UNIVERSITY OF KERALA

**Course Structure and Syllabus for Career Related
First Degree Programme in**

B.Sc. COMPUTER SCIENCE

**Under Choice based Credit and
Semester System (CBCS) System 2 (b)**

(2021 Admission onwards)

COURSE OUTCOME

The First Degree Programme in Computer Science is designed with the objective of equipping the students to cope with the emerging trends and challenges in field of computers and interrelated disciplines like computer engineering, computer science, information systems, information technology, and software engineering.

ELIGIBILITY FOR ADMISSION

Eligibility for admissions and reservation of seats for the First Degree Programme in Computer Science shall be according to the rules framed by the University from time to time. No student shall be eligible for admission to the First degree Programme in Computer Science unless he/she has successfully completed the examination conducted by a Board/ University at the +2 level of schooling or its equivalent.

DURATION

The normal duration of the First Degree Programme in Computer Science shall be three years consisting of six semesters. The duration of each semester shall be five months inclusive of the days of examinations. There shall be at least 90 working days in a semester and a minimum 450 hours of instruction in a semester. Odd Semester (June-October) commences in June and Even Semester (November – March) commences in November every Year.

PROGRAMME STRUCTURE

The First Degree Programme in Computer Science shall include:
1. Language courses
2. Foundation courses
3. Core courses
4. Complementary courses
5. Open/ Elective courses
6. Major and Minor software Projects

SCHEME

Semester 1

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				**Marks**		
CS1111	2	English I	3	-	-	3	20	80	100
CS1131	3	Mathematics I	3	1	-	4	20	80	100
CS1121	2	Computer Fundamentals and Programming in C	3	1	-	4	20	80	100
CS1132	3	Digital Electronics	3	-	-	3	20	80	100
CS1122	2	Value Education	3	-	-	3	20	80	100
CS1141	3	C Programming Lab	-	-	4	4	20	80	100
CS1133	3	Digital Electronics Lab	-	-	4	4	20	80	100
TOTAL	**18**		**15**	**2**	**8**	**25**			**700**

Semester 2

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				**Marks**		
EN1211	2	English II	3	-	-	3	20	80	100
MM1231	3	Mathematics II	3	1	-	4	20	80	100
CS1231	3	Environmental Studies	3	-	-	3	20	80	100
CS1241	3	Data Structures	3	1	-	4	20	80	100
CS1242	3	Computer Architecture and Microprocessors	3	-	-	3	20	80	100
CS1243	3	Data Structures Lab	-	-	4	4	20	80	100
CS1244	3	Assembly language Programming Lab	-	-	4	4	20	80	100
TOTAL	**20**		**15**	**2**	**8**	**25**			**700**

Semester 3

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				**Marks**		
CS1341	3	Programming in Java	3	-	-	3	20	80	100
CS1342	3	Software Engineering	3	1	-	4	20	80	100
CS1343	3	Operating Systems	3	-	-	3	20	80	100
CS1344	3	Database Management Systems	3	1	-	4	20	80	100
CS1345	3	Design and Analysis of Algorithms	3	-	-	3	20	80	100
CS1346	3	Java Programming Lab	-	-	4	4	20	80	100
CS1347	3	DBMS Lab	-	-	4	4	20	80	100
TOTAL	**21**		**15**	**2**	**8**	**25**			**700**

Semester 4

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				Marks		
CS1441	3	System Software	3	-	-	3	20	80	100
CS1442	3	Web Programming and PHP	3	1	-	4	20	80	100
CS1443	3	Computer Networks and Security	3	1	-	4	20	80	100
CS1444	3	Computer Graphics	3	-	-	3	20	80	100
CS1445	3	Minor Project	-	-	3	3	0	100	100
CS1446	3	Computer Graphics Lab	-	-	4	4	20	80	100
CS1447	3	Web Programming and PHP Lab	-	-	4	4	20	80	100
TOTAL	**21**		**12**	**2**	**11**	**25**			**700**

Semester 5

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				Marks		
CS1541	3	Python Programming	3	1	-	4	20	80	100
CS1542	3	Artificial Intelligence	3	-	-	3	20	80	100
CS1543	3	Free and Open Source Software	3	-	-	3	20	80	100
CS1551.1 CS1551.2 CS1551.3	2	**Open Course** Digital Marketing Internet and WWW Impact of Social Media Networks	3	1	-	4	20	80	100
CS1561.3	3	**Elective** Object Oriented Analysis and Design Embedded Systems Cloud Computing	3	-	-	3	20	80	100
CS1544	3	Python Programming Lab	-	-	4	4	20	80	100
CS1545	3	FOSS Lab	-	-	4	4	20	80	100
TOTAL	**20**		**15**	**2**	**8**	**25**			**700**

Semester 6

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total
			Hrs per week				**Marks**		
CS1641	4	Data Analytics	3	1	-	4	20	80	100
CS1642	4	Internet of Things (IoT)	4	-	-	4	20	80	100
CS1643	4	Cyber Security	4	-	-	4	20	80	100
CS1661.1 CS1661.2 CS1661.3	4	**Elective** Machine Learning Block chain Technology Digital Marketing	4	-	-	4	20	80	100
CS1644	4	Major Project	-	-	9	9	-	100	100
TOTAL	**20**		**15**	**1**	**9**	**25**			**500**

Division of Marks (Lab Examination)

1. Program in Part A should be sufficiently simple — 25 marks
   (Logic – 10 marks, Successful compilation – 10 marks, Result – 5 marks)
2. Program in Part B should be based on advanced concepts — 30 marks
   (Logic – 15 marks, Successful compilation – 10 marks, result – 5 marks)
3. Viva Voce — 15 marks
4. Lab Record — 10 marks

   Total Marks — **80 marks**

(Digital Electronics)

1. Procedure- Theory/Connection Diagram/ Equation — 20 Marks
2. Manipulation of Experiment- Connection/Soldering — 15 Marks
3. Observation/Tabulation/Calculation — 10 Marks
4. Result — 10 Marks
5. Identification of Circuit Components — 10 Marks
   (Resistors Using Color Codes, Capacitors, Diodes, Transistors etc)
6. Lab Record — 5 marks
7. Viva — 10 Marks

   Total Marks — **80 Marks**

Semester 1

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total
			Hrs per week			
EN1111	2	English I	3	-	-	3
MM1131	3	Mathematics I	3	1	-	4
CS1121	2	Computer Fundamentals and Programming in C	3	1	-	4
CS1132	3	Digital Electronics	3	-	-	3
CS1122	2	Value Education	3	-	-	3
CS1141	3	C Programming Lab	-	-	4	4
CS1133	3	Digital Electronics Lab	-	-	4	4
	18		15	2	8	25

CS1121 :COMPUTER FUNDAMENTALS AND PROGRAMMING IN C

COURSE OUTCOMES: At the end of the Course, the Student will be able to

CO1	Remember the basics of computer
CO2	Understand the structure of program writing
CO3	Apply control structures and pointers
CO4	Analyze user defined functions
CO5	Understand dynamic memory allocation
CO6	Understand string handling functions

COURSE CONTENT

Module I: Components & Characteristics of Computer: CPU, ALU, Registers, Control Unit, System Bus, Main memory unit, Cache memory **Inside a computer**: Power supply (SMPS), Motherboard, BIOS, CMOS, Ports and Interfaces, expansion cards, memory chips, storage devices, processors, CPU Registers, Cache Memory, Operations in Cache memory, hit ratio, Virtual memory.

Module II: Introduction to C programming: Algorithm & Flow charts: Definitions, Symbols used to draw flowcharts, Program Writing – Structure of the Program, Source code, Object code, Executable file, Variables and Constants, Rules for naming the Variables/Identifiers; Basic data types of C, int, char, float, double; storage capacity – range of all the data types; Basic Elements: Operators and Expressions: Expression Evaluation (Precedence of Operators); simple I/O statements.

Module III: Control structures: if, if else, switch-case, for, while, do-while, break, continue. Arrays: Defining simple arrays, Multi-dimensional arrays, declaration, initialization and processing. Functions & Pointers: User defined functions, declaration, definition & scope, recursion, Pointers: The & and * Operators, pointer declaration, visualizing pointers, call by value; call by reference.

Module IV: Advanced features: Concept dynamic memory allocation. Storage classes, Array & pointer relationship, pointer to arrays, array of pointers. Strings: String handling functions; Structures and unions; File handling: text and binary files, file operations, Functions for file handling, Modes of files.

CORE TEXT BOOKS
1. Alexis Leon, Mathews Leon, Fundamentals of Information Technology

2. Reema Thareja, Computer Fundamentals and Programming in C, Second Edition, Oxford publication.

REFERENCES
1. Anita Goel, Computer Fundamentals, Pearson publication, Computer Concepts and Programming in C by R.S Salaria, Khanna Publishing.
2. E. Balagurusamy, Programming in C
3. Yashavant Kanitkar, Let us C 17th edition, Authentic Guide to C programming Language.

WEB REFERENCES
1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.programiz.com/c-programming
3. https://www.w3schools.in/c-tutorial/intro/

CS1132: DIGITAL ELECTRONICS

COURSE OUTCOMES: At the end of the course the students should be able to:

CO1	Remember the basic concepts of electronics
CO2	Familarise the concept of different number systems
CO3	Understanding the properties of logic gates
CO4	Apply different techniques and theorems to simplify the sop forms
CO5	Analyse the characteristics of different combinational logic circuits.

COURSE CONTENT

Module I: Review of Basic Electronics: PN Junction Diode, Volt –ampere characteristics of PN junction diodes –Half wave and Full wave rectifiers, Ripple factor, Diode clippers and types, Transistors-types, terminals, NPN and PNP transistors, symbols, transistor as an amplifier, Introduction to oscillator, Barkhausen criteria, RC phase shift oscillator, Astable and Monostable multivibrator (555 timer).

Module II: Data Representation: Concept of number system bases –binary, octal, decimal and hexadecimal number systems and conversion between each, Binary arithmetic: Addition, Subtraction- 1s and 2s complement method, Gray code, BCD and BCD addition, Error detection codes-parity method and Hamming code.

Module III: Logic gates- AND, OR and NOT, NAND, NOR, XOR and X-NOR. Universal property of NAND and NOR gates, Laws and rules of Boolean algebra, DeMorgan's theorems. Standard forms-SOP and POS Karnaugh map. Flip flops –SR flip flop, JK flip flop, D flip flop

Module IV: Digital Circuits: Full and Half adders, Comparators –1 bit and 2 bit, Encoder and keyboard Encoder, Decoder, Multiplexer, De-multiplexer, Counters(2-bit,4 bit and decade counters).Shift registers-SI-SO, SI-PO, PI-SO, PI-PO

CORE TEXT BOOKS
1. Thomas L Floyd –Digital Fundamentals-Pearson, 11th edition
2. V K Mehta, Rohit Mehta -Principles of Electronics, S. Chand & Company 12/e

ADDITIONAL REFERENCES
1. M Morris Mano –Digital Logic and Computer Design-Pearson, 2013
2. B L Theraja –Basic Electronics-Chand Publications

CS1122 : VALUE EDUCATION

COURSE OUTCOMES

CO1	Remember the basic concepts on NSS and NCC
CO2	Understand the impacts of disaster management in different environments.
CO3	Understand the features of Constitution of India

COURSE CONTENT

Module I: NSS: Introduction: Basic Concepts, History, aims, Objectives-Emblem, Flag, motto, badge etc. Organizational structure, roles and responsibilities of various NSS functionalities, NSS Programmes and activities-regular activities, special camping Day camps, Coordination with different agencies, Maintenance of the Diary. Additional Life Skills: Positive thinking, self-confidence and self-esteem, setting life goals and working to achieve them, management of stress including Time management.

