator 1.6 comments some code 1.7 use of type expression.

SW-1 Suggested Sessional Work (SW):**a. Assignments:**

1. Write a note on how keywords different from variable names.
2. Write a note on list of I/O methods in Python.

b. Mini Project:

1. Develop a program to convert a string to integer.
2. Write a program that ask user to entry his/her name, stores the name in variable called name and say hello to him/her.

c. Other Activities (Specify):

1. Presentation on 'working mode' of python.

CO-2: Develop program in Python using decision making and loop statements.

(Approx. Hrs: 8+8)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Describe decision making statement. SO2.2 Determine the need of correct loop statement.	LE2.1 Write a program to find max and min of two Numbers. LE2.2 Write a program to find among three numbers LE2.3 Write a program to print table of '5'. LE2.4 Write a program to find the factorial of given number. LE2.5 Write a program to list prime number between 1 to 100.	Unit 2 Control Structure 2.1 Decision making 2.1.1 The <i>if else</i> Statement 2.1.2 <i>if-elif-else</i> statement 2.2 Control flow 2.2.1 while loop and its nesting 2.2.2 for loop 2.2.3 break, continue statement	2.1 Conditional branching statement in Python. 2.2 Nested for loop in Python 2.3 difference between break and continue

SW-2 Suggested Sessional Work (SW):**a. Assignments:**

1. Write short notes on decision making statement.
2. Write short notes on control flow statement.

b. Mini Project:

1. Write a program calculate grade from give percentage like
>85 'A' > 70 to <=85 'B' > 60 to <=70 'C' > 45 to <=60 'D'
2. Write a program to find the Armstrong number .

c. Other Activities (Specify):

1. Present a Power point presentation on *control statements*.

CO-3: Develop programs in Python using sequence and built in function.(Approx. Hrs: 10+10)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Describe the need and use of sequence	LE3.1 Write program to print the list of your subject name using List. LE3.2 Write a program to compare two different list and print duplicate records LE3.3 Write a program to find the length of entered string using Tuple. LE3.4 Write a program	Unit 3.0 Sequence, Dictionary & Built in Function 3.1 Sequence : 3.1.1 List : ▪ create, access & update list ▪ basic operation on list ▪ built in function of list	3.1 (a) Difference between list & Tuples (b) Built in function of Tuples. 3.3 Time zone and local time function.

Session Outcomes	Laboratory Instruction	Class room Instruction	Self Learning
	to print students name using their roll number. LE3.5 Write a program to print calendar of your birth month.	3.1.2 Tuples : ▪ create, access & update ▪ basic operation 3.2 Dictionary : ▪ Basic operation ▪ Built in function & method 3.3 Calendar& Time function 3.4 Built in Function of Python Cmp, Range, Round	3.4 min,max function

SW-3 Suggested Sessional Work (SW):**a. Assignments:**

1. Differentiate between List & Tuple in Python.
2. Merits and demerits of Dictionary.

b. Mini Project:

1. Develop a program in Python to sort the element of two different lists and store sorted elements in third list.
2. List the common method and built in function of List, Tuple and Dictionary.

c. Other Activities (Specify):

1. Present a power point presentation on *sequence of Python*.

CO- 4: Develop programs in Python using user defined function and exception handling.**(Approx. Hrs: 10+12)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Describe the use of inbuilt module. SO4.2 Describe the user defined function SO4.3 Describe handling of exception in Python	LE4.1 Write program to find ceil and floor of given floating number using math module. LE4.2 Write program to find sin(x) and cos(x). LE4.3 Write your own function 'si' to find the simple interested. LE4.4 Write program to handle exception 'Division by zero'.	Unit 4.0 Function & File Handling 4.1 introduction to module 4.1.1 Import module 4.1.2 From module 4.1.3 math and random module 4.2 user defined function 4.2.1 need of user defined function 4.2.2 define and declare function 4.2.3 function with return type and arguments 4.3 Exception handling 4.3.1 Need of exception	4.1 difference between import and from 4.2 log, pow, sqrt function in math module 4.3 function without argument and no return type.

	LE4.5 Write program to handle exception 'Accessing an out of bound list element'	handling 4.3.2 raise, try ,catch and finally	
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SW-4 Suggested Sessional Work (SW) :**a. Assignments:**

- 1 Write short note on different modules.
2. Write a short note on type of function.

b. Mini Project:

1. Develop a program in 'C' to find all prime factor of a given number.
2. Develop a program in 'C' to check whether the given number is Armstrong number or not.

c. Other Activities (Specify):

1. Seminar on need of functions and modules.

CO- 5: Develop programs in Python using GUI.**(Approx. Hrs: 12+14)**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Design GUI using Tkinter SO5.2 Describe the use of form component on GUI .	LE5.1 Write a GUI program to print your name in window using label. LE5.2 Write a GUI program to take number in textbox and print factorial of that number in label. LE5.3 Write a GUI program to find the age of in the form of year, month and day. LE5.4 Write a GUI program print biodata with your image. LE5.5 Write a GUI program in which label color is change when mouse entered or leaved. LE5.6 Write an interactive GUI program using tkMessageBox.	Unit 5.0 GUI Programming 5.1 Need of GUI 5.1.1 Advantage of GUI 5.1.2 List of graphic library 5.2 Tkinter graphic library 5.2.1 Creating Window 5.2.2 label,button checkbox, 5.2.3 Action on button click 5.2.4 text entry box 5.2.5 Layout Management using pack(),frame(),grid(),menu(), canvas(), create_line(), create_image() 5.2.6 Events-Capturing mouse 5.2.7 tkMessageBox, askyesno	5.2 option button on Tkinter 5.3 PhotoImage() function of Tkinter 5.4 askokcancel, askretrycancel, askquestion function of tkMessageBox

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :**a. Assignments:**

1. Write sort notes on list of available GUI library in Python.
2. Write sort notes on list of graphics function used in Tkinter.

b. Mini Project:

1. Make a menu driven program to display your college and faculty list with photograph.
2. Make a GUI program to calculate income tax of particular employee.

c. Other Activities (Specify):

1. Present a power point presentation about Tkinter GUI.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Title	Total Marks
I	Introduction to Python Programming	14
II	Control Structure	14
III	Sequence, Dictionary & built in Function	14
IV	Function & File Handling	14
V	GUI Programming	14
Total		70

J) Suggested Specification Table (For ESA of Laboratory Instruction*):

S.No	List of Practicals	30 Marks are allocated for performance under ESA
1	Write a program to create menu to simple interest, compound interest.	
2	Write a program to convert decimal number to binary and vice-versa.	
3	Write a program to print the calendar of give date.	
4	Write a program to print Armstrong number between given range using user defined function.	
5	Write a program to print * * * * * * * * *	
6	Write a GUI program to calculate factorial using textbox, button & message box.	
7	Write a GUI program to calculate SPI of your 2 semester result.	