Module II: NCC: History, NCC–functions and duties, committees, aims, Moto, flag, ,organization–RDC, CATC, NIC, Advanced leadership course, Army attachment camp, Hiking and trekking camps, ThalSainik Camp, VayuSainik Camp, NauSainik camp, All Indian Yachting regatta, rock climbing camps, Naval Wing activities, Air Wing Activities, Youth exchange programme.

Module III: Disaster Management: Introduction to disasters– concepts, and definitions– disaster, hazard, vulnerability, resilience, risks-bomb threat. Earthquake, Explosion, Hazardous materials pill/release, Disaster classifications, causes, impacts–social, economic, political, environmental, health, psychosocial etc, Financial emergency, Unexpected loss of income, Death in the family or other family emergency, National disaster, Different impacts–gender, age, location.

Module IV : Constitution of India - Salient features of Indian Constitution, Preamble, fundamental rights.- Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies.

REFERENCES
1. National Service Scheme–A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J. D. S. Panwaret al. Astral International. New Delhi.
2. Govt. of India Disaster Management act 2005
3. Govt. of India 2009, National Disaster Management Policy
4. Gupta AnilK, Sreeja S Nair, 2011, Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi.
5. Dr. J. N. Pandey, The constitutional Law of India, Central Law Agency Alahabad. PP
6. Maheendrapal Singh, Constitution of India, Eastern Book Company Lucknow

CS1141 : C PROGRAMMING LAB

PART A

The C laboratory work will consist of 25-30 Experiments

1-15.Testing out and interpreting a variety of simple programs to demonstrate the syntax and use of the following features of the language: basic data types, operators and control structures.

PART B

16.　1-D Arrays: A variety of programs to declare, initialize, read, print and process 1-D arrays of various basic data types. Processing to include, selection, sum, counting, selective sum, selective

counting, reversing etc.

17. Pointers: A large number of trivial programs involving all possible data types to familiarize the syntax of pointers and to draw memory diagrams based on the observations.
18. Structures: A variety of programs to declare, initialize, read, print and process structures made up of a variety of data types and structures.
19. 2-D Arrays: A variety of programs to declare, initialize, read, print and process 2-D arrays of various basic data types. Processing to include, selection, sum, counting, selective sum, selective counting, reversing etc.
20. Array of Structures and Structure of Arrays: Programs to demonstrate declaration and processing of structure of arrays and array of structures.
21. Pointers to Arrays: A number of programs to demonstrate handling of 1-D and 2-D arrays using pointers and to draw memory diagrams based on the observations.
22. Pointers to Structures: A number of programs to demonstrate use of pointers to structures and to draw memory diagrams based on the observations.
23. Functions –I: Simple Examples of declaring and using functions of the following categories (i) no argument, no return, (ii) argument, no return, (iii) no argument, return, (iv) argument, return, all pass by value
24. Functions –II: Declaring and using functions with pass by reference, Passing and Returning structures, Recursive functions.
25. Files: Simple Example involving use of multiple files: declaring, opening, closing, reading from and writing to text files.
26. Files: Example involving use of multiple files: declaring, opening, closing, reading from and writing to binary files.
27. Library functions: A variety of Examples demonstrating (i) string processing functions (ii) a variety of selected library functions
28. Debugging programs involving syntactic and/or logical errors
29-30: Developing programming solutions to problems including program design, algorithm development and data structure selection.

CS1133 : DIGITAL ELECTRONICS LAB

The laboratory work consist of 16 experiments. Minimum 9 experiments to be done

PART A
1) Familiarise with various components-Resistors, Capacitors, Diode, LED, Zener Diode & transistor.
2) Diode characteristics (forward and reverse)
3) Clipping circuits (series clippers)
4) Verification of truth table of logic gates
5) SR flip flop(Truth Table Verification)
6) Half adder(Truth Table Verification)
7) Code Converter (Binary to Gray and Gray to Binary)
8) Magnitude comparator(To compare the given inputs)
9) Four Bit Binary Up Counter(Synchronous) (Truth Table Verification)

PART B
10) Astable multi-vibrator (Using 555 IC)
11) Full wave rectifier and filter
12) Half wave rectifier and filter
13) R-C phase shift oscillator
14) JK flip flop(Truth Table Verification)
15) Multiplexer(Truth Table Verification)
16) Decoder(Truth Table Verification)

Semester 2

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total
			Hrs per week			
EN1211	2	English II	3	-	-	3
MM1231	3	Mathematics II	3	1	-	4
CS1221	3	Environmental Studies	3	-	-	3
CS1241	3	Data Structures	3	1	-	4
CS1242	3	Computer Architecture and Microprocessors	3	-	-	3
CS1243	3	Data Structures Lab	-	-	4	4
CS1244	3	Assembly language Programming Lab	-	-	4	4
TOTAL	**20**		**15**	**2**	**8**	**25**

CS1221 : ENVIRONMENTAL STUDIES

COURSE OUTCOMES

CO1	Understand environmental systems
CO2	Understand the biodiversity and conservation concepts
CO3	Remember concepts of biodiversity and conservations
CO4	Understand natural systems and resources
CO5	Apply pollution management techniques

Module I: Environmental Studies – Introduction, Multidisciplinary nature, Scope and importance, Concept of sustainability and sustainable development. **Ecosystems s**tructure, function, Energy flow, food chains, food webs and ecological succession, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, **Natural Resources –** Renewable and Non--renewable Resources, Land resources and use, Deforestation-Causes and impacts due to mining, dam building on environment, forests, Water : Use and over--exploitation of surface and ground water, floods, droughts, conflict overwater- international &interstate.

Module II : Biodiversity and Conservation- Levels of biological diversity: genetic, species and ecosystem diversity; Endangered and endemic species of India, Threats – habitat loss, poaching of wild life, man-wild life conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation Of biodiversity, Eco-system and bio-diversity services: Ecological, economic, social, ethical.

Module III: Environmental Pollution-Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste **Environmental Policies &Practices –**Climate change, global warming, ozone layer depletion, acid rain, Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act.

Module IV: Human Communities and the Environment –Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko Silent valley, Bishno is of Rajasthan, Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

CORE TEXT BOOK
1. "Text book for Environmental Studies for undergraduate courses of all branches of Higher Education", ErachBharucha for University Grants Commission.
ADDITIONAL REFERENCES
2. N Arumugan and V Kumaresan, "Environmental Studies", Saras Publication, 2014

CS1241 : DATA STRUCTURES

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	Remember purpose of Data Structures
CO2	Understand different Data Structures
CO3	Apply programming languages
CO4	Analyze working of different data structures
CO5	Evaluate expressions
CO6	Create different Data Structures

COURSE CONTENT
Module I: **Introduction:** Concept of Data Structures, Types of Data Structures, Linear versus Non Linear Data Structures, Data Structure Operations **Array:** Linear Array-Memory representation, insertion and deletion operation, Multidimensional Arrays-memory representation, Sparse Matrices. **Linked List:** Concept of Linked List, Memory representation, Single Linked List - Traversing, Searching, Insertion, Deletion, Circular Header Linked List , Doubly Linked List - Insertion, Deletion, Difference of Linked List and Array. **(20hr)**

Module II: Stack: Representation and operations on Stack using arrays and linked list, application of Stack - Polish Notation- Conversions to Infix, postfix and prefix notations, Infix to postfix conversion using stack, Evaluation of postfix expression using stack **Queue:** Implementation and operations on Queue using arrays and linked list, Deque- Types Input and output restricted, Priority Queues-Array and Linked list representation . **(15hr)**

Module III: Trees: Concept of Trees, Tree terminologies, **Binary tree:** Complete and Extended Binary tree, Expression trees, Representation of Binary Tree, Traversing Binary Trees – Preorder, Inorder, Postorder. **Binary Search Tree (BST):** Search, Insertion and Deletion operations, creating a Binary Search Tree. **Graph:** Concept of Graph, Graph terminologies, Graph Traversal – BFS, DFS. **(20hr)**

Module IV: Sorting: Bubble Sort, Selection Sort, and Insertion Sort. **Searching**: Sequential searching, binary searching. Hashing- hash table, types of hash functions, Collision Resolution Techniques-linear probing, quadratic probing, double hashing, chaining. **(15hr)**

TEXT BOOK
1. Seymour Lipschutz, Data Structures, Schaum's outline Series. The McGraw Hill
2. S. K Srivastava, Deepali Srivastava. Data Structures through C in Depth. BPB Publications. Second Revised & Updated Edition.
REFERENCE
1. K Sharma. Data Structures using C. Pearson, Second Edition.

2. Ashok N. Kamthane, Introduction to Data Structures in C, Pearson
Assignment and Activities: Recursion, B Tree, Huffman Tree.

CS1242 : COMPUTER ARCHITECTURE AND MICROPROCESSORS

COURSE OUTCOMES: At the end of the course, the student will be able to:

CO1:	Remember the basic concepts of computers.
CO2:	Understand the functional units of a standard PC and its working.
CO3:	Understand the architectural features of 8086 processor.
CO4:	Create assembly language programs for 8086 processor.
CO5:	Apply the tools debug, TASM/ MASM.

COURSE CONTENT
Module I: **Computer Architecture:** Processor to memory communication, processor to I/O device communication, Instruction Format; **Instruction Cycle:** Fetch Cycle, Execution Cycle; Instruction Set: CISC Architecture, RISC Architecture, Comparison; Memory Chips; Pipelining and Parallel Processing; **Input / Output Organization:** Asynchronous Data Transfer, Programmed I/O (concepts only); DMA: DMA Controller, DMA Transfer Modes; I/O Processor.

Module II: The 8086 Microprocessor: 8086 Internal Architecture: Execution Unit, Bus Interface Unit, Multiplexing of address/ data bus, 8086 registers, **Memory bank:** Even bank, Odd Bank, Pins and Signals, Bus cycles, Direct Memory Access, DMA Transfer modes.

Module III: Instruction set of 8086: Data transfer, Arithmetic, Bit manipulation, string, Branch control, Iteration control and Processor control, Addressing modes, **Interrupts:** Interrupt Vector Table, Response, Types, Priority.

Module IV: **Assembly Language Programming:** Program development tools, variables and constants used in assembler, Assembler directives, Procedures and macros, Interrupts of personal computers, Hand coding of assembly language programs, examples.

TEXT BOOKS
     1. N Mathivanan, Microprocessors, PC Hardware and Interfacing, PHI Edition.
     2. Introduction to Information Technology, 2nd Edition, ITL Education solutions limited, Pearson.
REFERENCES
     1. A NagoorKani, 8086 Microprocessor and it's applications, McGraw hill, second edition.
     2. John D Carpinelli, Computer system organization and architecture, Pearson Education.

CS1243 : DATA STRUCTURES LAB

The laboratory work will consist of 15-20 experiments like
PART A
1. Implementation of different searching techniques.
2. Implementation of different sorting techniques.
3. Stack and Queue Array Implementation.

PART B
1. Circular Queue Implementation.
2. Single Linked List and Double Linked List Operations.
3. Stack and Queue Linked List Implementation.
4. Evaluation of expression using Stack.

5. Tree traversal.
6. Graph Implementation.

CS1244 : ASSEMBLY LANGUAGE PROGRAMMING LAB

PART A
1. Arithmetic operations
2. Data movement operations
3. Control operations
4. Input-output operations
5. String operations
6. Logical operations

PART B
1. Program to move a block of data from one location to another
2. Program to find the presence of a given value in a block of data
3. Program for reverse a string
4. Program to find the number of alphabets in a word

Semester 3

Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total
			Hrs per week			
CS1341	3	Programming in Java	3	-	-	3
CS1342	3	Software Engineering	3	1	-	4
CS1343	3	Operating Systems	3	-	-	3
CS1344	3	Database Management Systems	3	1	-	4
CS1345	3	Design and Analysis of Algorithms	3	-	-	3
CS1346	3	Java Programming Lab	-	-	4	4
CS1347	3	DBMS Lab	-	-	4	4
TOTAL	21		15	2	8	25

CS1341: PROGRAMMING IN JAVA

COURSE OUTCOMES: On the completion of the course students will be able to

CO1:	Understand the java programming and oops concepts.
CO2:	Understand the concepts of Interface, exception handling, threading, and package
CO3:	Understand the basic concepts of Applet, Networking.
CO4:	Idea to approach and use a new package.