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

Note : Only one experiment has to performed at the end semester examination of 40 Marks as per assessment scheme

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Taming Python by Programming	Jeeva Jose	Khanna Publishing House	Latest Edition
2	Starting Out with Python	Tony Gaddis	Pearson publication,	Latest Edition
3	Python Programming: Using Problem Solving Approach	Reema Thareja	Oxford University Press	Latest Edition

(b) Open source software and website address :

1. 'Python' : <https://www.python.org/downloads/>
2. 'Python' Tutorial: https://www.tutorialspoint.com/python_online_training/
3. 'Python' Tutorial: <https://wiki.python.org/moin/BeginnersGuide>
4. Learn 'C' online: <http://www.learnconline.com>

(c) Others:

1. Learning Packages
2. Lab Manuals
3. Users Guide

M) List of Major Laboratory Equipment and Tools:

Computer System with latest configuration and memory

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Computer System	i3 processor or higher , 4GB RAM or higer with linux or windows o.s.	LE1.1-LE1.4 LE2.1-LE2.3 LE3.1-LE3.4 LE4.1-LE4.3 LE5.1-LE5.3
2	'Python' IDE	version 3.7.7 or higher	LE1.1-LE1.4 LE2.1-LE2.3 LE3.1-LE3.4 LE4.1-LE4.3 LE5.1-LE5.3

N) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO-1 Write a Python program using interactive and script mode.	3	3	1	1	0	0	1	1	1	3	1	0
CO-2 Develop program in Python using decision making and loop statements.	3	3	2	2	0	0	3	1	1	3	2	0
CO-3 Develop programs in Python using sequence and built in function.	2	2	3	1	0	0	2	2	1	2	2	0
CO-4: Develop programs in Python using modules, user defined function and exception handling.	3	2	3	2	0	0	2	2	1	3	2	0
CO-5: Develop programs in Python using GUI.	3	2	3	2	0	0	2	2	1	3	2	0

Legend - 0: No correlation, 1: Low, 2: Medium, 3: High

O) Course Curriculum Map

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO1,2,3,4,7,8,9,10 PSO1	CO-1 Write a Python program using interactive and script mode.	SO1.1 - SO1.4	LE1.1 LE1.2 LE1.3	Unit 1.0 Introduction to Python Programming	As mentioned in relevant page numbers
PO1,2,3,4,7,8,9,10 PSO1	CO-2 Develop program in Python using decision making and loop statements.	SO.2.1- SO.2.6	LE2.1 LE2.2 LE2.3 LE2.4 LE2.5	Unit 2.0 Control Structure	
PO1,2,3,4,7,8,9,10 PSO1	CO-3 Develop programs in Python using sequence and built in function.	SO.3.1- SO3.3	LE3.1 LE3.2 LE3.3 LE3.4 LE3.5	Unit 3.0 Sequence, Dictionary & built in Function	
PO1,2,3,4,7,8,9,10 PSO1	CO-4: Develop programs in Python using modules, user defined function and exception handling.	SO4.1 - SO4.6	LE4.1 LE4.2 LE4.3 LE4.4 LE4.5	Unit 4.0 Function & File Handling	
PO1,2,3,4,7,8,9,10 PSO1	CO-5: Develop programs in Python using GUI.	SO5.1 - SO5.5	LE5.1 LE5.2 LE5.3 LE5.5 LE5.5 LE5.6	Unit 5.0 GUI Programming	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

I. Course Curriculum Detailing (Semester- III)

- A) **Course Code** : 2000353(022)
 B) **Course Title** : Data Structure
 C) **Pre- requisite Course Code and Title** : Basic of C programming
 D) **Rationale** :

This course will enable diploma engineers to learn logical and mathematical model of storing and organizing data in a particular way in a computer. Methods and techniques of data structures are widely used in efficient problem solving and application programming. The study of data structure helps the students in developing logical and structured programs.

E) **Course Outcomes:**

- CO-1 To manipulate Linear Data Structure using C Programming.
 CO-2 Apply Linear Data Structure Stack and Queue in different application.
 CO-3 Develop programs in 'C' using Pointers, structure and Union for accessing memory.
 CO-4 Perform basic operation of insertion, deletion and searching on Linked list.
 CO-5 Perform basic operation of insertion, deletion and searching on graph and tree.

F) **Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Computer Science & Engineering	2000353 (022)	Data Structure	3	4	0	7	5

Legend: Lecture (L) and Tutorial (T) and Practical(P)

G) **Scheme of Assessment:**

Board of Study	Course code	Course title	Scheme of examination					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Computer Science & Engineering	2000353 (022)	Data Structure	70	30	30	30	50	210

H) **Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 To manipulate linear Data Structure using 'C' programming.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	SelfLearning (SL)
SO1.1 Describe declaring and initializing of One-Dimensional Array with example. SO1.2 Describe declaring and initializing of Multi-Dimensional Array with example. SO1.3 Apply various matrix operations in 'C' SO1.4 Describe declaring and initializing of String in 'C' with an example. SO1.5 Compare String and character array in 'C' with an example	LE1.1 Develop a program in 'C' to display list of values in reverse order LE1.2 Develop a program in 'C' to perform addition of all elements of a one dimensional array. LE1.3 Develop a program in 'C' to perform Addition of two square matrix. LE1.4 Develop a program in 'C' to perform transposition of square matrix. LE1.5 Develop program in 'C' to reverse a given string. LE1.6 Develop a program in 'C' to count number of characters in a given string. LE1.7 Develop a program in 'C' to count number of words in a string of sentence.	Unit-1.0 Introduction to data structure and Array in 'C' 1.1 Introduction to data structure 1.2 Type of data Structure 1.2.1 Primitive and Non Primitive data Structure 1.2.2 Linear And Non Linear Data Structure 1.3 Declaring and initializing One-Dimensional Array and array Operations- Insertion, Searching 1.4 Multi-Dimensional Array and its Operations- Matrix operations 1.5 Drawbacks of Linear Arrays 1.6 Introduction character array and string.	1.1 Advantages of array 1.2 Multiplication operations on array

SW-1 Suggested Sessional Work (SW):**a. Assignments:**

- i. Describe one dimensional array and two dimensional arrays in 'C' with examples.
- ii. Develop a program in 'C' to search a given number in one dimensional array.
- iii. Develop a program in 'C' to print even & odd numbers in square matrix.
- iv. Develop a program in 'C' to concatenation two given strings.

b. Mini Project:

- i. Develop a program in 'C' that performs inverse of square matrix.
- ii. Develop a program in 'C' on to check whether a string is palindrome or not.

c. Other Activities (Specify):

- i. A seminar on different dimension(s) of array in 'C'.
- ii. A seminar on 'use of String handling functions'.