COURSE CONTENT

Module I: Java Introduction: Object Oriented Programming concepts, Features of Java language, Types of Java programs, Java architecture, Program Structure, Literals, Data Types and variables, Operators, Control Statements, Arrays, Classes and objects: Class, Objects, Defining a class, Method declaration Constructor, Method overloading.

Module II: Inheritance: Creating subclasses, Method Over-riding, Super keyword, Final keyword,

Abstract Classes. Packages and Interfaces: Package, Import statement, Access Modifiers, Interfaces. IO Packages, Java Input Stream Classes, Java Output Stream Classes, File Class.

Module III: Exception: Introduction, exception handling techniques, creating your own exceptions. Threads: Multitasking, Creation of new Threads, State of a thread, Multithreaded programming, Thread Priorities.

Module IV: **Applets**- Introduction, Applet class, Applet Structure, Example Applet Program, Applet Life Cycle, **Graphics**, Stand-alone GUI applications with Awt/swing components, Event handling- Event delegation model, different Events and corresponding Listeners/Adapters. **JDBC**, **Socket Programming**-Socket class, Server Socket class, example client/server program.

CORE TEXT BOOKS
- Dr. K. Somasundaram., Programming in Java 2, Jaico publishing House

ADDITIONAL REFERENCES
- E Balagurusamy, "Programming with Java – A Primer", McGraw Hill, 2017
- Deitel, Java: How to Program, Pearson Education
- Java Programming, Schaum Outline Series

Assignments and Activities: Creation of simple programs with interfaces, concepts of OOPS.

NB:- Activities and assignments are not meant for End_Semester_Examination

CS1342 : SOFTWARE ENGINEERING

COURSE OUTCOMES: At the end of the course, the students should be able to:-

CO1	Understand the importance of having a process for software development.
CO2	Familiarize with various software testing techniques and tools.
CO3	Apply various models in the software development projects.
CO4	Analyze the process of software development

COURSE CONTENT

Module I: Introduction: Evolution, Software Development Projects-Program versus product, Types of Software Development Projects Software life cycle models: A few basic concepts, Waterfall model and its extensions, Rapid Application Development (RAD), Agile development models, Spiral model, Comparison of different life cycle models

Module II: Software Project Management, Project Planning, Metrics for project size estimations, Project Estimation Techniques, Basic COCOMO model, Scheduling-Work break down structure, Activity Network, Basic concepts of CPM, PERT and Gantt Chart. Software Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification.

Module III: Software Design: overview of the design process, how to characterize a good software design, Cohesion and Coupling, Approaches to software design, Function oriented design: Overview of SA/SD Methodology, Structured analysis, developing the DFD model of a system, Structured Design.

Module IV: Coding and Testing: Coding, Code review, Testing, Unit testing, Black box testing, white box testing: Basic concepts, Debugging, Integration testing, system testing, Software Reliability and quality management: Software reliability, Software maintenance: Characteristics of software maintenance,

Software reverse engineering, **Emerging Trends**: Client Server Software, Client Server architectures, CORBA, Service Oriented Architectures (SOA), Software as a Service.
CORE TEXT BOOKS: -
1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI

ADDITIONAL REFERENCES: -
1. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House
2. Software Engineering - A practitioner's approach (Sixth Edition), Roger S Pressman-McGraw Hill Companies, Inc

CS1343 :OPERATING SYSTEMS

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	Understand working of various Operating Systems
CO2	Apply constrained resource allocation, process scheduling and memory management techniques
CO3	Evaluate synchronization of processes and protection of an Operating System
CO4	Analyze salient features available to various Operating Systems

COURSE CONTENT
Module I: Operating System Overview: Introduction - Structure of Operating System, the Evolution of Operating System, Operating System Functions, System Calls. **Distributed Systems**: introduction, Trends in Distributed System, challenges.

Module II: Process Management: The Process, Process State, PCB, Threads, Process Scheduling - Basic Concepts, Scheduling Criteria, Scheduling Algorithms. **Process Coordination**: Critical Section problems, Semaphores, Synchronization - Interprocess Communication Problems. Deadlock – Definition, Resource Allocation Graph, Conditions of deadlock, deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery.

Module III: Memory Management: Basic Hardware, Address binding, Logical vs. physical address space, Dynamic Loading and Linking, Swapping, Memory Allocation Methods, Paging, Structure of Page Table, Segmentation, Virtual Memory- Background Demand Paging, Page Replacement- Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement, Thrashing.

Module IV: Storage Management: File Concept, Access Methods, Protection, Implementation- File System Structure, Allocation Methods, Recovery, Secondary Storage- Overview, Disk Scheduling, Disk Management, RAID. **I/O Systems**- I/O Hardware, Application I/O Interface, Kernel I/O Subsystem.

Assignment and activities: Case Study Analysis: Comparison of different Operating Systems using above functionalities-DOS, WINDOWS, UNIX, LINUX etc.

CORE TEXT BOOK
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne-Operating System Concepts, 10th Edition.
ADDITIONAL REFERENCES
1. P. Balakrishna Prasad- Operating Systems and Systems Programming, 5th Edition.
2. Achyut S Godbole and AtulKahate - Operating systems, McGrawhill
3. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair – Distributed Systems, Concepts and Designs, 5th Edition

CS1344 : DATABASE MANAGEMENT SYSTEMS

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	Understand the concept of database.
CO2	Develop skills to design an ER diagram.
CO3	Create database using SQL and perform operations in SQL.
CO4	Familiarize the management of concurrent transactions.
CO5	Apply the design concepts and normalization in database easily.

COURSE CONTENT

Module I: Introduction: Database system applications, Purpose of database systems, View of data, Database languages, Database design, Database and application architecture. **Data models:** Hierarchical model, Network model, Entity Relationship model, Object oriented data model, Relational model. **Introduction to relational model:** Structure of relational database, Database schema, Keys, Relational algebra and calculus.

Module II: Database design using ER model: Overview of the design process, Entity relational model, Complex attribute, Mapping cardinalities, Primary key, removing redundant attributes in entity sets, Reducing ER diagram to relational schema, Entity relationship design issues. **Relational database design:** Features of good relational design, Decomposition using Functional Dependencies, Normal forms (1NF, 2NF, 3NF, BCNF, 4NF)

Module III: Introduction to SQL: Overview of the SQL query language, SQL data definition, Basic structure of SQL queries, Additional basic operations, Set operations, Null values, Aggregate functions, Nested subqueries, Modification of the database, **Intermediate SQL:** Join expressions, Views, Integrity constraints, Authorization.

Module IV: Transactions: Transaction concept, A simple transaction model, ACID property, Serializability, **Concurrency control:** Lock based protocol, Deadlock handling, Multiple granularity, insert operations, delete operations and predicate Reads, Timestamp based protocols, Validation based protocols. **Basic security issues:** The need for security, Physical and Logical security, Design issues, Maintenance issues, Operating system issues and availability, Accountability.

CORE TEXT BOOK
1. Silberschatz, Hentry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition.

ADDITIONAL REFERENCES
1. Ramon A. Mata-Toledo and Pauline K. Cushman, Database Management Systems, MC Graw Hill Education.
2. Atul Kahate, Introduction to Database Management Systems.

CS1345 : DESIGN AND ANALYSIS OF ALGORITHMS

COURSE OUTCOMES At the end of the Course the Student will be able to

CO1. Develop and analyze new algorithms.
CO2. Analyze the complexity of algorithms
CO3. Understand good algorithms among multiple solutions for a problem.
CO4. Have better knowledge on fundamental strategies of algorithm design and awareness on algorithm

design strategies
CO5. Implement some typical algorithms
COURSE CONTENT

Module I: Algorithm Analysis: Algorithm, Properties of a good algorithm, efficiency considerations, Complexity: Time and Space complexity, Asymptotic notations: Big O notations, best case, worst case, average case, simple examples, recursion and its elimination- recursive and no-recursive algorithms for binary search.

Module II: Algorithm design techniques- Divide and conquer method: binary search as a divide-and-conquer algorithm, finding maximum and minimum, Strassen's matrix multiplication, Greedy method: Knapsack problem, minimum cost spanning trees, Prim's algorithm, Kruskal's algorithm.

Module III: Dynamic programming: principle of optimality, all pair shortest paths, single source shortest paths, travelling salesperson's problem, Back tracking: implicit constraints and explicit constraints, N queen problem, Branch and bound: LC search.

Module IV: Standard Algorithms: sorting-quicksort, merge sort, complexity of sorting algorithms, Deterministic and non-deterministic algorithms, NP- hard and NP complete- basic concepts.

CORE TEXT BOOK
- Anany Levitin, *Introduction to design and analysis of algorithms*, Pearson, Second Edition

ADDITIONAL REFERENCES
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekharan–*Computer Algorithms/C++*, Second Edition- Universities Press.

Assignments and Activities: *Studies on complexities of various algorithms, best case, average case worst case analysis.*

NB:- Activities **and assignments are not meant forEnd_Semester_Examination**

CS1346: JAVA PROGRAMMING LAB

The laboratory work will consist of 15-20 Experiments

PART A
Testing out and interpreting a variety of simple programs to demonstrate the syntax and use of the following
1. Features of the language: basic data types, operators and control structures.
2. Class definitions and usage involving variety of constructors and finalizers
3. Programs involving various kinds of inheritances,
4. Program involving Method Over-riding, Method Over-loading
5. Program involving Abstract Class and Methods

PART B
6. Program involving Interface,
7. Program to demonstrate creation and handling of packages, their imports and Class Path.
8. Programs involving a variety of Exception Handling situations
9. Program to define a class that generates Exceptions and using objects of the class.
10. Program involving creating and handling threads in applications and applets.
11-12: Programs to demonstrate methods of various i/o classes
13. Programs to demonstrate methods of string class

14. Program to demonstrate AWT/Swing graphic methods
15. Program for Loading and Viewing Images, Loading and Playing Sound
16. Programs to demonstrate various Layouts
17-18 Programs to demonstrate event handling
19. Program to demonstrate simple server-client (using a single m/c both as client and server) 20. Debugging programs involving syntactic and/or logical errors

CS1347 : DBMS Lab

The laboratory work will consist of 15-20 experiments.
PART A
1. SQL statements for creating, dropping and updating tables.
2. Record manipulation using insert, delete and update.
3. Experiments that clarify the importance of keys.
4. Practice all constraints of attributes.
5. Queries with substring comparison.
6. Usage of BETWEEN.
7. Aggregate functions.
8. Finding values with a certain range.
9. Queries with string comparison and ordering.
10. Usage of GROUPBY clause.

PART B
1. Join between two tables.
2. Foreign key.
3. Nested queries.
4. Views.
5. The EXISTS and UNIQUE in SQL.
6. Renaming attributes and joining tables

Semester 4

| Course code | Credits | Course Name | Hrs per week | | | | Marks | | |
			Lecture	Tutorial	Lab	Total	CE	ESE	Total
CS1441	3	System Software	3	-	-	3	20	80	100
CS1442	3	Web Programming and PHP	3	1	-	4	20	80	100
CS1443	3	Computer Networks and Security	3	1	-	4	20	80	100
CS1444	3	Computer Graphics	3	-	-	3	20	80	100
CS1445	3	Minor Project	-	-	3	3		100	100
CS1446	3	Computer Graphics Lab	-	-	4	4	20	80	100
CS1447	3	Web Programming and PHP Lab	-	-	4	4	20	80	100
TOTAL	21		12	2	11	25			700

CS1441 : SYSTEM SOFTWARE

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Understand different System Software.
CO2	Analyze SIC machine architecture with its instruction sets and capable to do programing. Illustrate machine dependent, independent assemblers and macro processors.
CO3	Remember the functions of loaders, linkers and illustrate machine dependent loaders and independent loaders.
CO4	Understand the functions of compilers and illustrate the machine dependent and

	independent compilers.

COURSE CONTENT

Module I: Introduction: System Software and Machine architecture. The simplified Instructional Computer (SIC& SIC/XE) - Data and instruction formats – addressing modes - instruction sets - I/O and programming.

Module II: Assemblers and Macro Processors: Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures. Machine dependent assembler features – Instruction formats and addressing modes, Program relocation - Machine independent assembler features - Literals, Symbol-defining statements, Expressions -assembler design options: One pass assemblers and Multi pass assemblers. , Implementation example - MASM: Basic macro processor functions - Macro definition and Expansion –- Implementation example –MASM Macro processor.

Module III: Loaders and Linkers: Basic loader functions - Design of an Absolute Loader Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features: Automatic Library Search, Loader Options. Loader design options: Linkage Editors, Dynamic Linking, Bootstrap Loaders.

Module IV: Compilers and system software tools: Basic Compiler Functions and Structure of compiler. Text editors-Overview of the Editing Process-User Interface-Editor Structure-Interactive debugging systems-Debugging functions and capabilities-Relationship with other parts of the system-User-Interface Criteria.

CORE TEXT
1. System Software – An Introduction to Systems Programming, Third edition, Pearson: Leland L. Beck & D. Manjula

ADDITIONAL REFERENCES
1. Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw-Hill: D. M. Dhamdhere
2. Systems Programming Tata McGraw-Hill: Donovan

CS1442 : WEB PROGRAMMING AND PHP

COURSE OUTCOMES:

CO1	Understand the basic skills in moderately complex use of the following tools/scripts/languages: HTML, DHTML, CSS, Javascript.
CO2	Apply the appropriate web tools/languages for creating state-of-the art websites
CO3	Understand the current trends and styles in web design and applications

CO4	Apply PHP in web designing

COURSE CONTENT
Module I: HTML - General Introduction to Internet and WWW; **HTML**: Structured language, Document types, Rules of html, Html tags, Head tags, Body tags, Headings, Divisions and Centering, Quotations, Preformatted text, Lists, Horizontal Rules, Block level elements, Text level elements, Character entities, Comments, Fonts, Tables: Table tags, Colors, Color names, Color values, Marquee tag. **Advanced HTML** - Linking in html: Anchor tags, Layer tags, Link relationships, URL: Relative, Absolute, Image, Image maps, Frames: Layouts, Targeting, No frame tag, Floating frames, Audio, Embed tag, Forms: form tag and its attributes.

Module II: CSS: Style sheet Basics, Adding Style to a Document, CSS (Cascading Style Sheet) and HTML Elements, Selectors, Document Structure and Inheritance. **Javascript** - Introduction to Javascript, Variables and data types, Declaring Variables, Operators, Control Structures, Conditional Statements, Loop Statements, Functions, Objects, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes, Javascript with HTML, Events, Introduction to DHTML-Components, Uses, Features.

Module III: PHP: Overview of PHP, The building blocks of PHP: variables, globals & super globals Data types: Set type, type casting, test type, Operators & Expressions, Flow control functions in PHP, Functions: Defining a function variable scope, calling a function returning values, setting default values for arguments, passing variable reference, built in functions

Module IV: Arrays: Creating arrays (associative & multidimensional), Array related functions. Working with Objects, Working with string functions: Formatting strings, Using Date and Time functions. Forms in PHP: Form elements, adding elements to a form, creating a simple input form, combining HTML & PHP code on a single page, redirecting the user, creating a send mail form, File upload form, working with files and directories. **Cookies**: Introduction, different types of cookies, setting a cookie with PHP, deleting a cookie, session function overview: starting a session, working with session variables.

CORE TEXT BOOK
1. V.K. Jain, Advanced Programming in Web Design, Cyber Tech Publications
2. Julie C.Meloni, PHP, MySQL and Apache,Pearson Education

ADDITIONAL REFERENCES
1. Ivan Bayross "Web Enabled Commercial Application Development: HTML, DHTML, JavaScript, PERL CGI - PHI, Ivan Byross, PHP for Beginners –PHI

CS1443 :COMPUTER NETWORKS AND SECURITY

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	Remember various network technologies, design issues and characteristics
CO2	Understand the purpose of computer networks and the basic issues in information security
CO3	Apply the use of layer architecture for networking systems, information security measures
CO4	Analyze the concept of different models of network and the working of various ciphers
CO5	Evaluate data link controls and Information Security policies
CO6	Create awareness on different networking protocols and information security policies

COURSE CONTENT

Module I: **Network Introduction**:- Use of computer networks-applications, network topologies, Network hardware-LAN,WAN, MAN, VPN, PAN, broadcast, point-to-point, Network software-connection-oriented, connectionless, protocol hierarchies, Reference model- OSI, TCP/IP-. Internet, mobile phone network, wireless LAN, RFID and sensor networks. Guided transmission media, Wireless transmission, Satellite, **Data communication**:-Data flow, data transmission mode-simplex, half duplex, full duplex. Bandwidth- bit rate, baud rate, multiplexing-FDM, TDM,WDM. Switching - circuit, packet, message. Mobile system -1G, 2G, 3G, GSM

Module II: Data link and Access controls: Framing, error control, flow control- feedback-based, rate-based, Error detection and correction- hamming code, parity, checksum, CRC, Stop and wait protocol, sliding window protocol, ALOHA, pure, slotted, CSMA, CSMA/CD. LAN transmission equipment-Network Interface card(NIC), repeaters, hubs, bridges, routers, switches, gateways, **Internetworking**-Datagram, routing algorithm- adaptive, non-adaptive, , static, dynamic, distance vector, link state, Dijikstra algorithm (shortest path),   Internet protocol (IP)- services, IP address, TCP, UDP. Network applications- client-server model, DNS, Remote login, FTP, email-SMTP, MIME

Module III: **Information Security:** Computer Security- objectives, security attacks, services, network security model, network security terminologies, **Cryptography**: Symmetric cipher model, cryptanalysis and Brute force attack, Classical Encryption Techniques, substitution, transposition techniques, Steganography, Feistel cipher, Data Encryption Standard (DES)-strength , Public-key cryptosystem- RSA algorithm-working **Authentication**: cryptographic hash function, message digest, message authentication code, authentication methods, Digital signature:- model, Digital Signature Standard(DSS)-approach, Digital Signature Algorithm (DSA)-working

Module IV: Web Security: threats, Secure Socket Layer(SSL)- architecture- session and connection, **E-Mail security:**- PGP, MIME , S/MIME, **IP Security:**- benefits, IPsec services-transport and tunnel mode, IPv4 and IPv6- comparison. **System Security:** malicious software-Virus-types, worms, Trojans, Spyware, Firewall-types, characteristics and benefits

CORE TEXTS
1. Andrew S. Tanenbaum, *"Computer Networks"*, Fourth/Fifth edition, Pearson
2. Brijendra Singh, *"Data Communication and Computer Networks"*, Fourth edition, PHI
3. William Stallings, *"Cryptography and Network Security: Principles and Practice"*, Fifth edition Pearson

ADDITIONAL REFERENCES
1. Behrouz A Forouzan, *"Data Communication and Computer networks"*, Fourth edition, McGraw Hill
2. Achyut S Godbole, *"Data communications and networks"*, Second edition McGraw Hill
3. V K Pachghare, *"Cryptography and Information Security"*, Third edition, PHI
4. Atul Kahate, *"Cryptography and Network Security"*, McGraw Hill
5. Mohammad Amjad, *"Cryptography and Network Security"*, Paperback

Assignment and Activities: *Peer–to-peer networking, Measurement and packet analysis, blue tooth, emerging topics, networking in LINUX AES, Blowfish algorithms, Kerberos, Comparison of PGP and/ SMIME., Trusted systems.*

NB:- ** Activities **and assignments are not meant forEnd_Semester_Examination

CS1444 : COMPUTER GRAPHICS

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Compare various graphics devices
CO2	Apply various transformations to 2D and 3D graphics objects
CO3	Analyze algorithms for clipping
CO4	Classify various projections of 3D objects
CO5	Explain current trends in computer graphics

Module I: Introduction: Computer graphics, application of computer graphics, pixel, resolution, aspect ratio, frame buffer, Raster scan , horizontal and vertical retrace, Random scan, video adapter, video controller, various input devices- keyboard, mouse, trackball, joystick, data glove, digitizers, image scanners, touch panels, light pens, voice systems, display devices- CRT, LCD, LED, DVST, beam penetration method, shadow mask CRT, printer – impact and non-impact printer, plotter, coordinate systems- modeling coordinates, world coordinates, device coordinates , output primitives : Straight line, DDA algorithm, Bresenham's Line drawing algorithm (m<1 left to right), midpoint circle algorithm, polygon filling algorithms-boundary fill, flood fill, scan line algorithm.

Module II: Two dimensional transformations: Basic transformations: Translation, Rotation, Scaling, homogenous coordinates for uniform matrix operations, composite transformation, Other transformations: reflection, shearing, transformations with respect to arbitrary points, matrix formulation and concatenation of transformations, 2D viewing pipeline: window point, view port, window to viewport transformation, workstation transformation, 2D clipping; clip window, Point clipping, Line clipping, Cohen-Sutherland Line Clipping algorithms, Midpoint subdivision algorithm, Polygon clipping- Sutherland Hodgeman algorithm, text clipping, exterior clipping.

Module III : 3D concepts and techniques: 3D display techniques, 3D object representations, basic 3D transformations, Projections: parallel and perspective projections, vanishing points, visible surface detection algorithms-scan line method, Z buffer algorithm, A- buffer algorithm, depth sorting.

Module IV : Color Illumination methods: color models – RGB, HIS, CMYK, Animation, morphing, tweening, warping, zooming, panning, rubber band methods, Illumination model and light sources, ambient light, Polygon rendering : Gourad Shading, Phong Shading.

CORE TEXT
- Donald D. Hearn, M. Pauline Baker, Computer Graphics (C Version) 2/e , Pearson

ADDITIONAL REFERENCE
- Amarendra N Sinha and Arun D Udai, Computer Graphics, McGraw Hill Publications

CS1445 :MINOR PROJECT

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Plan And Estimate a Project
CO2	Design And Analysis of a Problem
CO3	Coding / Implementation of a Software

1. GUIDELINES FOR MINOR PROJECT

The minor project is considered as a stepping stone in implementing major project of sixth semester.

Hence students should plan and organize their minor projects meticulously and necessary discussions and planning should be done so as to achieve this objective. Up to design is expected to complete as a part of minor project. The following guidelines should be adhered to:

1. Team size should preferably be three with a maximum limit of 4members.
2. Individual projects may be permitted in exceptional cases, for valid reasons
3. Minor Projects should be purely internal in nature.
4. No restriction on tools/platform/language chosen should be made.
5. Internal guide(s) should be assigned to each team.
6. Two interim reports (one after analysis and another after design) should be submitted to internal guides.
7. The number of records to be submitted is limited to team size + one (Departmental copy). Hard binding of reports is optional.
8. The report format guidelines used to document Major Projects should be followed for making the final report and evaluation will be made on the same grounds.

2 EVALUATION

Criteria for external evaluation of Minor Project

External evaluation is done by an external examiner appointed by the University
The following components are to be assessed for the End Semester Evaluation of the project.