CO-2ApplyLinear Data Structure Stack and Queue in different application.

Session Outcomes(SOs)	Laboratory Instruction (LI)	Class room Interaction(CI)	Self Learning (SL)
SO2.1Identify expression evaluation of stack SO2.2Performed Various operation on Stack Data Structure SO2.3List various applications of stack SO2.4 Implement Different type of Queue Data structure. SO2.5 Describe various applications of queue	LE2.1Evaluate Infix expression using stack. LE2.2Convert Infix expression to postfix expression. LE2.3Convert Infix expression to prefix expression. LE2.4Implement single ended queue using array. LE2.5Implement double ended queue using array. LE2.6Implement circular queue using array.	Unit 3.0 : Stack and Queue 2.1 Introduction to stack 2.2 Implementation of stack 2.3 Operations on Stack 2.3.1 Push 2.3.2 Pop 2.4 Application of Stack 2.4.1 Expression Evaluation 2.4.2 Infix to Postfix 2.4.3 Infix to Prefix 2.4.4 Recursion 2.5 Introduction to Queue 2.6 Types of queue 2.6.1 Single Ended Queue 2.6.2 Circular Queue 2.6.3 Double Ended Queue. 2.7 Implementation of Queue 2.8 Application of Queue	2.1Expression evaluation 2.2Recursion 2.3Compare single-ended, double-ended queue

SW-2 Suggested Sessional Work (SW):

- a. Assignments:
 1. Convert an expression (a + b * c) into postfix
 2. Write advantage of double-ended queue and circular queue over single ended queue.
- b. Mini Project:
 1. Implement tower of Hanoi problem.
- c. Other Activities (Specify):
 1. Seminar on "recursion"

CO-3 Develop program in 'C' using Pointers, structure and Union for accessing memory.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	SelfLearning (SL)
SO3.1 Describe declaring and initializing pointers with example. SO3.2 Apply various operations on pointers with example. SO3.3 Compare pointers and array with example. SO3.4 Describe declaring and initializing	LE3.1 Develop a program in 'C' to perform arithmetic operations on pointers LE3.2 Develop a program in 'C' to print address of variables LE3.3 Develop a program in 'C'to pass array inside a function. LE3.4 Develop programs in 'C' to read/write structure LE3.5 Develop, debug	Unit 3.0 Pointers, Structure and Union in 'C' 3.1Introduction and Features of Pointers 3.2Declaration of Pointer 3.3 Operations on Pointers 3.4 Array of Pointers 3.5 Pointers to Pointers 3.6 Passing array to function 3.7 Introduction and Features of Structure & Union 3.8Declaration of Structure & Union 3.9Operations on Structure	3.1 Advantages of pointers in 'C' program 3.2 Use of features of pointers in 'C' program 3.3 – 3.6 Uses of different operations on pointers in 'C' program 3.7 Advantages of Structure & Union 3.8 – 3.10 features

Session Outcomes	Laboratory Instruction	Class room Instruction	SelfLearning
Structure & Union in 'C'. SO3.5 Classify different types of Structure in 'C' SO3.6 Compare structure and union in 'C'	and execute programs in 'C' to create array of Structure. LE3.6 Use pointer, Structure & union in 'C'.	& Union 3.10 Array of Structure & Union 3.11 Pointers to Structure & Union	of Structure & Union

SW-3 Suggested Sessional Work (SW):**a. Assignments:**

- i. Develop a program in 'C' to show the concept of pointer to pointer.
- ii. Describe the use of pointers for arithmetic operation in 'C'.
- iii. Develop a program in 'C' to read & write students record.
- iv. Develop a program to search a number in specified location

b. Mini Project:

- i. Develop a program in 'C' 'to shows the relations between array and pointers'.
- ii. Develop a program in 'C' on structure to display information of 10 students

c. Other Activities (Specify):

- I. A seminar on pointers in 'C'
- II. A seminar on 'use of Structure & Union in 'C''

CO-4 : Perform basic operation of insertion, deletion and searching on Linked list.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Interaction(CI)	Self Learning (SL)
SO4.1 Define linked list and its terminology SO4.2 Identify different type of linked list. SO4.3 Describe various operations on linked list. SO4.4 Explain various applications of linked list	LE4.1 Perform searching, insertion and deletion operation on singly linked list. LE4.2 Perform searching, insertion and deletion operation on doubly linked list. LE4.3 Perform searching, insertion and deletion operation on Circular linked list.	Unit 4.0: Linked List 4.1 Introduction of Linked List 4.1.1 node, 4.1.2 next address 4.1.3 pointer, 4.1.4 null pointer 4.2 Types of Linked List 4.2.1 Singly Linked List 4.2.2 Doubly Linked List 4.2.3 Circular Linked List 4.3 Operations on Linked List 4.3.1 Searching 4.3.2 insertion 4.3.3 Deletion 4.4 Applications of Linked List	4.1 Nodes, pointer, NULL pointer 4.2 Calloc(), malloc(), free()

SW-4 Suggested Sessional Work (SW):**a. Assignments:**

- I. Explain various memory management functions in C.
- II. Write applications of linked list.

b. Mini Project:

- I. Implement various link lists & their operations.

- c. Other Activities (Specify):
- I. Seminar on doubly linked list and its applications.

CO-5 Perform basic operation of insertion, deletion and searching on graph and tree.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Interaction(CI)	Self Learning (SL)
SO5.1 Perform Various operations on Graph. SO5.2 Explain types of tree. SO5.3 Perform various operations on Tree Data Structure. SO5.4 Explain various operations on BST and its implementation	LE5.1 Implement binary search tree. LE5.2 Perform insertion in Binary search Tree. LE5.3 Perform deletion in Binary search Tree. LE5.4 Perform Searching in Binary search Tree.	Unit 5: Graph and Tree 5.1 Definition of graph 5.2 Representation of graph 5.2.1 Adjacency Matrix 5.2.2 Incidence Matrix 5.2.3 Adjacency List 5.3 Introduction to Tree 5.4 Type of tree 5.4.1 Binary Tree 5.4.2 Binary Search Tree (BST) 5.5 Operation on BST 5.5.1 Insertion 5.5.2 Deletion 5.5.3 Traversing	5.1 Node insertion and deletion in BST

SW-5 Suggested Sessional Work (SW):

- a. Assignments:
 - I. Write the procedure to delete node on BST.
 - II. Explain skew tree.
 - III. Differentiate between tree and graph.
- b. Mini Project:
 - i. Implement BST on list of any 10 values
- c. Other Activities (Specify):
 - i. Seminar on "tree and graph"

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Titles	Total Marks
I	Introduction to data structure and Array in 'C'	14
II	Stack and Queue	16
III	Pointers, Structure and Union in 'C'	14
IV	Linked List	12
V	Graph and Tree	14
Total		70

Legend: R: Remember, U: Understand, A: Apply and above

J) Suggested Specification Table (For ESA of Laboratory Instruction*):

Note: The student at the end of semester examination of **30Marks**; has to undertake any **ONE** of the listed practical's.

S.No.	List of Practical's	
1	Develop a 'C' program to print forward diagonal, backward diagonal and sum of diagonals of 3*3 square matrix.	30 Marks are allocated for performance under ESA
2	Develop a 'C' Program Swap Numbers in Cyclic Order Using Pointer by passing parameters	
3	Develop a 'C' Program to Find the Number of Vowels, Consonants, Digits and White space in a String	
4	Develop a 'C' Program to Add Two Complex Numbers by Passing Structure to a Function	
5	Develop a 'C' Program to Read Roll number, name and marks of students and store it in file. If file already exists, add information to it.	
6	Develop a 'C' Program to perform searching operation on different type tree data structure.	
7	Perform searching, insertion and deletion operation on different type of linked list.	

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:**(a) Books :**

S. No.	Titles	Author	Publisher	Edition & Year
1	Let us 'C'	Yashavant Kanetkar	BPB publications	2017 or latest
2	Programming in ANSI 'C'	E. Balaguruswami	TMH	2017 or latest
3	Programming in 'C'	A.N. Kamthane	Pearson	2017 or latest
4	Programming with 'C'	Schoums	Schoums series	2017 or latest

(b) Open source software and website address:

1. Learning 'C' Programming- <https://www.programiz.com/c-programming#learn-c-tutorial>
2. 'C' Programming- <http://www.programmingsimplified.com/c-program-examples>
3. 'C' Programming- <http://www.c4learn.com/c-programs/>
4. Learning 'C' Examples & Tutorials- https://www.tutorialspoint.com/learn_c_by_examples/index.htm
5. 'C' Programming Examples- <http://www.techcrashcourse.com/2014/10/c-program-examples.html>

(c) Others:

1. Learning Packages.
1. Lab Manuals.
2. Users' Guide

M) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Computer System	Latest configuration	LE1.1-LE1.7 LE2.1-LE2.6 LE3.1-LE3.6 LE4.1-LE4.3 LE5.1-LE5.4
2	'C' compiler	Code: Version 16.01 Version (or latest)	LE1.1-LE1.7 LE2.1-LE2.6 LE3.1-LE3.6 LE4.1-LE4.3 LE5.1-LE5.4

N) Mapping of POs & PSOs with COs:

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	PO-1 Basic knowledge	PO-2 Discipline knowledge	PO-3 Experiments and practice	PO-4 Engineering Tools	PO-5 The engineer and society	PO-6 Environment and sustainability	PO-7 Ethics	PO-8 Individual and team work	PO-9 Communication	PO-10 Life-long learning	PSO-1	PSO-2
CO-1 To manipulate Linear Data Structure using C Programming.	3	3	2	2	2	1	2	1	1	2	2	3
CO-2 Apply Linear Data Structure Stack and Queue in different application.	2	2	3	2	3	1	1	2	2	2	3	2
CO-3 Develop programs in 'C' using Pointers, structure and Union for accessing memory.	2	2	3	2	2	1	2	2	2	2	3	2
CO-4 Perform basic operation of insertion, deletion and searching on Linked list.	2	2	3	2	2	1	1	2	2	2	2	3
CO-5 Perform basic operation of insertion, deletion and searching on graph and tree.	2	2	2	2	2	1	2	2	2	2	3	2

Legend: 1 – Low, 2 – Medium, 3 – High

O) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO - 1, 2, 3, 4, 5, 7, 8, 9, 10 PSO - 1, 2	CO-1 To manipulate Linear Data Structure using C Programming.	SO1.1 - SO1.5	LE1.1 - LE1.7	Unit-1.0 Introduction to data structure and Array in 'C'	SL1.1 – 1.2
PO - 1, 2, 3, 4, 5, 7, 8, 9, 10 PSO - 1, 2	CO-2 Apply Linear Data Structure Stack and Queue in different application.	SO2.1 - SO2.5	LE2.1 - LE2.6	Unit-2.0 Stack and Queue	SL2.1 – 2.3
PO - 1, 2, 3, 4, 5, 7, 8, 9, 10 PSO - 1, 2	CO-3 Develop programs in 'C' using Pointers, structure and Union for accessing memory.	SO3.1 - SO3.6	LE3.1 - LE3.6	Unit-3.0 : Pointers, Structure and Union in 'C'	SL3.1 – 3.8
PO - 1, 2, 3, 4, 5, 7, 8, 9, 10 PSO - 1, 2	CO-4 Perform basic operation of insertion, deletion and searching on Linked list.	SO4.1 - SO4.4	LE4.1 - LE4.3	Unit-4.0: Linked List	SL4.1 – 4.2
PO - 1, 2, 3, 4, 5, 7, 8, 9, 10 PSO - 1, 2	CO-5 Perform basic operation of insertion, deletion and searching on graph and tree.	SO5.1 - SO5.4	LE5.1 - LE5.4	Unit-5.0 Graph and Tree	SL5.1

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

Course Curriculum Detailing (Semester- III)

- A) **Course Code** : 2000354(022)
 B) **Course Title** : E-commerce
 C) **Pre- requisite Course Code and Title** : Computer Fundamentals and Applications
 D) **Rationale** :
 The unbounded growth of the Internet and World Wide Web is having great impact on global as well as local business scenario. This subject challenges students to explore the realities and implications of E-commerce from a digital business perspective.