Quality of documentation	: 30 marks
Individual involvement & team work	: 30 marks
Presentation of work	: 20 marks
Viva Voce	: 20 marks
TOTAL	**: 100 marks**

CS1446 : COMPUTER GRAPHICS LAB

PART A
1. Use functions to draw different shapes
2. Implementing DDA algorithm
3. Implementing Bresenham's line drawing algorithm
4. Implementing Midpoint circle generation algorithm
5. Implementing Boundary fill & flood fill algorithm

PART B
6. Program for performing the basic 2D transformations such as translation, Rotation, Scaling for a given 2D object
7. Program for performing the other 2D transformations Reflection along x-axis and y-axis, x-direction shearing and y- direction shearing for a given 2D object
8. Implement composite transformations
9. Program for performing the basic 3D transformations such as translation, Rotation, Scaling for a given 3D object
10. Programs for designing simple animations using transformations

CS1447 : WEB PROGRAMMING AND PHP LAB

The laboratory work will consist of 20-25 Experiments

Part A (HTML/ JAVA SCRIPT)
1. Practicing basic HTML tags, text tags test styles, paragraph styles, headings, lists
2. Tables in HTML, Frames in HTML, nested frames, Link and Anchor Tags
3. Including graphics, video and sound in web pages, including Java applets
4. Layers & Image Maps
5. Creating animated Gifs
6. Cascading Style sheets
7. DHTML
8. HTML forms and Fields
9. Exercises covering basic introduction to JavaScript
10. Development of a web site involving a variety of tools practiced above

Part B (PHP) Sample Questions
1. *Setup WAMP/XAMPP Server or Setup Apache, MySQL and PHP separately in your PHP Lab.*
2. Write a PHP program to generate a random number between 1 and 100.
3. Modify above program to accept range of the random number from HTML interface.
4. Programs involving various control structures like if, else, elseif/else if', Alternative Syntax for 'if, else, elseif/else if'
5. Programs involving various control structures like while, do-while, for, for each, switch, break, continue. Try alternative syntax for while, do-while, for, foreach, switch.
6. Programs involving the declare, return, require, include, require- once, include_once and goto.
7. Programs to demonstrate PHP Array functions, PHP Array Sorting, PHP Key Sorting, PHP Value Sorting, PHP Multi Array Sorting, PHP Array Random Sorting,
8. Programs to demonstrate PHP Array functions. PHP Array Reverse Sorting, Array to String Conversion, Implode() function, String to Array, Array Count, Remove Duplicate Values
9. Programs to demonstrate PHP Array functions. array Search, Array Replace, Array Replace Recursive, Array Sub String Search
10. Demonstrate the use of regular expression to compare two strings.
11. Extract Domain name from URL
12. Find the number of rows from a mysql database for your query.
13. Generate a Guestbook which will allow your website visitor to enter some simple data about your website.
14. Write a PHP script to find whether the given number is a prime or not.
15. Write a PHP script to demonstrate the use of break, continue statements using nested loops.
16. Write a PHP script to display the Fibonacci sequence with HTML page.
17. Write a PHP script to create a chess board.
18. Write a PHP script using built-in string function like strstr(), strops(), substr_count(), etc
19. Write a PHP script to transform a string to uppercase, lowercase letters, make a string's first character uppercase.
20. Write a PHP function to check whether all array values are strings or not.
21. Write a PHP script to count number of elements in an array and display a range of array elements.

<u>Semester 5</u>

Course code	Credits	Course Name	Hrs per week			
			Lecture	Tutorial	Lab	Total
CS1541	3	Python Programming	3	1	-	4
CS1542	3	Artificial Intelligence	3	-	-	3
CS1543	3	Free and Open Source Software	3	-	-	3

	3	**Elective** Object Oriented Analysis and Design	3	1	-	4
CS1551.1						
CS1551.2		Embedded Systems				
CS1551.3		Cloud Computing				
	2	**Open Course** Digital Marketing	3	-	-	3
CS1561.1						
CS1561.2		Internet and WWW				
CS1561.3		Impact of Social Media Networks				
CS1544	3	Python Programming Lab	-	-	4	4
CS1545	3	FOSS Lab	-	-	4	4
TOTAL	**20**		**15**	**2**	**8**	**25**

CS1541 : PYTHON PROGRAMMING

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Remember the concepts of python programming
CO2	Understand data types and differences
CO3	Apply CGI programming
CO4	Analyze the concepts of database programming in python
CO5	Evaluate the usage of Python package installer PIP
CO6	Create programs using libraries such as Flask, SQL Alchemy, Pandas, Numpy etc..

COURSE CONTENT
Module I: Introduction to Python - Features of Python, Identifiers, Reserved Keywords, Variables, Comments in Python, Input, Output and Import Functions, Operators; **Data Types and Operations** - int, float, complex, Strings, List, Tuple, Set, Dictionary, Mutable and Immutable Objects, Data Type Conversion; **Flow control** - Decision Making, Loops-for, range() while, break, continue, pass;

Module II: Functions- Definition, calling, arguments, anonymous function, recursion, return; **Modules & Packages** - Built-in Modules, Creating Modules, import statement, Locating, modules, Namespaces and Scope, dir (), reload (), Packages in Python; **File Handling**- open, close, write, read, methods, rename, delete, directories;

Module III: Object oriented programming- class, object, method, attribute, destructor, encapsulation, data hiding; **Exception handling**- built in exceptions, Handling, Exception with arguments, Raising and User defined exceptions, Assertions in Python**; Regular expressions –** match, search, replace, patterns.

Module IV: Database Programming- Connection, Create, insert, update, delete, commit, rollback, disconnection, exceptions; **Iterators**- Data type supports iterators; **CGI Programming**- HTTP Header, Env variables, Forms, Radio button, Dropdown box, check box, text area, cookies, uploading file.
CORE TEXT
1.   Jeeva Jose, "Taming PYTHON By Programming", Khanna Publications, 2017
 ADDITIONAL REFERENCES
1.   Allen B. Downey," Think Python- How to think like a computer scientist", Second Edition, O'Reilly, 2016.
2.   Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

CS1542 : ARTIFICIAL INTELLIGENCE

COURSE OUTCOMES: At the end of the Course, the Student will be able to

CO1	Remember features of AI and knowledge-based systems
CO2	Understand basic parsing techniques
CO3	Apply search and control strategies
CO4	Understand expert systems
CO5	Evaluate the performance of various searching algorithms
CO6	Evaluate different knowledge representation schemes

COURSE CONTENT

Module I: Overview of Artificial Intelligence: What is AI, The importance of AI; Knowledge: Introduction, Definition and Importance of knowledge, Turing Test, Knowledge–Based Systems, Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition of Knowledge.

Module II: Knowledge Representation & Reasoning: Prepositional logic-Syntax, semantics, normal forms; Predicate logic- Syntax, semantics, Clausal Normal Form; Procedural vs declarative knowledge representation- Semantic Nets, Frames , Scripts.

Module III: Search Strategies and Expert systems: Search methods- Uniformed or blind Search-DFS, BFS; Informed or heuristic Search-Best First Search, A* search; Expert System- Architecture, Knowledge bases and Inference Engines, applications of expert systems.

Module IV: Natural Language Processing: Introduction, Overview of Linguistics, Grammars and Languages, Basic Parsing Techniques, Semantic Analysis and Representation Structures, Natural Language Generation, Natural Language Systems.

CORE TEXT
 ● Dan W. Patterson, Introduction to Artificial Intelligence And Expert Systems, PHI Learning 2014

ADDITIONAL REFERENCES
 ● Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, Third Edition, McGraw Hill Education (India) PVT LTD

CS1543 : FREE AND OPEN SOURCE SOFTWARES (FOSS)

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Remember FOSS concepts, features
CO2	Understand Linux OS
CO3	Apply shell programming
CO4	Analyze various Linux commands
CO5	Evaluate conditional and looping statements

CO6	Create user defined function

COURSE CONTENT
Module I: Open source software: concepts, features, benefits over proprietary software, examples, Free software: concepts, features, advantages, Free software Vs Open Source software, Free and Open Source Software (FOSS), Four essential freedoms, Free software movements, free software foundation(FSF), history, policies, GPL, free operating systems

Module II: Linux: features, history, various Linux distributions, Linux architecture, kernel and shell, Linux desktop environments- GNOME and KDE, Linux File System and Directories, types of files, Installing and Configuring Linux, File access permissions, understanding system administration

Module III: Linux Commands: date, time, who, echo, man, info, cal, pwd, more, less, head, tail, mkdir, cd, cp, mv, rm, touch, sort, wc, cut, cat with options, ls with options ,grep with options, chmod, diff, mounting the file system, command line processing etc. Types of editors in Linux, Introduction to vi editor, modes in vi editor, common vi editor commands for open a file, save a file, delete a file, quit a file etc

Module IV: Shell Programming: Introduction to Linux Shell and Shell Scripting, types of shells in Linux, steps in creating a shell script, write and run shell scripts, shell variables and printing, deleting shell variables, script permissions and names, scripting guidelines, adding shell comments, shell variables, constants, operators, conditional statements, looping statements, using arrays, shell functions, files, shell built-in functions

CORE TEXTS
    1.   Christopher Negus, *Red Hat Linux 9 Bible*, WILEY- Dreamtech, New Delhi,
    2.   Thomas Schenk, *Red Hat Linux System Administration*, Techmedia, New Delhi, 2003
ADDITIONAL REFERENCES
    •   https://www.tutorialspoint.com/unix/shell_scripting.htm

<u>ELECTIVES</u>
CP1551.1: OBJECT ORIENTED ANALYSIS AND DESIGN

COURSE OUTCOME: At the end of this course the students will be able to

CO1	**Remember** object oriented features
CO2	**Understand** Object Oriented System Development
CO3	**Apply** Unified Approach
CO4	**Analyze** various UML diagrams
CO5	**Evaluate** objects static and dynamic model
CO6	**Create** UML diagrams for any system

COURSE CONTENT:-

MODULE I: Object Oriented concepts: class, object, defining a class, comparison between algorithmic decomposition and object oriented decomposition, Object Oriented System Development Life cycle(use-case driven).

MODULE II: Object Oriented Methodologies, The Unified Approach, Concepts of UML,OOAD using UML,UML diagrams, static model, UML class diagrams, representing various features of a class, messages, types of associations; object diagram ;use case diagram, identifying use cases, elements of use

case diagram, uses and extends associations.

MODULE III: UML dynamic modeling: UML interaction diagram, Sequence Diagram, elements of sequence diagrams, benefits of sequence diagrams, collaboration diagram, elements; Activity diagram, elements of Activity diagram; State chart diagram ,examples.

MODULE IV: UML Implementation diagrams: Component diagram, elements, examples, Deployment diagram, elements examples; UML meta model. Object Oriented Analysis: Classification theory, Approaches for identifying classes; Object Oriented Design process, Design axioms and corollaries, an example UML class diagram.

CORE TEXT
  • Ali Bahrami-Object Oriented System Development, McGraw Hill
ADDITIONAL REFERENCES
  • Grady Booch, Object Oriented Analysis and Design, Addison Wesley, Pearson
  • Edward Yourdon, Carl Argila, Case studies in Object Oriented Analysis and Design
  • Joey F.George, Dinesh Batra, Joseph S.Valacich, Jeffrey A.Hoffer, Object Oriented System Analysis and Design

CS1551.2 :EMBEDDED SYSTEMS

COURSE OUTCOMES: At the end of the course students will be able to

CO1	To understand the basic concepts of Embedded System.
CO2	To familiar with the architecture of Embedded System.
CO3	To understand the Embedded Operating system and Programming languages.
CO4	To analyze the process of Embedded Software Development process.
CO5	To familiarize the various applications of Embedded System.

COURSE CONTENT

Module I: Introduction to Embedded Systems, Stand-alone and real-time embedded systems, network appliances and mobile devices, Requirements of embedded systems, Embedded processors, memory, OS, programming languages and tools.