- E) **Course Outcomes:** The course content should be taught and implemented with the aim to develop the following outcomes in the students.

- CO-1 : Distinguish different types of E-commerce.
 CO-2 : Identify different Firewalls and their use in security.
 CO-3 : Describe Electronic payment systems.
 CO-4 : Identify the role of E-commerce in retailing.
 CO-5 : Use the various supply chain management software.

- F) **Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Computer Science & Engineering	2000354(022)	E-commerce	2	0	0	2	2

Legend: Lecture (L) and Tutorial (T) and Practical (P)

- G) **Scheme of Assessment:**

Board of Study	Course code	Course title	Scheme of examination					
			Total Marks					Total Marks
			Theory			Practical		
ESE	CT	TA	ESE	TA				
Computer Science & Engineering	2000354(022)	E-commerce	70	30	30	0	0	130

- H) **Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course. Convert unit of the given physical quantity from one unit system to other.

- CO-1 Distinguish different types of E-commerce.

(Approx. Hrs: CI+LI+SW+SL =08)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define E-commerce SO1.2 Acquaint with industry framework SO1.3 Distinguish different types of E-commerce		Unit 1.0 Introduction to E-commerce 1.1 Definition of E-commerce 1.2 E-commerce industry framework 1.2.1 The information Superhighway 1.2.1 multimedia content and network publishing 1.2.3 message and information distribution 1.3 Type of E-commerce 1.3.1 inter-organizational E-commerce 1.3.2 intra-organizational E-commerce 1.3.3 consumer to business E-commerce 1.3.4 intermediaries and E-commerce	1.1 Identify need of E-commerce in current digital world 1.2 Find the importance of E-commerce in business

SW-1 Suggested Sessional Work (SW):**a. Assignments:**

- i. Differentiate between B2C and C2B E-commerce

b. Mini Project:

- i. Identify and prepare chart depicting different types of digital transactions..

c. Other Activities (Specify):

- i. Differentiate between inter-organizational E-commerce & intra-organizational E-commerce

CO-2 Identify different Firewalls and their use in security.

(Approx. Hrs: CI+LI+SW+SL =16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Find the importance of Firewall in network security. SO2.2 compare types of firewall SO2.3. Discuss merits of Firewall security policy		Unit 2.0 Firewall and Transaction security 2.1 Firewall and Network Security 2.1.1 Type of Firewall 2.1.2 Firewall Security policy 2.3 Transaction Security 2.3.1 Type of online transaction, 2.3.2 Requirement for	2.1 List out the types of Firewall 2.2 Differentiate between private key and public key cryptography 2.3 identify the role of digital signature.

Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.4 State the procedure for Online Transaction		transaction security	2.4 list the uses of digital signature
SO2.5 identify requirements for transaction Security		2.4 cryptography 2.4.1 Symmetric key cryptography 2.4.2 Asymmetric key cryptography	
SO2.6 Define Cryptography and its different types			

SW-2 Suggested Sessionals Work (SW):**a. Assignments:**

- i. Differentiate between Symmetric and Asymmetric Cryptography
- ii. Differentiate between packet filter firewall and Application Firewall

b. Mini Project:

- i. Develop a program for encrypting and decrypting using substitution technique.

CO- 3 Describe Electronic payment system.

(Approx. Hrs: CI+LI+SW+SL =16)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Demonstrate the use of Digital cash and state its properties		UNIT 3.0 Electronics Payment System(EPS)	3.1 Differentiate between e-cash and e-cheque
SO3.2 Demonstrate the use of E-checks and Explain its properties		3.1 Digital cash, 3.1.1 properties of digital cash	3.2 Differentiate between credit card and debit card
SO3.3 Compare various online credit card payment systems.		3.2 Electronic cheque 3.2.1 properties of E-Cheque	
SO3.4 List features of Secure Electronic Transaction		3.3 Online credit card based System 3.3.1 types of credit card payments, 3.3.2 secure electronic transaction(SET),	
SO3.5 Differentiate amongst POS, NetBanking and M-		3.4 Other Financial Instruments 3.4.1 Point of sale (POS) 3.4.2 Net Banking 3.4.3 M-Wallet	
		3.5 Advantage and disadvantage of EPS	

	Laboratory	Class room Instruction (CI)	Self
Wallet SO3.5 Determine the advantage and disadvantage of EPS			

SW-3 Suggested Sessionals Work (SW):**a. Assignments:**

- i. Differentiate between Netbanking and M-wallet
- ii. Explain the use of POS.

b. Mini Project:

- i. Prepare a survey report of different digital transactions used in your area.

c. Other Activities (Specify):

- i. Perform digital transaction using POS machine, mobile, and Computer.

CO 4: Identify the role of E-commerce in retailing.

(Approx. Hrs: CI+LI+SW+SL =12)

Session Outcomes (SOs)s	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Determines the various Changing retail industry dynamics SO4.2 Classify mercantile model from consumers perspective SO4.3 List and study various management challenges in online retailing		Unit 4.0E-commerce and Retailing 4.1 Changing retail industry dynamics 4.1.1 over building and excess capacity 4.1.2 demographics changes 4.1.3 consumer behavior 4.2 Mercantile model from consumer's perspective 4.2.1 distinct phases of mercantile model 4.2.2 pre-purchase preparation 4.2.3 purchase consumption 4.2.4 Post purchase Interaction 4.3 Management challenges in online retailing 4.3.1 retailing strategies 4.3.2 managing channel conflict 4.3.3 learn to price online products and services 4.3.4 design the layout of online Store	4.1 Identify various management challenges in Online retailing 4.2 identify Recent trends in application softwares

SW-4 Suggested Sessionals Work (SW):

- a. Assignments:**
- Describe pre-purchase preparation of mercantile model from consumer's perspective
 - Conduct market survey and prepare report which describe challenges in online retailing
- b. Mini Project:**
- Design the layout of online Store
 - Prepare a flow charts for purchasing a product from existing online store.

CO- 5: Use the various Supply chain management software.