Module II: Hardware Architecture for embedded systems: Processors, micro-controller, microprocessor, DSP processor, memory, ADC and DAC, Display units and keypads, communication interfaces.

Module III: Embedded Systems Development: EPROM programmer and eraser, Embedded system development process, software development environments.

Module IV: Embedded OS: Windows XP and open source OSs, Real-time OSs: RT Linux and eCOS, Mobile OSs, Programming in C and assembly for embedded systems. Emulators. Applications of embedded systems. Future trends in Embedded systems.

CORE TEXT
       • Programming for Embeded Systems- Dreamtech Software Team, Wiley Dreamtec
ADDITIONAL REFERENCES
       • Daniel W Lewis, Fundamentals of Embedded Software, Pearson Education.

CS1551.3 : CLOUD COMPUTING

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Remember the basics of cloud computing
CO2	Understand the main concepts and key technologies of cloud computing.
CO3	Apply the concept of virtualization in the cloud computing
CO4	Analyze the evolution of cloud from the existing technologies.
CO5	Evaluate and choose the technologies for implementation and use of cloud.
CO6	Create services using cloud computing

COURSE CONTENT

Module I : Cloud Computing Foundation: Introduction to Cloud Computing- Basics, History, importance, Characteristics, Pros and Cons of Cloud computing. Types of Cloud – Public and Private Cloud. Cloud Computing infrastructure, Cloud Services SaaS, DaaS, IaaS, PaaS

Module II : Cloud Computing Architecture: Cloud Computing Technology- Cloud Life Cycle Model. Cloud Architecture – Cloud Computing Logical Architecture, Developing Holistic Cloud computing Reference Model. Cloud System Architecture, Cloud Development Model.

Module III : Virtualization: Definition, Adopting Virtualization, Types, Virtualization and Software, Virtual Clustering, Virtualization Application, Pitfalls of Virtualization.

Module IV : Data Storage & Security: Data Storage- Introduction to Enterprise Data Storage, Data Storage Management, File Systems, Cloud Data Stores. Cloud Computing and Security – Risks in Cloud Computing, Types of Risks, Risk Management Process.

CORE TEXT

Cloud Computing – A Practical Approach for Learning and Implementation, A.Srinivasan and J.Suresh, Pearson India Publications, 2014

ADDITIONAL REFERENCES

1. Cloud Computing: Principles and Paradigms, edited by Rajkumar Buyya, James Broberg, Andrzej, Wiley India Publications, 2011
2. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley India Pvt. Ltd., New Delhi, 2011.

OPEN COURSES

CS1561.1 : DIGITAL MARKETING

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Understand different digital marketing types
CO2	Understand the main concepts and key technologies of digital marketing.
CO3	Remember the concept of e-banking, cyber security

CO4	Analyze the evolution of digital marketing from the existing technologies.
CO5	Analyze services using digital marketing

COURSE CONTENT

Module I: Introduction: Nature, Scope and Importance of Digital Marketing; Evolution of Digital Marketing; Core Concepts-Inbound Marketing, Content Marketing, Email Marketing, Influential Marketing; Holistic Digital Marketing Concept, 10Ps of digital marketing; Digital Marketing Environment: Macro and Micro Environment.

Module II: E-banking: approaches, devices, services, benefits, drawbacks, Electronic payment systems-credit cards, debit cards, smart cards, credit accounts, cyber security, encryption, secret key cryptography, public key cryptography, digital signatures, firewalls

Module III: Digital Marketing: Search Engine Optimization (SEO), Social Media, Content Marketing; Email Marketing, Mobile Marketing. Challenges for Digital Marketing: Increased Security Risk, Cluttered Market, Less Focus on Keywords, More Ad Blockers, Increased Ad Costs.

Module IV: Digital Marketing: Pay per Click-Search Engine Advertising, Advantages, Factors, Conversion Rate Optimization (CRO); Digital Marketing- Web Analytic. Social Media Marketing: Face book, Pinterest, Twitter, LinkedIn, YouTube, Google Adwords, Google Analytics; Issues and Future enhancement of Digital Marketing.

CORE TEXT
1. Ian Dodson-*The art of Digital Marketing*, Wiley
ADDITIONAL REFERENCES
1. Puneet Singh Bhatia- *Fundamentals of Digital Marketing*, Pearson Education

Assignments and activities: *Collection of current marketing tools, case studies, new trends.*
NB:- Activities **and assignments are not meant for End_Semester_Examination**

CS1561.2 : INTERNET AND WWW

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	To **understand** the basic concepts of Networks.
CO2	To **learn** the working of Internet.
CO3	To **analyse** different search engines and its working
CO4	To **familiarise** Network Protocols and WWW.

COURSE CONTENT
Module I: Introduction to Network-Types of Network-Network Topologies, Basic communication technology, Intranet, Extranet-Advantages, Internet-History, Modes of Connecting to Internet-Dialup Access-Direct to dedicated connections, Internet Service Providers, Domain Name Service, Internet Addresses-Addressing Scheme-IPV6, Modems, Routers, Network cards Communication Software, Internet Tool-File Transfer Protocols, Search Tools, Telnet.

Module II: Introduction to WWW-WWW and HTTP, Webpage, Introduction to Web Browser-Book Marks-Comparison, Directories, Search Engines-Working and features-Search Strategies – Search Generalization-Search Specialization-Working.

Module III: Uniform Resource Locator (URL), OSI reference model, Introduction to TCP/IP-TCP/IP Model, Email-Working with Email-Sending Mail-Reading Mail-Replying to Mail-Deleting Mail-Advantages and Disadvantages of Email, Basics of Chat Rooms, SMTP.

Module IV: Introduction to Web Server-Personal Web Server (PWS)-Internet Information Server (IIS)-Apache Webserver-Benefits of Web Server, Introduction to Security-Internet Security-Identifying Network Stations, Network Protocols-Internet Security Threats.

CORE TEXT
1. Dr. SurenderJangra, "Basics of Internet and Web", Vayu Education of India. New Delhi, 110002
ADDITIONAL REFERENCES
1. Raymond Greenlaw, Ellen Hepp, "Fundamentals of Internet and the World Wide Web, McGraw-Hill.

CS1561.3 : IMPACT OF SOCIAL MEDIA NETWORKS

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	To understand the types of social media networks and its uses.
CO2	To learn the impact of social media on society& commerce
CO3	To analyse the impact of social media on work, training & development and on relationships
CO4	To familiarize challenges of social media in terms of privacy, security & health

COURSE CONTENT
Module I: Introduction to Social Media networks: Types of Social Media- Uses of Social Media Networks-Popular Social Media Websites-Mobile social media- Types of Users- Growth of social media networks Impact of Social Media on Society: Sharing of Information and its Need – Entertainment – Communication Tool -Influence-Social media activism-societal issues- social cause- Impacts on Politics-Pros and Cons- Positive and negative effects of Social media on Society.

Module II: Impact of Social Media on Commerce: Social media Marketing-Promotion of Business-Digital Marketing & SMM -Advantages to Business-Knowledge sharing and Collaborative Work Management- Customer Benefits-Impacts-pros and cons. Impact of Social Media on the World of Work: Job Recruitment and Hiring-Benefits- Researching Job Candidates-Impact of professional social media networks.

Module III: Impact of Social Media on the Training & Development: Social media in Learning-Online-Long Distance Learning-Impact of Blogs, Wikis, LinkedIn, Twitter, Facebook and Podcast- Privacy and Frauds. Impact of Social Media on relationship: Bonding and Friendships –Pros and Cons- Issues Arising-Impact of Social Media on Kids, Teens & Youth.

Module IV: Challenges of Social Media- Criticism on Social Media-Cyber bullying-Lack of Privacy-Security Issues. Addictions to Social media – Games- Impact on Education: Positive and negative effects–Impact on Physical and Mental Health-Emotional Insecurities- Depression-Anxiety-Behavioural Issues-Wastage of Time etc. Future of Social Media Networks.

CORE TEXT
1. Hana S. Noor Al-Deen, John Allen Hendricks, "Social Media-Usage & Impact", Rowman & Little field Publishing Group

ADDITIONAL REFERENCES
1. Dedria Bryfonski, "The Global Impact of Social Media"-Greenhaven Press
2. Dr.Sanjay Singh Baghel, Dr Uma s singh,'Social Media and Indian Youth" Apple Books Publishers

CS1544 : PYTHON PROGRAMMING LAB

The laboratory work will consist of 10-15 Experiments

PART A
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops. (square root, gcd, exponentiation, sum of an array of numbers, linear search, binary search, bubble sort, insertion sort, selection sort etc.)
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.

PART B
- Read and write data from/to files in Python.
- Programs to demonstrate creating and handling of modules and packages
- Programs involving a variety of Exception Handling situations
- Programs involving Database manipulation
- CGI programming

CS 1545 : FREE and OPEN SOURCE SOFTWARE (FOSS) LAB

PART A
- Installing and Configuring Linux, Basic Linux commands –date, echo, cat with options, ls with options, mkdir, cd, rmdir, cp, mv, cal, pwd, wc, grep with options, who, touch, chmod, cut, mount, command line etc.
- Using desktop environments: GNOME & KDE, File access permissions, understanding system administration

PART B
- Shell programming: basic commands, operators, variables, conditional statements, looping statements, files etc.

REFERENCES
1. Christopher Negus, *Red Hat Linux 9 Bible*, WILEY- Dreamtech, New Delhi,
2. Thomas Schenk, *Red Hat Linux System Administration*, Techmedia, New Delhi, 2003

Semester 6

			Hrs per week				Marks		
Course code	Credits	Course Name	Lecture	Tutorial	Lab	Total	CE	ESE	Total

CS1641	4	Data Analytics	3	1	-	4	20	80	100
CS1642	4	Internet of Things (IoT)	4	-	-	4	20	80	100
CS1643	4	Cyber Security	4	-	-	4	20	80	100
CS1661.1 CS1661.2 CS1661.3	4	**Elective** Machine Learning Block chain Technology Digital Marketing	4	-	-	4	20	80	100
CS1644	4	Major Project	-	-	9	9	-	100	100
TOTAL	**20**		**15**	**1**	**9**	**25**			**500**

CS1641 : DATA ANALYTICS

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	Remember purpose of data analytics
CO2	Understand the principles and tools of data analytics
CO3	Apply different analytical theories and methods
CO4	Analyze text data

COURSE CONTENT

MODULE I: - **An Introduction to Data Analysis** - Data Analysis, **Knowledge Domains of the Data Analyst** - Computer Science, Mathematics and Statistics, Machine Learning and Artificial Intelligence Professional Fields of Application. **Introduction to Big Data Analytics:** - Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem. **Characteristics of Big Data**- Volume, Velocity, Variety, Veracity, Value. **Data Analytics Lifecycle:** -Data Analytics Lifecycle Overview, Discovery**,** Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Case Study: Global Innovation Network and Analysis (GINA).

MODULE II: Advanced Analytical Theory and Methods: Clustering - Overview of Clustering, K-means, Additional Algorithms. **Advanced Analytical Theory and Methods:** - **Association Rules** - Overview, Apriori Algorithm, Evaluation of Candidate Rules, An Example: Transactions in a Grocery Store. **Advanced Analytical Theory and Methods:** Introduction to regression and classification.

MODULE III: Advanced Analytical Theory and Methods: Text Analysis - Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

MODULE IV: Advanced Analytics- **Technology and Tools: MapReduce and Hadoop** - Introduction

to MapReduce and Apache Hadoop. The Hadoop Ecosystem – Pig, Hive, HBase, Mahout, NoSQL. **Advanced Analytics- Technology and Tools: In-Database Analytics:** - SQL Essentials – Joins, Set Operations. In-Database Text Analysis, **Data Privacy and Ethics:** - Privacy Landscape, Rights and Responsibility, Technologies.

CORE TEXT
1. **WILEY**, Data Science & Big Data Analytics- Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, John Wiley & Sons, Inc, 2018.
Website: https://www.wiley.com

ADDITIONAL REFERENCES
1. **Robert J Woz,** Data Analytics for Beginners, 2017.
2. **V.K. Jain,** Data Science and Analytics, Khanna Publishing, 2019.
3. **Anil Maheshwari,** Data Analytics, McGraw Hill Education, 2018.

CS1642 :Internet of Things (IoT)

COURSE OUTCOMES: At the end of the Course, the student will be able to

CO1	**Remember** the purpose of computer networks and its developments
CO2	**Understand** various network technologies, design issues and characteristics
CO3	**Apply** the use of layer architecture for networking systems
CO4	**Analyze** the working of different models of network and data communication
CO5	**Evaluate** data link controls
CO6	**Create** different networking protocols

COURSE CONTENT

Module I: Introduction to IoT - An Architectural Overview - Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

Module II: Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Module III: IoT Data Link Layer & Network Layer Protocols PHY / MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Module IV: Transport & Session Layer Protocols : Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP) - (TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT **SERVICE LAYER PROTOCOLS & SECURITY :**Service Layer - one M2M, ETSI M2M, OMA, BBF - Security in IoT Protocols - MAC 802.15.4, 6LoWPAN, RPL, Application Layer

CORE TEXT

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**",** 1st Edition, Academic Press, 2014.

ADDITIONAL REFERENCES

1. Peter Waher**, "**Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
4. Vijay Madisetti and Arshdeep Bahga, **"**Internet of Things (A Hands-on Approach)**",** 1st Edition, VPT, 2014.
5. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

ASSIGNMENTS AND ACTIVITIES: Case studies on the application of IoT in different scenarios

NB:- Activities **and assignments are not meant for End_Semester_Examination**

CS1643 : CYBER SECURITY

COURSE OUTCOMES: At the end of the course the student will be able to

CO1	Understand the features, development and use of information systems
CO2	Identify the various types of information system risks, threats and pitfalls.
CO3	Analyze the security approaches applied.
CO4	Compare the approaches in the context of achieving security goals.
CO5	Create awareness about cyber laws and cyber crimes and cyber ethics.

COURSE CONTENT

Module I: Introduction to Information Systems: components, categories, types, individuals involved, steps in developing information systems, Information Assurance, security challenges, need for cyber security, **Information Security Risk analysis:** use and benefits of risk analysis, risk analysis model, risk assessment, risk equation, risk management, trusted computing.

Module II: Cyber Security Threats and vulnerabilities: types of threats, attacks, malwares, firewalls, hacking, network and services attack, IDPS, honeypots, cryptography and cryptanalysis, network behaviour analysis**, Intrusion Detection Systems:** Types and components of IDS- Network based, Host Based, Hybrid IDS, wireless IDPS

Module III: Security policies: needs and uses**,** policy development, types of security policies, steps in policy review process, **Security Standards**- ISO, Intellectual property rights, patents, trademarks, copyrights, software licensing, e-contracts, Cyber laws in India.. **Security and Law:-**Regulations in India- IT Act 2000/2008, Cyber Crime- cyber law, Indian Copyright Act, Indian Contract Act , Consumer Protection Act, Future Trends –The Law of Convergence.

Module IV: Cybercrimes and cyber ethics: cyber space, cyber crimes-nature and scope of cyber crimes**,** types and categories of cybercrimes, penalty for cybercrimes under IT Act, digital foot prints,

cyber forensics, Cyber ethics- concerns and responsibilities.

CORE TEXT
1. Fundamentals of Cyber Security, Mayank bhushan, BPB publication, First Edition 2017

ADDITONAL REFERENCES
1. Security in Computing, Charles P.Pfleeger, Shari Lawrence Pfleeger, Pearson Publication, Fifth Edition 2015
2. Introduction to Information Security and Cyber Law, Surya Prakash Tripathi, Dreamtech Press, 2014

ELECTIVES

CS1661.1 : MACHINE LEARNING

COURSE OUTCOMES: At the end of the Course, the Student will be able to

CO1	Remember applications of machine learning
CO2	Understand different learning techniques
CO3	Apply clustering of raw data
CO4	Analyse the performance of classification methods
CO5	Evaluate hierarchical methods
CO6	Create a semi supervised learning model

COURSE CONTENT
Module I: What is Machine Learning? Machine Learning Vs. Traditional Programming, How Machine Learning Works? Applications of Machine Learning, Selecting the right features, Understanding data:- numeric variables – mean, median, mode, Measuring spread. Types of Learning – Supervised Learning, Unsupervised Learning, Semi-supervised Learning, Challenges in Machine Learning.

Module II: Regression – Introduction, Types of Regression, Linear Regression, Multiple Linear Regression, Non-Linear Regression (Polynomial Regression) Classification –Introduction, Logistic Regression, Decision Trees, Naïve Bayes Classification, Support Vector Machines, K-Nearest Neighbours, Random Forest

Module III: Clustering- Introduction, Requirements of Clustering, Types of Data in Cluster Analysis -Interval-Scaled Variables, Binary Variables, Categorical Variables, Ordinal Variables, Ratio-Scaled Variables, Variables of Mixed Types. Categorization of Major Clustering Methods - Partitioning Methods - K-means, K-medoids, CLARANS. Hierarchical Methods -Agglomerative Clustering, BIRCH, Density-based Methods – DBSCAN

Module IV: Advanced multivariate analysis – Introduction-Dimensionality Reduction - Principal Component Analysis, Linear Discriminant Analysis, Principal Component Analysis Vs. Linear Discriminant Analysis. Multidimensional scaling. . Evaluating Model Performance: Precision and recall, Confusion matrix, Cross validation Bootstrap sampling, Improving model performance with ensemble learning, Bagging and Boosting

CORE TEXT
1) Vinod Chandra S S, Anand H S, Artificial Intelligence and Machine Learning, Prentice

Hall of India, New Delhi, 2014

2) C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

ADDITIONAL REFERENCES
1) K. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2) Vinod Chandra S S, Anand H S, Machine Learning: A Practitioners Approach, Prentice Hall of India, New Delhi, 2020
3) Brett Lantz, "Machine Learning with R", Packt Publishing, 2nd Edition.
4) Tom Micheal, "Machine Learning", Mcgraw Hill (1997)
5) Simon Rogers, Mark Girolami, "A First course in Machine Learning", CRC Press, First Indian reprint, 2015.
6) N P Padhy, "Artificial Intelligence and Intelligent Systems", Oxford Uty Press, 1st Edn.
7) E. Alpayidin, "Introduction to Machine Learning", Prentice Hall of India (2005)
8) T. Hastie, RT Ibrashiran and J. Friedman, "The Elements of Statistical Learning", Springer 2001
9) Toby Segaran, "Programming Collective Intelligence: Building Smart Web 2.0 Applications", O'Reilly Media; 1 edition (16 August 2007).
10) Drew Conway, John Myles White, "Machine Learning for Hackers: Case Studies and Algorithms to Get You Started", O'Reilly Media; 1 edition (13 February 2012)
11) Machine Learning - Course Materials @ http://cs229.stanford.edu/materials.html

Suggested MOOC

1. https://www.coursera.org/learn/machine-learning

CS1661.2 : BLOCKCHAIN TECHNOLOGY

COURSE OUTCOMES : At the end of the course, the student will be able to

CO1	**Understand** the concepts behind Blockchain technology
CO2	**Analyze** the challenges in practical uses
CO3	**Evaluate** the various implementation criteria
CO4	**Remember** the new components of Blockchain technology

COURSE CONTENT

Module I:- Introduction: History of block chain, Generic elements of block chain ,Features of block chain, Types of block chain, Benefits and limitations, Decentralization, Smart contract, cryptography, DES,AES, Asymmetric cryptography, Public and Private keys, RSA, Hash function, Merkle tree, Patria trees, Distributed Hash Tables(DHTs),Digital Signature

Module II :- Bit coin: Definition, Keys and address, Public and Private keys, Currency units, Transation: Structure and types of transactions, Block chain: Structure of a block, The genesis block, The bitcoin network, Wallets, Bit coin payments, Alternative coin, Bit coin limitations, Name coin ,Lite coin, Cash

Module III :- Smart Contract :Ricardian Contract, Smart contract templates, Smart oracles, Deploying smart contract on a block chain, The DAO, Ethereum 101: Ethereum clients and releases, The Ethereum stack, Ethereum block chain, currency, Forks, Gas, The consensus mechanism, Elements of the Ethereum blockchain: Ethereum Virtual Machine(EVM),Execution environment, Machine state, Functions and Operations, Precompiled contracts, Accounts, Block, Ether, The yellow paper, The Ethereum network

Module IV:- Introduction to WEB3: POST requests, The HTML and JavaScript frontend, Development frameworks, Introduction to Hyper ledger, Hyper ledger as a protocol reference architecture and

requirements, Hyper ledger Fabric ,Fabric architecture, Components of the Fabric, CORDA, architecture, Components and Development environment, Alternative Blockchains, Blockchain Outside of currencies

CORE TEXT
 1.   Mastering Block chain by Imran Bashir (Second edition)

ADDITIONAL REFERENCES
1 Block chain -A step by step guide for beginners to implementing blockchain technology and Leveraging block chain programming By Tailor Jacobs
2 Block chain Technology explained By Alan .T. Norman

Assignment and activities: - Case studies on different application areas of blockchain technology. Study the future scope and compare the implementation methods.

NB:- Activities and assignments are not meant for End_Semester_Examination

CS1661.3 : DIGITAL MARKETING

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1	Understand different digital marketing types
CO2	Understand the main concepts and key technologies of digital marketing.
CO3	Remember the concept of e-banking, cyber security
CO4	Analyze the evolution of digital marketing from the existing technologies.
CO5	Analyze services using digital marketing

COURSE CONTENT

Module I: Introduction: Nature, Scope and Importance of Digital Marketing; Evolution of Digital Marketing; Core Concepts-Inbound Marketing, Content Marketing, Email Marketing, Influential Marketing; Holistic Digital Marketing Concept, 10Ps of digital marketing; Digital Marketing Environment: Macro and Micro Environment.

Module II: E-banking: approaches, devices, services, benefits, drawbacks, Electronic payment systems-credit cards, debit cards, smart cards, credit accounts, cyber security, encryption, secret key cryptography, public key cryptography, digital signatures, firewalls

Module III: Digital Marketing: Search Engine Optimization (SEO), Social Media, Content Marketing; Email Marketing, Mobile Marketing. Challenges for Digital Marketing: Increased Security Risk, Cluttered Market, Less Focus on Keywords, More Ad Blockers, Increased Ad Costs**.**

Module IV: Digital Marketing: Pay per Click-Search Engine Advertising, Advantages, Factors, Conversion Rate Optimization (CRO); Digital Marketing- Web Analytic. Social Media Marketing: Face book, Pinterest, Twitter, LinkedIn, YouTube, Google Adwords, Google Analytics; Issues and Future enhancement of Digital Marketing.

CORE TEXT
              1. Ian Dodson-*The art of Digital Marketing*, Wiley
ADDITIONAL REFERENCES
              1. Puneet Singh Bhatia- *Fundamentals of Digital Marketing*, Pearson Education
Assignments and activities: *Collection of current marketing tools, case studies, new trends.*

CS1644: MAJOR PROJECT

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1 : CREATE an industry-standard project through a real-life project work under time and deliverable constraints, applying the knowledge acquired through various courses.
CO2 : To provide an opportunity to apply the knowledge gained through various courses in solving a real life problem
CO3 : To provide an opportunity to practice different phases of software/system development lifecycle
CO4 : To introduce the student to a professional environment and/or style typical of a global IT industry
CO5 : To provide an opportunity for structured team work and project management
CO6 : To provide an opportunity for effective, real-life, technical documentation
CO7 : To provide an opportunity to practice time, resource and person management.

1. **PROJECTGUIDELINES**
   - Group Size – Maximum 4, most preferably-3
   - No. of records – No. of group members+ 1 (Department copy)
   - Certificate should include the names of all members

The minimal phases for the project are: Project feasibility, Investigation of system requirements, Data and Process Modeling, System Design, Program design, Program coding and unit testing, System integration, System implementation and acceptance testing.

1.1 Planning the Project: The Major Project is an involved exercise which has to be planned well in advance. The topic should be chosen in Semester 4 itself and the study of Course CS1342 should as far as possible, be based on the project topic, although in cases with valid reasons, the project guide may waive this condition. Related reading, training and discussions should start from semester 5itself.

1.2 Selection of project work: Project work could be of 3types:

a) Developing solution for a real-life problem: In this case, a requirement for developing a computer based solution already Exists and the different stages of system development life cycle is to be implemented successfully. Examples are Accounting Software Package for a particular organization, Computerization of administrative functions of an organization, Web Based Commerce, etc. The scope for creativity and exploration in such projects is limited, but if done meticulously, valuable experience in the industrial context can be gained.

(b) Innovative Product development: These are projects where a clear-cut requirement for developing a computer based solution may not be existing, but a possible utility for the same is conceived by the proposer. An Example is a Malayalam Language Editor with Spell Checker, Computer Music Software for Indian Music, Heat Engines Simulation Software for eLearning, Digital Water Marking Software etc.

(c) Research level project: These are projects which involve research and development and may not be as structured and clear cut as in the above case. Examples are Malayalam Character Recognition, Neural Net Based Speech Recognizer, Biometric Systems, Machine Translation System etc. These projects provide more challenging opportunities to students and can be attempted.

If any student identifies proper support in terms of guidance, technology and references from External organizations and also the supervisors are convinced of the ability of the student(s) to take up the project,

it shall be permitted. The methodology and reporting of such projects could be markedly different from type (a) and is left to the proposer/external supervisor of the projects.

1.3 Selection of Team: To meet the stated objectives, it is imperative that Major Project is done through a team effort**.** Though it would be ideal to select the team members at random (drawing lots) and this should be strongly recommended, due to practical considerations, students may also be given the choice of forming themselves into teams preferably **3** in numbers up to a maximum of **4** members(teams less than 3 members may be permitted in certain cases, or valid reasons). A gender mix should also be strongly suggested. A team leader shall be elected through drawing lots. Teams shall maintain team meeting minutes and ensure that every team member has tasks assigned in writing. Team meeting minutes shall form a part of the Project Report. Even if students are doing projects as groups, each one must independently take up different modules of the work and must submit the reports also independently (though, in such cases, some common materials is permissible). Evaluation will also be done independently.

1.4 Selection of Tools: No restrictions shall be placed on the students in the choice of platforms/tools/languages to be utilized for their project work, though open source is strongly recommended, wherever possible. No value shall be placed on the use of tools in the evaluation of the project.

1.5 Selection of Organization & Guide: No restrictions shall be placed on the students in the choice of organization where project work may be done, in terms of locality, type (public/private)etc. It is the duty of the Head of Institute/Principal of College to ensure that the Aim, Objectives and full project guidelines are communicated to the external organization. The guide should ideally be a post-graduate with minimum 2 years of work experience.

Students may also choose to do project in the college/institute (or partially in the college/institute and partially in an external organization), especially product-based work, but in such cases the supervisors must ensure that (i) industry practices are followed (ii)the students undertake a planned visit an IT industry with international operations to make up for the loss of experience and (iii) the services of an external guide with industry experience is obtained.

1.6 Project Management: Head of Department /Institute should publish a list of students, projects topics, internal guide and external organization (if any) and teams agreed, before the end of semester 5. Changes in this list may be permitted for valid reasons and shall be considered favourably by Head of Department/Institute any time before commencement of the project. Any request for change after commencement should considered by a committee of 3 teachers and their recommendation shall be accepted by Head of Department/Institute.

1.7 Gantt-chart of proposed activities and a draft statement of project deliverables (which may subsequently be altered if justified) should be prepared before the commencement of the project. The actual completion of each phase should be noted on the chart in the course of the project work. Team meetings should document the progress of the project. Students should submit a fortnightly report of progress which could be indication of percentage of completion marked on the original Gantt-chart, with any notes attached. Students should ideally keep a daily activity log sheet. Changes in the submitted documents are possible, as project development is essentially an evolutionary process. The project guide must ensure that changes are necessary due to the knowledge gained in succeeding phases of the project. The date of Completion of a phase should be brought forward if the changes made are deemed to be errors and not due to additional knowledge gained from a succeeding phase.

1.8 Documentation:

The following are the major guidelines: The final outer dimensions of their port shall be 21cm X 30 cm. The colour of the flap cover shall be light green. Only hard binding should be done, with title of the Project and the words "< TITLE> BSc(CS) Project Report 2018" displayed on the spine in 20 point, Bold, Times New Roman. It is highly recommended that Latex be used for documentation.

• The text of the report should be set in 12 pt, Times New Roman, 1.5Spaced.

- Headings should be set as follows: CHAPTER HEADINGS 20 pt, Times New Roman, Bold, All Caps, Centered.
  1. SECTION HEADINGS 12 pt, Times New Roman, Bold, All Caps, Left Adjusted.

  1. 1 Section Sub-headings 12 pt, Times New Roman, Bold, Left Adjusted.

  Titles of Figures, Tables etc are done in 12 point, times New Roman, Italics, Centered.

PROJECT REPORT
<DEPARTMENT NAME>

<COLLEGE NAME > <EMBLEM>
<PROJECT TITLE>
Submitted by <STUDENTNAME(REG.NO.)>

Submitted in partial fulfilment of
the requirements for the award of

BSc (Computer Science) degree of

University of Kerala

2024

Some general guidelines on documentation stylistics are:

- Double quotes and single quotes should be used only when essential. Words put in quotes are better highlighted by setting them in italics. Eg: This process is known as "morphing". This process is known as *morphing.*
- Page numbers shall be set at right hand top corner, paragraph indent shall be set as3.
- Only single space need be left above a section or sub-section heading and no space may be left after them.
- Certificate should be in the format: "Certified that this report titled.......................................is   a bonafide record of the project work done by Sri/Kum.....................under   our   supervision   and guidance, towards partial fulfillment of the requirements for the award of the Degree of BSc (Computer Science) of the University of Kerala" with dated signatures of Internal Guide, external guide and also Head of Department/Institute.
- If the project is done in an external organization, another certificates on the letterhead of the organizations required: "Certified that this report titled...is   a   bonafide record of the project work done bySri/Kum...under   any supervision and guidance, at the ....Department of.................... (Organization) towards partial fulfilment of the requirements for the award of the Degree of BSc (Computer Science) of the University of Kerala".
- References shall be IEEE format (see any IEEE magazine or transaction). Take care in use of italics and punctuation. While doing the project, keep note of all books you refer, in the correct format, and include them in alphabetical order in your reference list. Eg: A book is cited as: Kartalopoulos, S V Understanding Neural Networks and Fuzzy Logic, BPB Publishers, 1996, pp. 21-27. (pp.21-27 indicates that pages 21-27 have been referred. If the whole book is being referred, this may be omitted. If a single page is referred, say 7, it may be cited asp.**7.**

- **Report writing is NOT a hasty activity done after finishing the project**. Students must try to

develop the report along with the work, so as to give it flesh and blood. Drafts should be read, modified, spell checked and grammar checked at least thrice during the course of the project and before a final printout is taken, the same may be got approved from the internal guide.

- The students should send two interim reports after the analysis and design phases of the project to internal guides. This will also help the students in their report writing.
- A soft copy of the complete documentation, including source code, should be maintained for any clarification during assessments.
- The Gantt chart, fortnightly progress reports recorded in team meeting minutes mentioned in section 3.5 should appear as appendix to the project report.

Regarding the body of the report, as an indicative example, the following is given (though students should not attempt to fit every kind of project report into this format):
- Organizational overview (of the client organization, where applicable)
- Description of the present system
- Limitations of the present system
- The Proposed system- Its advantages and features
- Context diagram of the proposed system.
- DFD of the proposed system with at least one additional level of Expansion
- Structure Chart/E-R diagrams of the System
- System flowchart
- Files or tables (for DBMS projects) list. Class names to be entered for each file in OO systems.
- List of fields or attributes (for DBMS projects) in each file or table.
- File table that shows the files/tables used by each program and the files are read, written to, updated, queried or reports were produced from them.
- Reports List with column headings and summary information for each report.
- System Coding and variable/file/table naming conventions
- System controls and standards
- Screen layouts for each data entry screen.
- Report formats for each report.
-
  Program documentation is suggested on the following lines:
- Program id
- Program function explanation
- Program level pseudo code or flowchart.
- Data entry screen (reproduced from system documentation).
- Report layout (reproduced from system documentations)
- Decision tables, decision trees, with English Explanation where necessary.
- Program listing
- Test data
- Test results.

1.9 Methodology:
Wherever applicable, object oriented approach should be used for software development. The project report should generally contain details of the following steps *(though students should not attempt to fit every kind of project into this format):*

(a) Analysis
- Study of existing systems and its drawbacks

- Understanding the functionalities of the system in detail
- Preparation of requirements
- Conduct of Feasibility study
  - Development of DFD/use case diagrams

(b) Design
- Design of each subsystems/modules
- Design of each classes
- Design of Algorithms for problem solving
- User interface /Input/ Output Design
- Any other steps if necessary
(c) Coding and Implementation
(d) Testing
(e) Security, Backup and Recovery Mechanisms
(f) On line help and User Manuals
(g) Upgradability Possibilities

1.10 **Project IPR & Utilization:** The intellectual property rights in all project work done by the students shall vest with the University of Kerala, except in cases where some external organizations seek undertaking from students to concede IPR in all work done in their organization or under their guidance. Where possible, students should attempt to obtain at least a joint IPR for the University. In cases where project works are of public utility, students shall be asked to publish their work including source code and documentation, in so far as their rights are clear.

CORE TEXT
- S A Kelkar, *Software Project Management*, Prentice Hall of India
- W Alan Randolph, Barry Z. Posner, *Effective project planning and management* ,PHI

ADDITIONAL REFERENCES
- Greg Mandanis, *Software Project Management Kit for Dummies*, IDG Books Joel Henry, *Software Project management*
- Frederic P B, Mythical Man-month, *Essays on Software Engineering*, Addison Wesley David Lamport, *Latex: A document Preparation System*, 2/e, Pearson Edn

3. EVALUATION

3.1 Criteria for external evaluation of Major Project

External evaluation is done by an external examiner appointed by the University

The following components are to be assessed for the End Semester Evaluation of the Major Project:

Quality of documentation	: 30 marks
Individual involvement & team work	: 30 marks
Presentation of work	: 20 marks
Viva Voce	: 20 marks
TOTAL	**: 100 marks**

INDUSTRIAL VISIT - CUM STUDY TOUR

Study tour to be mandatory for the BSc Computer Science Programme. In view of the current Covid-19 situation, considering the safety of all, it is applicable only after the lockdown period. It should cover an organization where functional applications of concepts/ theories covered in the Programme are being practiced. The visit should be pre- planned with an objective to learn identified applications like computation, algorithms, programming languages, program design, computer software, computer hardware etc.

The total time to be devoted in the organization is one day out of five days set aside for the tour. The outcome of the visit to be documented in a report with the following form a Student Tour Dairy

1. Name of the College
2. Name of the Student
3. B.Sc Programme …………..Semester
4. Name of the Organisation
5. Date of Visit
6. Learning Objectives
7. Interactions held ……………….
8. Outcome in the form of learnings …………………………
9. Observations (along with pictures, citations, illustrations)

Counter Signed by HoD