(Approx. Hrs: CI+LI+SW+SL =12)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain the fundamental SCM SO5.2 Discuss the working of managing retail supply chain SO5.3 Compare and study various Supply chain application softwares		UNIT: 5.0 Intranet and supply chain management (SCM). 5.1 Fundamental of supply chain 5.1.1 pull v/s push SCM 5.1.2 element of SCM 5.1.3integrating function in supply chain 5.2 Managing retail supply chain 5.2.1the Order Management Cycle(OMC) 5.3 Supply chain application software 5.3.1 softwares for SCM 5.3.2 intranet and network centric computing, 5.3.3 impact of web on application softwares	5.1 List out different softwares that are used in SCM. 5.2 Identify recent trends in SCM

SW-5 Suggested Sessionals Work (SW) :

- a. Assignments:**
- Compare advantage and disadvantage of different SCM softwares.
- b. Mini Project:**
- Prepare a report for SCM of online store.

I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Title	Total Marks
I	Introduction to E-commerce	14
II	Firewall and Transaction security	14
III	Electronics Payment System (EPS)	14
IV	E-commerce and Retailing	14
V	Intranet and supply chain management(SCM)	14
Total		70

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1	Electronic commerce A manager's guide	Ravi kalakota, Andrew B whinstone	Addison – Wesley, pearson	1 st edition
2	Frontier of Electronic commerce	Ravi kalakota, Andrew B whinstone	Pearson	1 st edition

(b) Open source software and website address

1. Tutorial of E-commerce https://www.tutorialspoint.com/e_commerce/index.htm
2. Lecture Notes on Ecommerce and www.vssut.ac.in/lecture_notes/lecture1428551057.pdf
3. E-Commerce Lecture Notes
www.nptel.ac.in/courses/106108103/pdf/Lecture_Notes/LNm13.pdf
4. Ecommerce for beginners https://www.cdu.edu.au/centres/aflf/pdf/Ecommerce_for_beginners.PDF
5. ebooks of -E-commerce
https://books.google.co.in/books?id=7UNqSnb52H4C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO1 - Distinguish different types of E-commerce.	3	1	0	0	3	0	3	0	3	3	3	3
CO2 - Identify different Firewalls and their use in security.	3	3	3	3	3	0	3	2	1	2	3	3
CO3 - Describe Electronic payment systems.	3	3	3	0	3	0	2	3	1	3	3	3
CO4 - Identify the role of E-commerce in retailing.	2	3	1	0	3	2	3	3	1	3	3	3
CO5 - Use the various supply chain management software.	3	3	3	0	3	0	2	3	1	3	3	3

Legend:0 - No correlation,1 – Low, 2 – Medium, 3 – High

N) Course Curriculum Map:

POs & PSOs No.	COs No.& Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,5,7,9,10 PSO1, PSO2	CO-1 Explain concepts of E-commerce	SO1.1 - SO1.3		Unit 1.0 Introduction to E-commerce	As mentioned in relevant page numbers
PO-1,2,3,4,5,7,8,9,10 PSO1, PSO2	CO-2 : Identify different Firewalls and their use in security	SO2.1 - SO2.6		Unit 2.0Firewall and Transaction security	
PO-1,2,3,5,7,8,9,10 PSO1, PSO2	CO-3Describe Electronic payment system.	SO3.1 - SO3.5		Unit 3.0Electronics Payment System(EPS)	
PO-1,2,3,5,6,7,8,9,10 PSO1, PSO2	CO-4Identify the role of E-commerce in retailing.	SO4.1 - SO4.4		Unit 4.0 E-commerce and Retailing	
PO-1,2,3,7,8,9,10 PSO1, PSO2	CO-5Use the various Supply chain management software.	SO5.1 - SO5.3		Unit 5.0 Intranet and supply chain management (SCM).	

Legend:CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

vii.Course Curriculum Detailing (Semester- III)

- A) **Course Code** : 2000355(028)
 B) **Course Title** : Digital Electronics
 C) **Pre- requisite Course Code and Title** : Basic Electronics Engineering
 D) **Rationale** :

Digitization of automation industries and communication systems has changed the complete Industrial scenario and human lifestyle across the globe. The advancements in microelectronics integrated circuits, manufacturing of VLSI and ULSI chips, computer technology and information systems have caused the rapid increase in the use of digital circuits. Hence this subject is intended to learn facts, concepts, principles and procedures of digital techniques and their application used in digital circuits and systems. Concepts of this course will help the students to develop skills to analysis and built applications based on digital Integrated circuits.

- E) **Course Outcomes** :

- CO-1 Use number systems and codes for various applications.
 CO-2 Test the functionality of various logic gates.
 CO-3 Build and test various combinational circuits.
 CO-4 Build and test various sequential circuits.
 CO-5 Maintain various types of A/D converters, D/A converters.

- F) **Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Electronics and Telecommunication	2000355 (028)	Digital Electronics	2	2	1	5	4

Legend:Lecture (L) and Tutorial (T) and Practical(P)

- G) **Scheme of Assessment:**

Board of Study	Course code	Course title	Scheme of examination					
			Total Marks					
			Theory			Practical		Total Marks
ESE	CT	TA	ESE	TA				
Electronics and Telecommunication	2000355 (028)	Digital Electronics	70	30	30	30	50	210

- H) **Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 Use number systems and codes for various applications.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Convert a given number into the given type of number system. SO1.2 Identify the various types of binary codes. SO1.3 Apply the arithmetic operation on the given binary numbers.	LE1.1 Implement and test 4bit binary to gray code. LE1.2 Implement and test 4bit gray code to binary code.	Unit-1 NUMBER SYSTEM and CODES 1.1 Use number systems and codes for various applications 1.2 Conversion between different number systems 1.3 r 's and $(r-1)$'s complement of number 1.4 Binary Arithmetic operations : Addition, Subtraction, Multiplication and Division 1.5 Binary Codes Weighted and Un-weighted codes, Excess- 3 code, Gray code, Error Detection and Correction Code, Hamming code, BCD Code, ASCII code	SE1.1 List application of various codes.

SW-1 Suggested Sessional Work (SW):

- a. Assignments:
 1. Generate a hamming code for the data word 11000100.
 2. Perform the conversion and arithmetic operation between the different types of number system.
 3. Perform r ' and $(r-1)$ ' complement for different types of number system.
- b. Mini Project:
 1. Prepare a report on the applications of binary codes.
- c. Other Activities (Specify):

CO-2 Test the functionality of various logic gates.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Explain functions of the given type of logic gate with the help of truth table. SO2.2 Apply Boolean algebra to minimize the given logic expression. SO2.3 Design simple logic circuits using logic gates. SO2.4 Apply the De-Morgan's theorem to simplify the given logic expression. SO2.5 Minimize given logic expression using K-map method.	LE2.1 Test the functionality of the following Logic Gates: AND, OR, NOT, NAND and NOR Gates (For TTL logic gates and CMOS logic gates). LE2.2 Implement and test the basic gates Using NAND gates. LE2.3 Neither implements and test the Basic Gates Using NOR gates. LE2.4 Simplify and implement the given Boolean functions using NAND gates.	Unit -2Logic gates and Boolean algebra 2.1 Logic Gates: basic gates,AND, OR, NOT, EX-OR, EX-NOR, Universal Gates: NAND, NOR, truth table ,symbol, implement Basic Gate using Universal gate 2.2 Boolean Algebra: Boolean theorems, De Morgan's Theorems, duality 2.3 Max - term, Min - term, Sum of product (SOP) and Product of Sum(POS) expressions, Simplify the Boolean functions,, Simplify the Boolean functions using K- map method(up to 4 variables).	SL2.1 Simplify the Boolean function up to 5 variables using K-map method. SL2.2 Obtain standard SOP and POS form for given expression

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

- i. Show that both NAND and NOR gate are universal gate.
- ii. Draw the logic symbols, construct the truth table, and with the help of circuit diagram explain the working of following gate
i) AND ii) OR iii) NOT iv) NAND v) NOR
- iii. Explain the procedure to expand an SOP and POS expression into standard SOP form and standard POS form with suitable example.

Activities (Specify):

- i. Seminar on applications of different types of Gates.
- ii.

CO-3 Build and test various combinational circuits.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Write step by step procedure to realize any combinational. SO3.2 Design a full adder using half adder. SO3.3 List applications of encoder and decoders. SO3.4 Design 4X1 multiplexer using 2X1	LE3.1 Build and test half-adder and full-adder. LE3.2 Build and test half and full subtractor. LE3.3 Implement and test 2X1 multiplexer using AND and OR gates. LE3.4 Build 4X1 multiplexer using 2X1	Unit-3Combinational Circuits 3.1 Half Adder, Full Adder, Half subtract or, Full Subtractor, parallel adder, 4 bit binary adder, 4 bit binary Subtractor, BCD adder 3.2 Magnitude comparator(2, 3 and 4 bit) 3.3 Encoder and Decoder: 4 I/P and 2 O/P encoder, 8 I/P and 3 O/P encoder, Octal to Binary and Decimal to BCD EncoderDecoders: 3-Line to 8-Line Decoder, 8-4-2-1 BCD	SE3.1 Explain priority encoder circuit with its application. SE3.2 Realize Adder circuit using Mux and Demux.

Session Outcomes	Laboratory	Class room Instruction (CI)	Self Learning
SO3.5 Design a 3 bit magnitude comparator.	LE3.5 Build and test BCD to seven segment decoder.	to Decimal Decoder, BCD to Seven Segment Decoder Multiplexer(Mux) and Demultiplexer(Demux): 2X1,4X1 and 8X1 multiplexer,1X2,1X4 and 1X8 demultiplexer, applications of Multiplexers and demultiplexers	

SW-3 Suggested Sessional Work (SW) :

- a. Assignments:
 1. Realize a full adder using
 - i) Only NAND gate
 - ii) Only NOR gate
 2. Discuss applications (any two) of multiplexer.
 3. Show an arrangement to obtain a 16 input mux from two 8 input mux.
- b. Mini Project:
 1. Design BCD to 7 segment decoder using IC7447.
 2. Design 4 bit binary adder/subtractor using IC7483
- c. Other Activities (Specify):
 1. Prepare a PPT on all the combinational circuits.
 2. Prepare a chart to show the applications of Combinational circuits.

CO- 4 Build and test various sequential circuits.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Explain working of given FF with the help of excitation table.	LE4.1 Test the functionality of SR, D, JK and T Flip-flops.	Unit-4SEQUENTIAL CIRCUITS 4.1 Flip Flop - basic flip flop and latch, Clock, Set and Reset inputs to F/F, clock triggering - Positive & Negative clock Edge triggering, level triggering RS F/F, JK F/F, D F/F, T F/F, truth table, characteristic table or excitation table 4.2 Race around condition, Master Slave F/F 4.3 Counters: - Modules of a counter, Synchronous & Asynchronous counter, Ripple Counter, Up – down binary counter, Decade counter, BCD counter, Designing of counters. 4.4 Register –Shift register, Serial in parallel out, Serial in Serial out, Parallel in Serial out, Parallel in Parallel out register, designing of register.	4.1
SO4.2 Describe designed procedure of Mod -10 up and down counter,	LE4.2 Build and test binary Mod-4 synchronous and asynchronous counter.		
SO4.3 Compare characteristic of synchronous and asynchronous counter.	LE4.3 Build and test Mod-8 up / down counter.		
SO4.4 Sketch the timing diagram at the output of each FF of 4-bit serial in serial out shift register for the given input.	LE4.4 Test the output of the shift register (SISO, SIPO).		
	LE4.5 Build and test Mod-10 counter using D or T FF.		

SW-4 Suggested Sessional Work (SW) :

- a. Assignments:
 1. Distinguish between combinational and sequential logic circuit.
 2. Explain the procedure to convert one flip flop to another flip flop(ex. JK flip flop to SR flip flop.)
- b. Mini Project:
 1. Design 4 bit synchronous counter using IC7476.
 2. Design decade counter using IC7492/93.
- c. Other Activities (Specify):
 1. Prepare a PPT on all the applications of sequential circuit in the digital systems.
 2. Prepare a chart to show the difference between sequential and combinational circuits.

CO- 5 Maintain various types of A/D converters, D/A converters.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 With the help of circuit diagram describe the working of following i) R-2R DAC ii) Weighted resistor DAC. SO5.2 With the help of circuit diagram describe the working of following: i) Counter type ADC ii) Flash ADC iii) Successive Approximation ADC Compare technical specifications of different logic families.	LE5.1 Test the input and output voltages of IC ADC0808. LE5.2 Test the input and output voltages of IC DAC0808.	Unit-5 CONVERTERS AND LOGIC FAMILIES 5.1 Digital to Analog converter(DAC): R-2R DAC, Weighted resistor DAC 5.2 Analog to Digital converter(ADC) Counter type, ramp, Successive approximation, Flash type 5.3 Logic Families – Digital IC specifications (threshold voltage, propagation delay, power dissipation, Fanin, Fanout, transition width, logic levels, Noise margin, speed power product, figure of merit), TTL, RTL, DTL, ECL, I ² L and CMOS	SE 5.1 Compare various logic families.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :

- a. Assignments:
 1. With the help of neat diagram explain the working of following DAC and ADC
 i) R-2R ii) weighted resistor type DAC iii) Counter type ADC iv) Flash type ADC v) Successive Approximation type ADC
- b. Mini Project:
 1. On the basis of Internet search prepare a report to summarize technical specifications of ADC and DAC ICs.
- c. Other Activities (Specify):
 1. Prepare a PPT on logic family
 2. Prepare PPT on DAC and ADC

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Title	Total Marks
I	Number System and Codes	10
II	Logic Gates and Boolean Algebra	15
III	Combinational Circuits	15
IV	Sequential Circuits	15
V	Converters And Logic Families	15
Total		70

J) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Title
1	Implement and test 4bit binary to gray code.
2	Implement and test 4bit gray code to binary code.
3	Test the functionality of following Logic Gates: AND, OR, NOT, NAND and NOR Gates (For TTL logic gates and CMOS logic gates).
4	Implement and test the basic gates Using NAND gates.
5	Implement and test the Basic Gates Using NOR gates.
6	Simplify and implement the given Boolean functions using NAND gates.
7	Build and test half-adder and full-adder.
8	Build and test half and full subtractor.
9	Implement and test 2X1 multiplexer using AND and OR gates.
10	Build 4X1 multiplexer using 2X1 multiplexers.
11	Build and test BCD to seven segment decoder
12	Test the functionality of SR, D, JK and T Flip-flops.
13	Build and test binary Mod-4 synchronous and asynchronous counter.
14	Build and test Mod-8 up / down counter.
15	Test the output of the shift register (SISO,SIPO).
16	Build and test Mod-10 counter using D or T FF.
17	Test the input and output voltages of IC ADC0808.
18	Test the input and output voltages of IC DAC0808.

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

Legend : PRA: Process Assessment, PDA : Product Assessment

Note : Only one experiment has to be performed at the end semester examination of **30** Marks as per assessment scheme

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:**(a) Books :**

S. No.	Title	Author	Publisher	Edition & Year
1.	Digital Logic and Computer Design	Morris Mano	Pearson Education India sevicepvt limited	2016 ISBN:9789332542525
2.	Digital Electronics: Principle Devices and Applications	Anil K. Maini	John Wiley & Sons Ltd	2007 ISBN:9788126514663
3.	Digital Principles and Applications	Malvino & Leach	Tata McGraw-Hill	8 th edition, 2014 ISBN: 9789339203405
4.	Digital Electronic	Mamta Agrawal	Deepak Prakashan	2016, ISBN-13: 9788177762242
5.	Fundamental Digital Circuits	KUMAR, A. ANAND	Prentice Hall of India	4 th edition ISBN: 9788120352681
6.	Modern Digital Electronics	R.P. Jain	Tata McGraw-Hill	4 th edition ,2009 ISBN: 9780070669116
7.	Digital Circuits and Design	A. Arivazhgan	Vikash Publishing House	2003 ISBN: 9788125914358
8.	Digital Electronics (Digital Logic Design)	Sanjay Sharma	Kataria & Sons	2010 ISBN: 9789350140468
9.	Digital Fundamentals	Floyd	Pearson	10 th edition 2011 ISBN: 9788131734483
10.	Digital Systems: Principles and Applications	Tozzi	Pearson	10 th edition 2009 ISBN: 9788131923289

(b) Open source software and website address :

1. <http://logos.cs.uic.edu/366/notes/ErrorCorrectionAndDetectionSupplement.pdf>
2. <https://www.youtube.com/watch?v=N8Yy0-4YMS4>
3. Full Subtractor:-<http://www.flintgroups.com/2012/10/half-subtractor-and-full-subtractor.html>.
4. Encoder and Decoder:-<http://www.edgefxkits.com/blog/encoders-and-decoders-truth-tables/>

M) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	CRO	50 MHz, Dual Trace, Dual beam, in built +-5v supply, component tester, function generator	LE 17,18
2	Digital multimeter	Digital multimeter 3 and ½ digit with component tester	LE 15,17,18
3	Function generator	0-2 MHz with sine, square and triangular wave output with variable frequency and amplitude	LE 12,13,14,15,16
4	Power supply	0-24v, 1A	LE 1 to LE 18
5	Logic Analyzer	24 channel	LE 1 to LE 16

N) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	Discipline knowledge PO-2	Experiments & Practice PO-3	Engineering Tools PO-4	The Engineer & Society PO-5	Environment & Sustainability PO-6	Ethics PO-7	Individual & Team work PO-8	Communication PO-9	Life Long learning PO-10	PSO-1	PSO-2
CO-1 Use number systems and codes for various applications.	3	2	1	1	1	1	1	1	1	1	2	1
CO-2 Test the functionality of various logic gates.	2	1	2	2	1	1	1	2	2	1	2	2
CO-3 Build and test various combinational circuits.	2	2	3	3	1	1	1	3	3	2	3	3
CO-4 Build and test various sequential circuits.	1	2	3	3	1	1	1	1	1	1	1	1
CO-5 Maintain various types of A/D converters, D/A converters.	2	2	3	3	1	1	1	2	2	1	2	3

O) Course Curriculum Map:

POs & PSOs No.	COs No.& Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1 to PO-10 PSO-01 to PSO-02	CO-1 Use number systems and codes for various applications.	SO1.1 - SO1.3	LE1.1 - LE 1.2	Unit-1 NUMBER SYSTEM and CODES	SE 1.1
PO-1 to PO-10 PSO-01 to PSO-02	CO-2 Test the functionality of various logic gates.	SO 2.1 - SO 2.5	LE2.1 - LE 2.4	Unit-2 Logic gates and Boolean algebra	SL 2.1 - SL 2.2
PO-1 to PO-10 PSO-01 to PSO-02	CO-3 Build and test various combinational circuits.	SO 3.1 - SO3.5	LE3.1 - LE 3.5	Unit-3 Combinational Circuits	SL 3.1 - SL 3.2
PO-1 to PO-10 PSO-01 to PSO-02	CO-4Build and test various sequential circuits.	SO4.1 - SO 4.4	LE4.1 - LE4.5	Unit-4 SEQUENTIAL CIRCUITS	-
PO-1 to PO-10 PSO-01 to PSO-02	CO-5 Maintain various types of A/D converters, D/A converters.	SO5.1 - SO 5.2	LE5.1 - LE5.2	Unit-5 CONVERTERS AND LOGIC FAMILIES	SL 5.1

Legend:CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning