



**Parvatibai Chowgule College
Of Arts And Science
(Autonomous)**

LEARNING OUTCOME-BASED EDUCATION (LOBE)

for

**Undergraduate Programme
BSc Computer Science Department
(LOCF)**

1. Introduction

The Department of Computer Science was established in 1986. With the initiatives taken by the former Principal V.R. Shirgurkar, Prof. C.D. Pradhan and Late Prof. U.A. Katre, the Post Graduate Diploma in Computer Applications was offered to the students and herein started the growth journey of the department. The department has played a major role in contributing to the academic community and society at large.

Subsequently, recognizing the need for skilled computer professionals, the B.Sc. program in Computer Science was introduced in the year 1991 and M.Sc. IT (Information Technology) was started in the year 2003. Both these programs are affiliated to the Goa University. Department of Computer Science took an initiative to start BVoc program in Software Development in the year 2017.

To augment the knowledge base of the students, the department conducts various short term, add-on/honors programmes, seminars, workshops, internship programme and other need based courses from time to time. The department has launched three Inter-Collegiate Technical Competitions GIGATECH, I-RIX and Technobit in which students from other colleges of the state take part.

Identifying the need of using open source softwares the department took an initiative to start FOSS(free and open source) club in the year 2015. A large number of students have passed out from this department over the last 34 years and have been absorbed by the industrial and business houses.

The department uses modern teaching and learning aids for teaching learning process. Department is well equipped with up to date hardware and software laboratories. All the above facilities are supported by a centralized uninterrupted power supply.

2. Objectives:

Mission Statement:

This B.Sc programme is for students interested in Object Oriented Programming, Database Administration, Web Designing, Software Engineering, Computer Networking, Operating systems, Server Side Programming, Mobile Application Development, Multimedia Techniques etc.

B.Sc curriculum includes core courses in Programming, Advanced Database Management Systems, Operating Systems, Data Structures, Computer Networking, Computer Architecture & Organization etc. The elective courses include Software engineering, Web Designing, Server Side Programming,

Embedded Systems, HCI, Cloud Computing, software Testing, Multimedia Techniques, Digital Marketing etc.

Apart from regular lectures, presentations and assignments, we also organize workshops and lectures on recent IT technologies, conducted by industry professionals. Students Projects and assignments³ undergo verification & validation standards by faculty and industry experts. Our students undertake and work on live projects through FOSS (Free Open Source Software) Club to get hands-on experience.

Our infrastructure has well equipped labs with Wi-Fi support, Seminar hall and an Oracle 12c specialized lab. The Department also encourages students to undertake online certification courses provided by global companies/institutes (Oracle,D-Link, Mumbai IIT's Spoken Tutorial, Leap courses etc.).

Unique to this course are:

The Department has signed an MOU with Infiswift which entitles our students to be given preference during allotment of projects/internship by Infiswift.

Industrial Internship – Our Department students also implement projects in any IT industry or Organization.

After completion of B.Sc course our students are empowered to pursue a career in any software development industry; start an entrepreneurial venture or pursue a career in academics and research field.

Students who have passed XII Science with at least a minimum of 50% marks are eligible to take up this course on merit basis.

3.Overview of Department:

4. Graduate Attributes:(GA)

Graduate Attributes (GA) are the qualities, skills and understandings that students should develop during their time with the HEI. These are qualities that also prepare graduates as agents of social good in future.

Graduate Attributes can be viewed as qualities in following subcategories.

- Knowledge of the discipline
- Creativity
- Intellectual Rigour
- Problem Solving and Design
- Ethical Practices
- Lifelong Learning
- Communication and Social Skills

Among these attributes, categories attributes under Knowledge of the Discipline are specific to a programme of study.

3.1.a. Knowledge of Discipline of CS Knowledge of a discipline is defined as "command of a discipline to enable a smooth transition and contribution to professional and community settings. This Graduate Attribute describes the capability of demonstrating comprehensive and considered knowledge of a discipline. It enables students to evaluate and utilize information and apply their disciplinary knowledge and their professional skills in the workplace.

3.1.b. Creativity is a skill that underpins most activities, although this may be less obvious in some disciplines. Students are required to apply imaginative and reflective thinking to their studies. Students are encouraged to look at the design or issue through differing and novel perspectives. Creativity allows the possibility of a powerful shift in outlook and enables students to be open to thinking about different concepts and ideas.

3.1.c. Intellectual Rigour is the commitment to excellence in all scholarly and intellectual activities, including critical judgment. The students are expected in having clarity in thinking. This capability involves engaging constructively and methodically when exploring ideas, theories and philosophies. It also relates to the ability to analyze and construct knowledge with depth, insight and intellectual maturity.

3.1.d. Problem Solving and Design Problem solving skills empower students not only within the context of their programmes, but also in their personal and professional lives. Many employers cite good problem solving skills as a desired attribute that they would like graduates to bring to the workplace. With an ability to seek out and identify problems, effective problem solvers are able to actively engage with a situation, think creatively, to consider different perspectives to address identified challenge, to try out possible solutions and subsequently evaluate results as a way to make decisions. Through this process they can consolidate new and emergent knowledge and develop a deeper understanding of their subject discipline.

3.1.e. Ethical Practices key component of professionalism and needs to be instilled in curricula across courses. When operating ethically, graduates are aware that we live in a diverse society with many competing points of view. Ethical behaviour involves tolerance and responsibility. It includes being open-minded about cultural diversity, linguistic difference, and the complex nature of our world. It also means behaving appropriately towards colleagues and the community and being sensitive to local and global social justice issues.

3.1.f. Life-Long Learning The skill of being a lifelong learner means a graduate is open, curious, willing to investigate, and consider new knowledge and ways of thinking. This flexibility of mind means they are always amenable to new ideas and actively seek out new ways of learning or understanding the world.

3.1.g. Communication and Social Skills The ability to communicate clearly and to work well in a team setting is critical to sustained and successful employment. Good communication and social skills

involve the ability to listen to, as well as clearly express, information back to others in a variety of ways - oral, written, and visual - using a range of technologies.

3.1.h. **Self-Management Graduates** must have capabilities for self-organization, self-review, personal development and life-long learning.

3.2 LIST OF GRADUATE ATTRIBUTES for B.Sc. and B.Sc.(Hons)

Afore-mentioned GAs can be summarized in the following manner.

GA 1. A commitment to excellence in all scholarly and intellectual activities, including critical judgment.

GA 2. Ability to think carefully, deeply and with rigour when faced with new knowledge and arguments.

GA 3. Ability to engage constructively and methodically when exploring ideas, theories and philosophies.

GA 4. Ability to consider other points of view and make a thoughtful argument.

GA 5. Ability to develop creative and effective responses to intellectual, professional and social challenges.

GA 6. Ability to apply imaginative and reflective thinking to their studies.

GA 7. Commitment to sustainability and high ethical standards in social and professional practices.

GA 8. To be open-minded about cultural diversity, linguistic difference, and the complex nature of our world.

GA 9. Ability to be responsive to change, to be inquiring and reflective in practice, through information literacy and autonomous, self-managed learning.

GA 10. Ability to communicate and collaborate with individuals, and within teams, in professional and community settings.

GA 11. Ability to communicate effectively, comprehending and writing effective reports and design documentation, summarizing information, making effective oral presentations and giving and receiving clear oral instructions.

GA 12.Ability to demonstrates competence in the practical art of computing in by showing in design an understanding of the practical methods, and using modern design tools competently for complex real-life IT problems.

GA 13. Ability to use a range of programming languages and tools to develop computer programs and systems that are effective solutions to problems.

GA 14.Ability to understand, design, and analyze precise specifications of algorithms, procedures, and interaction behaviour.

GA 15.Ability to apply mathematics, logic, and statistics to the design, development, and analysis of software systems.

GA 16.Ability to be equipped with a range of fundamental principles of Computer Science that will provide the basis for future learning and enable them to adapt to the constant rapid development of the field.

GA 17.Ability of working in teams to build software systems.

GA 18.Ability to identify and to apply relevant problem-solving methodologies.

GA 19.Ability to design components, systems and/or processes to meet required specifications.

GA 20.Ability to synthesize alternative/innovative solutions, concepts and procedures.

GA 21.Ability to apply decision making methodologies to evaluate solutions for efficiency, effectiveness and sustainability.

GA 22.A capacity for self-reflection and a willingness to engage in self-appraisal.

GA 23.Open to objective and constructive feedback from supervisors and peers. GA 24.Able to negotiate difficult social situations, defuse conflict and engage positively in purposeful debate.

5.Qualification Descriptors:

Qualification descriptors are generic statements of the outcomes of study. Qualification descriptors are in two parts. The first part is a statement of outcomes, achievement of which a student should be able to demonstrate for the award of the qualification. This part will be of interest to those designing, approving and reviewing academic programmes. They will need to be satisfied that, for any programme, the curriculum and assessments provide all students with the opportunity to achieve, and to demonstrate achievement of, the outcomes. The second part is a statement of the wider abilities that the typical student could be expected to have developed. It will be of assistance to employers and others with an interest in the general capabilities of holders of the qualification. The framework has the

flexibility to accommodate diversity and innovation, and to accommodate new qualifications as the need for them arises. It should be regarded as a framework, not as a straitjacket.

5.1. Qualification Descriptor for B.Sc. with CS :

On completion of B.Sc. with Computer Science, the expected learning outcomes that a student should be able to demonstrate are the following.

QD-1. Fundamental understanding of the principles of Computer Science and its connections with other disciplines.

QD-2. Procedural knowledge that creates different types of professionals related to Computer Science, including research and development, teaching and industry, government and public service.

QD-3. Skills and tools in areas related to computer science and current developments in the academic field of study.

QD-4. Use knowledge, understanding and skills required for identifying problems and issues, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, and their application, analysis and evaluation using methodologies as appropriate to Computer Science for formulating solutions.

QD-5. Communicate the results of studies undertaken in Computer Science accurately in a range of different contexts using the main concepts, constructs and techniques.

QD-6. Meet one's own learning needs, drawing on a range of current research and development work and professional materials.

QD-7. Apply Computer Science knowledge and transferable skills to new/unfamiliar contexts.

QD-8. Demonstrate subject-related and transferable skills that are relevant to industry and employment opportunities.

6.PROGRAMME LEARNING OUTCOMES (PLOs) for B.Sc. Computer Science

Programme Learning Outcomes (PLO)	Short Title of the POs	Description of the Programme Outcomes Graduates will be able to :
PLO-1	Problem Analysis and Solutions	Think critically, identify, analyze problems/ situations and further attempt to design/ develop solutions that meet the specified goals.
PLO-2	Use of Technology	Apply appropriate IT tools efficiently in their daily life-

		professional and personal.
PLO-3	Environment and Sustainability	Be aware of environmental issues and commit towards sustainable development at local/ national and global context.
PLO-4	Ethics	Recognize and understand professional ethics /human values and be responsible.
PLO-5	Individual and Team work	Function effectively at various levels, capacities and situations.
PLO-6	Communication	Communicate proficiently (oral and written) as a responsible member of society.
PLO-7	Research Aptitude	Understand general research methods and be able to analyse, interpret and derive rational conclusions.
PLO-8	Life Skills	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of domain specific change.

PROGRAMME SPECIFIC OUTCOMES (PSO) for B.Sc. Computer Science

At the end of the programme the students will be able to:

PSO1: Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.

PSO2: Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.

PSO3: Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.

PSO4: Apply the concept of networking and security features in designing the systems.

7. Course Structure of B.Sc. Computer Science

STRUCTURE	CREDITS	SUBJECT	Major(Core)	Minor	Elective
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			SPECIFIC COURSES	+ Project		(Major/ Generic)
Component A (92 Credits)	CHOICE 1 : Single Major	32+4	8 Core Courses (Major) + Project Paper	8 + 1		
		48	12 Elective Courses (Major)			12
		8	2 Generic Elective Courses			2
	CHOICE 2 : Major – Minor	32+4	8 Core courses (Major)+ Project Paper	8 + 1		
		24	6 Elective Courses (Major)			6
		24	6 Core Courses (Minor)		6	
		8	2 Generic Elective Courses			2
	CHOICE 3 : Double Major	32+4	8 Core Courses (Major-1) + Project Paper	8 + 1		
		32	8 Core Courses (Major-2)	8		
		16	2 Elective Courses (Major-1) + 2 Elective Courses(Major-2)			4
		8	2 Generic Elective Courses			2
	STRUCTURE		CREDITS	FOUNDATION COURSES	Compulsory	
		4	Language	1		
Component B (28 Credits)	Foundation Courses	4	Academic Writing (AW)	1		
		4	Research Writing (RW)	1		
		4	*Statistical Methods/ (SM) **Elements of Basic Statistics	1		
		4	Environmental Studies (EVS)	1		

		8=(4+4 or 4+2+2 or 2+2+2+2)	Skill Enhancement Courses (SEC) of 2 or 4 credits (Internal Option Offered)		2 to 4
Component C (6 Credits)	Extra-curricular	6 Or 3+3 Or 2+4 Or 2+2+2	Music / Dance Programme	One Or A Combination of Programmes	
			Sports Programme		
			NCC Programme		
			NSS Programme		
			Life-skills Programmes		
			Student Exchange Programme		
			Outreach Programme		
			Fine Art		
Component D	Internship	4	Internship (Minimum One Month / 120 Contact Hours)	1	
* Statistical Methods (For Economics, Geography, Psychology, Botany, Biotechnology, Biochemistry, Chemistry, Computer Science, Geology, Mathematics, Physics and Zoology) ** Elements of Basic Statistics (For English, French, Hindi, Konkani, Marathi, History, Philosophy and Sociology)					

8.Course Description

SEM E STER	CORE COMPULSORY		CORE ELECTIVE			
I	COM-I.C-1 Mathematical Foundation of Computer Science -I	COM-I. C-2 * Introduction to Programmin g	----	---	----	---

II	COM-II.C-3A** Database Management System I	COM-II.C4* Data Structures	----	---	----	---
III	COM-III.C-5A* Object Oriented Programming	----	COM-E1 Software Engineering	COM-E2 Digital Logic Design	COM-E3 Mathematical Foundation of Computer Science -II	COM-E4 Web Designing
IV	COM-IV.C-6 Computer Architecture and Organization	----	COM-E5 Design & Analysis of Algorithms	COM-E10 Mobile Application Development	COM-E7 Server Side Programming	COM-E8 Human Computer Interface
V	COM-V.C7* Operating Systems	----	COM-E9 Embedded Systems	COM-E17 Database Management Systems II	COM-E11 Introduction to Data Science	COM-E12 Software Testing
VI	COM-VI.C-8* Computer Networks	----	COM-E13 Network Security	COM-E14 Cloud Computing	COM-E15 Multimedia Techniques	COM-E16 Digital Marketing

9. COURSE DESCRIPTION

Semester I

Course Title: Mathematical Foundation of Computer Science I

Course Code: COM-I.C-1

Marks: 75

Credits: 3

Duration: 45Hrs

Prerequisite Courses: Nil

Course Objectives:

- To build mathematical foundations that are essential requirement in understanding various concepts related to computer science.

Course Outcome:

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

CO1: Explain various fundamental concepts.

CO2: Convert a given number from one base to another.

CO3: Apply counting principles to determine probabilities.

CO4: Demonstrate an understanding of relations and functions and determine their properties.

CO5: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

CO6: Write an argument using logical notation and determine if the argument is valid or not.

CO7: Construct and analyze finite state automata.

SYLLABUS

UNIT I: Combinatory and Number systems

[15 HRS]

Permutations; Combinations; Counting; Summation; generating functions; recurrence relations.

Binary Number System-Decimal to binary conversion and vice versa, binary number representation (signed, 1's Complement and 2's complement) binary addition, subtraction, binary to octal, hexadecimal conversion and vice versa. Floating point representation.

UNIT II: Boolean Algebra, Set, Relations and Functions

[15HRS]

Boolean functions, truth table, De Morgan's theorem, logic gates, Realization of Boolean Function using logic gates, Simplification using Karnaugh map.

Set-Venn diagram, set operations, relations and properties, closures, equivalence, relations, ordering

Functions-function types, inverse of functions, composition of Partial functions, recursive functions, growth of functions.

UNIT III: Logic, Grammars, Languages and Automation

[15 HRS]

Propositional logic, first order logic, mathematical induction, deduction, proof by contradiction, program correctness. Grammars and languages, finite automation of finite state machines, regular languages, regular expressions.

REFERENCES:

MANDATORY:

1. Rosen, K. H., & Krithivasan, K. (2012). *Discrete mathematics and its applications: with combinatorics and graph theory*. Tata McGraw-Hill Education.

SUPPLEMENTARY:

1.Sarkar, S. K. (2016). *A Textbook of Discrete Mathematics*. S. Chand Publishing.

WED BASED:

1. <https://web.stanford.edu>

2.<https://www.cse.iitb.ac.in>

Practical: Mathematical Foundation of Computer Science I

Credit: 1

Marks: 25

Duration: 30 Hrs

Programs to be written using C Language:

1. Generate all permutations of n symbols, where $2 \leq n \leq 5$ is user defined.
2. Read a number and convert to other number formats.
 - a) Convert an integer into binary number
 - b) Convert a binary number to decimal number.
 - c) Convert a binary number to octal number.
 - d) Convert a number into normalized form.
3. String Manipulation
 - a) Read a string of decimal digits. Find the frequency distribution of digits.
 - b) Read a binary string. Check the occurrence of the pattern 1001 in the string.
 - c) Read two binary numbers. Add them using 1's complement and 2's complement method.
4. Read two integer numbers. Find their GCD using recursion.
5. Read the value of p. Find the p-th Fibonacci number from the following recurrence relation.
 $f(0) = 0, f(1) = 1, f(n) = f(n-1) + f(n-2), n \geq 2.$
6. Given two functions $f(x) = x^3 + 2x + 3$, and $g(x) = 3x^2/4 + 10$, find $f \circ g(x)$.
7. Read an expression containing parentheses and check whether it is properly parenthesized.
 - a) Equal number of (and) ' brackets
 - b) Equal number of { and } ' brackets
 - c) Equal number of [and] ' brackets
8. Applications of set theory
 - a) Read a set and check whether a given number is a member of the set.
 - b) Read two sets. Find their union.
 - c) Read two sets. Find their intersection.
9. Applications of finite state machines, matrices, Boolean algebra, gates.
10. Bit-wise operations using C

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Course Title: Introduction to Programming

Course Code: COM-I.C-2

Marks: 75

Credits: 3

Duration: 45 Hrs

Pr-requisites courses: Nil

Course Objectives :

- To understand the concept of basic computer algorithm and flowchart and use the algorithm for various problem solving.
- To implement algorithms using high level programming language.
- To understand basic principles of structured programming – example C.

Course Outcome: Upon completion of the course students will be able to:

CO1: Explain problem solving strategies.

CO2: Draw a flowchart for a given problem.

CO3: Write an algorithm for a given problem.

CO4: Explain and Apply sorting and searching algorithms.

CO5: Recognize and incorporate programming elements such as loops, decision making, functions, arrays, strings.

CO6: Recognize and incorporate programming elements such as structures, pointers and files into applications that solve real world problems.

SYLLABUS

UNIT I

[10 HRS]

Introduction to Computer Problem Solving : Algorithm, Flowchart, The Problem-Solving Aspect, General problem-solving strategies, Top-Down Design, Implementation of Algorithms, Efficiency of Algorithms, Recursive algorithms.

Basic Algorithms : Exchanging the values, Summation of a set of numbers, factorial computation, generation of the Fibonacci series, reversing the digits of an integer, base conversion.

Factoring Methods : Finding divisors of an integer, finding the Greatest Common Divisor of two integers, generating prime numbers, computing prime factors of an integers.

Sorting and Searching : Bubble sort, Insertion Sort, Sequential Search and Binary Search.

UNIT II

[20 HRS]

C Language : History, Structure of a C program, Keywords, Identifiers, variables, constants, data types, Arithmetic Operators & Expressions, Logical operators and Relational Operators, Precedence and Associativity rules.

Conditions and Iterations : Conditions and Actions, Condition statement, Simple control statement (if, if-else, switch), Iterative control statements (for, while, do-while).

Functions : What is a function, Advantages of functions, Standard library functions; User define functions – declaration, definition, function call, parameter passing, return keyword. Scope of variables, Storage classes, Recursion.

Arrays : One- and Two-dimensional arrays: Array declaration, initialization, accessing the values, passing arrays to functions.

Pointers : Pointer declaration, initialization, Pointer arithmetic, Pointer to Pointer, Arrays and Pointers, Functions and Pointers – passing pointers to functions, function returning pointer, dynamic memory allocation.

UNIT III

[15 HRS]

Strings : Declaration and initialization, standard library string functions, strings and pointers, array of strings.

Structure and Union : Creating structures, accessing structure members, array of structures, passing structure to functions, nested structure, pointers and structures, union, difference between structures and unions.

File Handling : FILE variable, file access modes, operations on files, random access to files, command line arguments.

Pre-processing : Format of Preprocessor directive, File Inclusion directive, Macro substitution, conditional compilation.

REFERENCES:

MANDATORY:

1. Dromey, R. G. (1982). How to Solve it by Computer. Prentice-Hall, Inc..
2. Kanetkar, Y. (2012). Let us C, BPB Publications,
3. Forouzan, B. A., & Gilberg, R. F. (2000). Computer Science: A structured programming approach using C. Brooks/Cole Publishing Company..

SUPPLEMENTARY:

1. Horowitz, E., Sahni, S., Sanguthevar, R. (2008). Fundamentals of Computer algorithm, Orient Longman.
2. Gottfried, B. (2010). Programming with C, Tata McGraw Hill.

WED BASED:

- GNU GCC (GNU Compiler Collection) @<http://gcc.gnu.org>, with source codes.
- Bjarne Stroustrup's C++11 FAQ @<http://www.stroustrup.com/C++11FAQ.html>.
- <https://www.tutorialspoint.com/cprogramming>
- <https://www.javatpoint.com/c-programming-language-tutorial>
- <https://www.w3schools.in/c-tutorial/>
- <https://www.guru99.com/c-programming-tutorial.html>
- <https://www.geeksforgeeks.org/c-programming-language/>
- E Book - <https://www.edutechlearners.com/download/books/Let%20Us%20C%20by%20Yashavant%20Kanetkar%20PDF.pdf>
- E Book - <http://www2.cs.uregina.ca/~hilder/cs833/Other%20Reference%20Materials/The%20C%20Programming%20Language.pdf>
- E Book - http://www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf

Practical: Introduction to Programming

Credit: 1

Marks: 25

Duration: 30 Hrs

1. Programs using C language that covers the following concepts:

- Conditions
- if..else
- nested if

2. Iterative Control Statements

- for
- while
- do...while

3. Functions.

- Standard Library functions
- Call by Value
- Call by reference
- Recursive functions

4. Arrays.

- One Dimensional Arrays
- Two Dimensional Arrays

5. Sorting

- Bubble sort
- Insertion sort

6. Searching.

- Sequential search
- Binary search

7. Pointers.

- Arrays and Pointers
- Function returning pointers
- Dynamic memory allocation

8. Strings.

- Standard Library string functions
- Strings and Pointers
- Array of Strings

9. Structure and Union

- Array of structures
- Passing Structure to functions
- Nested structure
- Structure and Pointer
- Union

10. File Handling.

- Text file
- Binary file
- Random Access to a file
- Command Line arguments

Semester II

Course Title: Data Base Management Systems -I

Course Code: COM-IL.C-3A

Marks: 75

Credits: 3
Duration:45 Hrs

Prerequisites: Nil

Course Objectives:

- To provide basic knowledge of a database management system.
- To understand importance of Entity Relationship diagram.
- To formulate queries in Relational Algebra and SQL for Database manipulation.
- Familiarity with any RDBMS during practical sessions.

Course outcomes:

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

CO1: Explain the various database concepts and the need for database systems.

CO2: Identify different entities and relationship between them.

CO3: Represent the given system using ER diagram.

CO4: Convert an ER diagram to a database schema.

CO5: Formulate queries in Relational Algebra, SQL to manipulate the database.

CO6: Analyze the schema to see if they fulfill Normalization criterion.

CO7: Design database using appropriate RDBMS.

CO8: Design User Interface for Database.

CO9: Design Reports for Database.

SYLLABUS:

UNIT I Overview of DBMS, Design and ER model.

[15HRS]

Overview of database management : Data, information, database, database management system; Managing data; File systems versus a DBMS, advantages of a DBMS; Data abstraction, instances and schemas, data models; Data manipulation language, data definition language; Architecture of a DBMS; Users of a DBMS, database administrator.

Database design and the ER model : Design phases – conceptual design, logical design, physical design; ER model – entities, attributes, and relationships, mapping cardinalities, keys; ER diagrams – strong entities, weak entities, generalization, specialization, aggregation; Converting ER diagram to relational schemes.

Unit II : Functional dependency and normalization

[10HRS]

Atomic domain, nested relation; Key, super key, primary key, candidate key; Functional dependency, axioms, closure of a set of attributes, closure of a set of functional dependencies; Purpose of normalization; 1NF; 2NF; 3NF; BCNF.

UNIT III : Relational model and SQL

[20HRS]

Relational model :Relation, properties of relational model; Entities, integrity constraints, referential integrity constraints; Relational algebra – select, project, cross product, set operations, rename operation; Other relational operations – natural join, outer join.

SQL:Basic structure of SQL query – Create, select, where, from, rename operation; Set operations; Aggregate functions; Group by, having clauses; DDL Nested queries; Views; Insert, delete, update.

REFERENCES:

MANDATORY:

1. Silberschatz, A. (2006). Database system concepts.—6th ed.

SUPPLEMENTARY:

1. Ramakrishnan, R., & Gehrke, J. (2000). Database management systems. McGraw Hill.
2. Elmasri, R., & Navathe, S. (2017). Fundamentals of database systems. Pearson.

WEB BASED:

- 1.<https://www.db-book.com/db6/slide-dir/> (Sixth edition Powerpoint , PDF of A Silberschatz, H F Korth, S Sudarshan, Database system concepts,)
- 2.<https://www.db-book.com/db7/>
- 3.[https://www.tutorialspoint.com dbms](https://www.tutorialspoint.com/dbms)
- 4.[https://www.w3schools.in dbms](https://www.w3schools.in/dbms)
- 5.[https://www.studytonight.com dbms](https://www.studytonight.com/dbms)
- 6.<https://www.oracletutorial.com>

Practical: :Database Management Systems

Credit :1

Marks :25

Duration: 30 Hrs

1. ER diagram (1P)
2. ER diagram with specialization/generalization and aggregation.(1P)
3. Converting ERD into Schema.(2P)
- 4 SQL (2P)
- 5 Nested Queries (2P)
- 5Normalization(2P)
- 6 Report Writing (1P)
7. Mini project (4P)

Course Title: Data Structures

Course Code: COM-II.C-4

Marks: 75

Credits: 3
Duration:45 Hrs

Prerequisite Courses: Nil

Course Objectives:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To Understand basic concepts about stacks,queues,lists,trees and graphs.
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

Course outcomes:

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

CO1 : Define relevant standard algorithms for various data structures. Learn various applications of data structures.

CO2 : Implementation of data structures.

CO3 : Use various data structures for sorting and searching.

CO4 : Analyze and compare algorithms for efficiency using Big-O notation.

CO5 : Formulate new solutions for programming problems.

SYLLABUS

UNIT I:

[15HRS]

Introduction to data structures:

Concept, Data type, Data object, ADT, Need of Data Structure, Types of Data Structure.

Algorithm analysis:

Algorithm – definition, characteristics, Space complexity, time complexity, Asymptotic notation (Big O).

Linked List:

Introduction to List, Implementation of List – static & dynamic representation, Types of Linked List, Operations on List, Applications of Linked List, polynomial manipulation, Generalized linked list – concept & representation.

Stacks:

Introduction, Representation-static & dynamic, Operations

UNIT II

[15HRS]

Stack Applications :

Application - infix to postfix & prefix, postfix evaluation, Simulating recursion using stack.

Queues:

Introduction, Representation -static & dynamic, Operations, Circular queue, priority queue (with implementation), Concept of doubly ended queue.

Trees:

Concept & Terminologies, Binary tree, binary search tree, Representation – static & dynamic, Operations on BST – create, Insert, delete, traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes, non recursive in order traversal, Expression Tree. Introduction to AVL Trees

UNIT III**[15HRS]**

M-Way Search Trees : Introduction, B Tree, B+ Tree.

Searching and Sorting :

Use of various data structures for searching and sorting, selection sort, merge sort, quick sort, heap sort and hashing.

Graph :

Concept & terminologies, Graph Representation – Adjacency matrix, adjacency list, Traversals – BFS & DFS, Application of BFS, DFS – Shortest path, Backtracking.

REFERENCES:**MANDATORY:**

1. Horowitz, E., Sahni, S. (2008). Fundamentals of Data Structures in C, University Press.

SUPPLEMENTARY:

1. Langsam Yedidyah, Augenstein J. Moshe, Tenenbaum M. A. aron, (2018), Data Structure using C, Pearson Education
2. Richard.G, Behrouz.F, Data Structures: A Pseudocode Approach with C, Cengage Learning.

WEB BASED:

1. https://www.tutorialspoint.com/data_structures_algorithms
2. <https://www.w3schools.in/data-structures-tutorial>
3. <https://www.studytonight.com/data-structures/>
4. <https://www.programiz.com/dsa>
5. <https://www.geeksforgeeks.org/data-structures/>
6. <https://www.javatpoint.com/data-structure-tutorial>

7. E Book - <https://www.scribd.com/doc/261233741/Data-Structures-Through-C-Yashavant-Kanetkar>

Practical: Data Structures

Credit: 1

Marks: 2

Duration: 30 Hrs

Programs using C language that covers the following concepts:

- Stack: Static/Dynamic stack implementation.
- Stack: infix to postfix.
- Stack: Evaluation of Postfix expression.
- Queues: Static and Dynamic Queue Implementation
- Queues: Circular queue
- List: Singly Linked List,
- List: Doubly Linked List
- List: Circular Linked List
- Linked List: Polynomial addition
- Trees: Binary Search Tree: create, add, delete, display nodes.
- Trees: BST traversal.
- Graph: Representation of Graphs, Graph Traversals.
- Graph: DFS, BFS.

SEMESTER III

Course Title: Object Oriented Programming

Course Code: COM-III.C-5A

Marks : 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses : Nil

Course Objectives:

- To teach the basic concepts and techniques which form the object oriented programming paradigm.
- To introduce object oriented programming (OOP) using Java.

Course Outcomes:

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

CO1 : Apply fundamental object-oriented concepts in problem solving.

CO2: Analyze problem scenario and identify classes/objects, their properties/functionalities and associations.

CO3 : Analyze the problem scenario and model the system using UML diagrams.

CO4 : Implement the object oriented model in any object oriented language.

SYLLABUS:

UNIT I: Introduction

[15 HRS]

Principles of OOP

Programming paradigms. Basic concepts in OOP. OOP: major principles - encapsulation, abstraction, inheritance, polymorphism. Benefits of OOP. Applications of OOP.

Introduction to Java

Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, java.Math class, Arrays in java.

UNIT II Principles of OOP

[15 HRS]

Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, object serialization, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Inheritance and Polymorphism:

Inheritance in java, Super and sub class, Overriding, java.lang.Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java,

Package in java, java.util package.

UNIT III: Exceptions, Multi-threading and GUI programming:

[15 HRS]

Event and GUI programming

Design patterns – what and why? It's classification. Introduce the Observer design pattern.

Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers:

Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle.

Multi-threading in java

Multi-threading in java, Thread life cycle and methods, Runnable interface, Thread synchronization.

Exception handling

Exception handling – what and why? Try and catch block. Multiple catch blocks. Nested try, finally block, throw keyword, throws keyword. Custom Exception. Introduction to the Collections Framework.

REFERENCES:

MANDATORY:

1. Deitel, P., & Deitel, H. (2011). Java How to program. Prentice Hall Press.

Supplementary:

2. Naughton, P., Schildt, H. (2000), Java 2 – The Complete Reference TMH publications

3. Patrick, N. (1997). The Java Handbook – TMH publications

4. Mughal, K. A., & Rasmussen, R. W. (2003). A programmer's guide to Java certification: a comprehensive primer. Addison-Wesley Professional.

5. Flanagan, D. (2004). Java examples in a nutshell.

6. Arnold, G., H. (2005) "The Java Programming Language" Addison-Wesley Professional,

WEB BASED:

1. www.javapoint.com

2. www.tutorialspoint.com

3. www.gurugg.com

docs.logout.org > Programming > Java > Programming with Java_A primer

Practicals: Object Oriented Programming

Credit: 1

Marks: 25

Duration: 30 Hrs

Programs using Java language that covers the following concepts:

1) Classes and instances

- 2) Working with the java.Math class
- 3) Inheritance
- 4) Composition v/s inheritance
- 5) Polymorphism, abstract classes and interfaces
- 6) Algorithm and Data Structures
- 7) Utilizing the java.util package
- 8) Event handling and GUI
- 9) Applets
- 10) I/O programming
- 11) Exception handling
- 12) Multi-threading
- 13) Collections framework

Course Title: Software Engineering

Course Code: COM-E1

Marks: 75

Credits: 3

Duration: 45 Hrs

Prerequisite Courses : Nil

Course Objectives:

- To Understand the various software development methodologies and estimation of software projects.
- To analyze and design software projects.
- To study the various phases of a S/W Development Project.

Course Outcomes:

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

CO1: Understand the various Software Development Methodologies.

CO2: Apply Estimation techniques to live projects.

CO3: Analyze Software Projects.

CO4: Design Software Projects.

SYLLABUS:

UNIT I:

[15 HRS]

SOFTWARE PROCESS:

Characteristics of software process.

Software Development Processes and Methodologies: waterfall, prototyping, iterative, spiral, unified process. Benefits of iterative and incremental approach with emphasis on Unified process, CASE Tools, Agile methodologies.

PROJECT MANAGEMENT:

Planning a Software Project – Cost estimation, Project Scheduling, Software configuration management plans, Quality Assurance plans, Project Monitoring plans and Risk

Management. Techniques such as Interviewing , Requirement Workshop, brainstorming, prototyping. Characteristics of SRS.

UNIT II:

[15 HRS]

OOAD and UML:

OOAD: Definition; object oriented analysis; object oriented design and modeling; Assigning responsibilities.

UML: Main UML diagrams – Class diagram , sequence diagram, activity diagram, use case diagram.

Use case model – use case diagram , use case descriptions, use case realization using sequence and activity diagrams. Supplementary requirements. Advanced use case model features.

Requirements: Functional and non-functional

System Design : Class diagram, sequence diagram, activity diagram, state chart diagram, deployment diagram. Brief introduction to other UML diagrams.

SOFTWARE ARCHITECTURE PATTERNS:

Major Architectural Styles (patterns) like Layered Architecture, Pipe and Filter, Shared (Central) Data Store, Event Driven,

Model-View-Controller (MVC), “Distributed & Emerging” Service Oriented Architecture (SOA) and Elementary GRASP

Patterns.

UNIT III

[15 HRS]

HUMAN COMPUTER INTERACTION:

HCI Definition; User categories, Interface Design-Internal & External Interface design, user interface design, Interface design guidelines.

CODING:

Coding styles, standards, peer reviews, checklist.

TESTING:

Testing Fundamental, Functional Testing, Structural Testing, Testing Object-Oriented Programs, Testing Process and Metrics.

DOCUMENTATION and MAINTENANCE:

Need for Software Documentation. Types of documentation, Need for Maintenance; Types of Maintenance.

REENGINEERING:

Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, The Economics of Reengineering.

REFERENCES:

MANDATORY:

1. Pressman, R. S. (2005). *Software engineering: a practitioner's approach*. Palgrave Macmillan.
2. Larman C., (2015) *Applying UML and patterns*. Addison Wesley.
3. Bourque, P., & Fairley, R. E. (2014). *Guide to the software engineering body of knowledge (SWEBOK (R))*: Version 3.0. IEEE Computer Society Press.

SUPPLEMENTARY:

1. Jalote, P. (2012). An integrated approach to software engineering. Springer Science & Business Media.
2. Sommerville I., (2015) Software Engineering. Addison Wesley.
3. Fowler, M. (2003). UML Distilled: A Brief Guide to the Standard Modeling Object Language. Object Technology Series, 3rd edition, Addison-Wesley.

WEB BASED:

1. https://www.tutorialspoint.com/software_engineering
2. <https://www.w3schools.in/sdlc-tutorial>
3. <https://www.geeksforgeeks.org/software-engineering>
4. <https://www.javatpoint.com/software-engineering-tutorial>

Practicals : Software Engineering

Credit : 1

Marks : 25

Duration: 30 Hrs

List of suggested PRACTICALS :

For a given project/case study

- 1) Requirements Gathering Techniques [2P]
- 2) Gantt Chart [2P]
- 3) USE Case diagram and Use Case descriptions for the Use Cases [3P]
- 4) Class Diagram [2P]
- 5) Sequence Diagram [2P]
- 6) Activity Diagram [2P]
- 7) State Chart Diagram [2P]

Course Title: Digital Logic Design

Course Code: COM - E2

Marks: 75

Credits: 3

Duration: 45 Hours

Prerequisite Courses: Nil

Course Objectives:

- To understand the basics of Boolean algebra and the operation of logic components, combinational, sequential circuits and design of digital systems.

Course Outcomes:

After completing this course, students will be able to:

CO1: Convert values between various number systems/codes.

CO2: Simplify the logical expression using Boolean algebra.

CO3: Design, simplify and implement combinational logic circuits.

CO4: Design and implement the sequential logic circuit and their applications.

CO5: Explain the methods of D/A converter and A/D converters (Successive Approximation method).

CO6: Explain the classifications and characteristics of semi conductor memories with memory expansion.

SYLLABUS:

UNIT I: Number Systems, Boolean Algebra and Convertors: [15 HRS]

Number Systems: Decimal, Binary, Hexadecimal, and Octal number systems; BCD Code, Gray Code, Excess-3 Code, ASCII code, Unicode.

Boolean Algebra: Basic Boolean functions, Postulates and theorems of Boolean Algebra, logic gates, Sum-of-Products and Product-of-Sums forms of Boolean functions; Canonical and Standard forms.

Simplification of Boolean Functions, Plotting of K-Maps, POS and SOP Simplification, NAND and NOR implementation.

D/A & A/D Converters: Digital to Analog converter – Introduction, Weighted-Resistor & R-2R Ladder, Analog to Digital Converter – Introduction, Successive Approximation method.

UNIT II: Combinational and Sequential Circuits:

[15 HRS]

Combinational Circuits: Design procedure for combinational logic circuits; design and analysis of Half Adder, Full Adder; their use in designing other combinational logic circuits; Analysis & Design of Encoders and Decoders; Multiplexer and demultiplexers; their use in designing combinational circuits.

Sequential Circuits (Registers): SR, JK, T, D Flip-flops and Latches, their schematic symbols, Truth tables. Shift Registers - SISO, SIPO, PISO, PIPO, Bi-directional Shift Registers, Loading methods for Shift, Registers.

UNIT III: Sequential Circuits (Counters) and Semiconductor memories:

[15 HRS]

Counters: Design and analysis of Counters: Synchronous Counters, Modulo Counters, Asynchronous, Ripple and Ring Counters; Application of Counters.

Semiconductor memories: Memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, Synchronous DRAM (SDRAM), Double Data Rate SDRAM, Synchronous SRAM, DDR and QDR SRAM, Content Addressable Memory.

REFERENCES:

MANDATORY:

1. Jain, R. P. (2003). Modern digital electronics. Tata McGraw-Hill Education.

SUPPLEMENTARY:

1. Leach, D., Malvino, M., Saha, G., Digital Principles and Applications, Mc. Graw Hill (SiE).
2. Mano, M. M. (2017). Digital logic and computer design. Pearson Education India.
3. Taub, H., & Schilling, D. L. (1977). Digital integrated electronics. McGraw-Hill College.

WEB BASED:

1. <https://nptel.ac.in/courses/117/106/117106114/>
2. <https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/>
3. <https://logisim.en.uptodown.com/windows>
4. <https://www.edutechlearners.com/download/books/Morris%20Mano%20Digital%20Design%203rd%20Edition.pdf>
5. https://books.google.co.in/books?id=dnq3HmDN1ZAC&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

Practicals : Digital Logic Design

Credits :1
Marks :25
Duration: 30 Hrs

Practicals:

1. Introduction to digital ICs, specifications, verification of the truth tables of logic gates1 (2 Lab sessions)
2. Introduction to digital ICs, specifications, verification of the truth tables of logic gates2. (2 Lab sessions)
3. Implementation of the given Boolean function using logic gates in SOP form . (adder/subtractor -2 sessions)
4. Decoder and Encoder (2 sessions).
5. Multiplexer –Demultiplexer (2 sessions).
6. Verification of state tables of RS, JK, T and D flip-flops.
7. Design and verification of the 4-bit asynchronous and Synchronous counter (3 sessions)

Course Title: Mathematical Foundation of Computer Science - II
Course Code: COM - E3
Credits: 3
Marks: 75
Duration:45 Hrs

Prerequisite Courses: Nil

Course Objectives:

- To build mathematical foundations in the areas namely graph theory.
- Application of numerical analysis related to topics of computer science.

Course Outcomes:

On completion of the course students should be able to:

CO1: System of linear equations in solving the problems

CO2: Apply the Interpolation methods for solving the problems numerically.

CO3: Demonstrate the process of curve fitting of data.

CO4: Determine the roots of polynomial equations.

SYLLABUS:

UNIT I: Systems of Linear Equations and Matrices, Linear Combinations and

[10 HRS]

Linear Independence

Systems of Linear Equations, Matrices and Elementary Row Operations, The Inverse of a Square Matrix, Matrix Equations, Applications of Systems of Linear Equations. Linear Combinations and Linear Independence.

UNIT II: Vector Spaces, Linear Transformations, Eigenvalues and Eigenvectors [15 HRS]

Definition of a Vector Space, Subspaces, Basis and Dimension, Coordinates and Change of Basis Linear Transformations, The Null Space and Range, Isomorphisms, Matrix Representation of Linear Transformations, Similarity. Eigen values and Eigen vectors, Diagonalization.

UNIT III: Interpolation, Numerical Integration, algebraic and transcendental equation [20 HRS]

Introduction; Various methods of interpolation; Various methods of curve fitting; Newton's method of forward interpolation formula; Newton's method of backward interpolation formula. Lagrange's formula.

General quadrature formula; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule; Weddle's rule.

Graphical method; Bisection method; Method of false position; Secant method; Newton-Raphson method.

Adjoint, inverse of a matrix; Rank; Linear equations; Characteristics roots and vectors.

REFERENCES:

MANDATORY:

1. Defranza, J., & Gagliardi, D. (2015). Introduction to Linear Algebra with applications. Waveland Press.
2. Parthasarathy.K,(1994) Basic Graph Theory, Tata McGraw-Hill Publishing
3. Goel,B., & Mittal,S. (1998) Numerical Analysis, PragatiPrakashan,
4. Iyengar,S.N.,(2010) Matrices, Anmol Publications.

SUPPLEMENTARY:

1. Clark, J., & Holton, D. A. (1991). A first look at graph theory. World Scientific.
2. Chatterjee,P. (1996) Numerical Analysis, RajhansPrakashanMandir.
3. Krishnamurthy,V. (1976) Introduction to Linear Algebra, Affiliated East-West Press.

WEB BASED:

1. <https://www.cse.iitb.ac.in>

Practicals : Mathematical Foundation of Computer Science - II

Credit: 1

Marks: 25

Duration: 30 Hrs

Linear equations

1. Systems of Linear Equations
2. Linear Transformations
3. Matrix Representation of Linear Transformations

Numerical Analysis

- 4) Find the value of dependent variable using Newton's forward formula for a given value of independent variable.
- 5) Use Newton's backward formula to estimate a value.
- 6) Estimate a value using Lagrange's formula.
- 7) Apply Simpson's three-eighth rule to find the value of integration.
- 8) Apply Newton-Raphson method OR secant method to estimate the root of a equationLinear Algebra.
- 9) Find the rank of a matrix.
- 10) Find solutions of a system of equations
- 11) Find the Eigen values and Eigen vectors

Course Title: Web Designing

Course Code: COM-E4

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses: Nil

Course objectives:

- Design good user interfaces.
- Apply design principles such as learnability, visibility, error prevention, efficiency and graphic design.

Course Outcomes:

On completion of the course students will be able to:

CO1:Design Content for a web application.

CO2:Style content so as to provide an effective User Interface.

CO3:Provide for dynamism in the User Interface to enhance usability.

CO4:Develop a static web application.

SYLLABUS:

UNIT I: Structuring the UI with HTML/HTML5

[15 HRS]

User Interface – Introduction, its importance, design principles – learnability, visibility, error prevention, efficiency, graphic design. Design Patterns for GUI – View tree, Listener, Widget, Model-View-Controller.

HTML - Introduction. The development process, basic HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, simple HTML forms, web site structure, Meta tags, Character entities, frames and frame sets.

HTML5 - Introduction, New Elements, Canvas, SVG, Drag/Drop, Geolocation, Video, Audio, Input types, form elements, form attributes, semantic, web storage, app cache, web workers, SSE

UNIT II : Styling the UI with CSS/CSS3

[10 HRS]

CSS - Introduction – Syntax, Id & Class, Backgrounds, Text, Fonts, Links, Lists, Tables. CSS Box Model – Border, Outline, Margin, Padding. Advanced - Grouping/Nesting, Dimension, Display, Positioning, Floating, Align, Pseudo-class, Pseudo-element, Navigation Bar, Image Gallery, Image Opacity, Image Sprites, Media Types, Attribute Selectors.

CSS3 - Introduction, Borders, Backgrounds, Gradients, Text Effects, Fonts, 2D Transforms, 3D Transforms, Transitions, Animations, Multiple Columns.

UNIT III: Dynamism in UI

[20 HRS]

JavaScript - Introduction - What is JavaScript, Understanding Events, JavaScript Example, External JavaScript. Basic Elements – Comment, Variable, Global Variable, Data Types, Operators, If Statement, Switch, Loop: for and while, Function. JavaScript Objects – objects, Array. Browser Object Model - Browser Objects, Window Object, Document Object – getElementById, getElementsByName, getElementsByTagName, innerHTML property, inner Text property. Validation- form validation, email validation.

JQuery : Introduction - Syntax, Selectors, Events. Effects- Hide/Show, Fade, Slide, Animate, stop(), Callback, Chaining. HTML/CSS- Add, Remove, CSS Classes, css(), Dimensions, slider. Traversing – ancestors, descendants, siblings, filtering.

REFERENCES:

MANDATORY:

1. D.T,(2018) Web Technologies, Black Book,DreamTech

WEB BASED:

- 1.<https://www.w3schools.com>
- 2.<https://www.tutorialspoint.com/html/index.htm>
- 3.<https://www.tutorialspoint.com/css/index.htm>
- 4.<https://www.tutorialspoint.com/javascript/index.htm>

5.<https://www.tutorialspoint.com/jquery/index.htm>
6.<https://www.udemy.com/courses/development/web-development/>

Practicals : Web Designing

Marks: 25

Credits: 1

Duration: 30 Hrs

List of Assignments: (the numbers in brackets indicate number of practicals) :

- 1) Case studies to review UI designs [2 P]
- 2) Create a HTML page with the following: [3 P]
 - a) title heading paragraph emphasis strong and image elements
 - b) complex HTML table
 - c) simple HTML Form covering major form elements
 - d) Embed Video in an HTML page
- 3) Using CSS do the following: [3 P]
 - a) Create a Navigation bar (with dropdown) with CSS
 - b) Create a CSS Grid
 - c) Create a CSS3 based button
 - d) Make an image rounded shape
 - e) Create a CSS based sticky footer
 - f) Create CSS3 Corner Ribbon
 - g) Create CSS3 blurry text effect
 - h) Create CSS3 speech bubble shape
 - i) Create image cross fade with CSS3 transition
 - j) Set style for link hover active and visited states of hyperlink
- 4) Write JavaScript functions to : [4 P]
 - a) accept a string as a parameter and converts the first letter of each word of the string in upper case.
 - b) check whether a given credit card number is valid or not.
 - c) check whether a given value is an valid url or not.
 - d) check whether a given email address is valid or not.
 - e) print an integer with commas as thousands separators
 - f) remove items from a dropdown list.
- 5) Use JQuery to : [3 P]
 - a) Disable buttons
 - b) Make textbox read only
 - c) Uncheck check boxes
 - d) Confirm again

- e) Sort
- f) Switch rows and columns

A mini project combining all the technologies learnt using a front-end development framework such as bootstrap is recommended.

SEMESTER IV

Course Title: Computer Architecture and Organization

Course Code: Com-IV. C-6

Marks: 75

Credits: 3

Duration: 45Hours

Prerequisite Courses: Nil

Course Objectives:

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Analyze processor performance improvement using instruction level parallelism.
- Explain different types of addressing modes and memory organization.
- Study various data transfer techniques in digital computer.
- Learn microprocessor architecture and study assembly language programming.

- Understand the taxonomy of Parallel Processor.
- To have a thorough understanding of the basic structure and operation of a digital computer.

Course Outcomes:

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

CO1: Identify various components of the Computer System.

CO2: Explain the detailed function of a typical microprocessor and its control unit.

CO3: Implement Assembly Language Program for 8086 processor for a given task.

CO4: Differentiate the function and role of semiconductor memories and map the cache memory for the given scenario.

CO5: Appraise the importance of input/output modules and Interrupts and their functions.

CO6: Distinguish the characteristics and function of I/O interfaces to computer system.

CO7: Illustrate the function of pipelined architecture and classify the Multiprocessor systems.

SYLLABUS

UNIT I: Computer System and Processor Unit:

[15 HRS]

Function and structure of a computer, Interconnection of components, Performance of a computer. Computer Architecture – Princeton (Von Neumann) and Harvard architecture. Architecture of 8086 processor - Registers, ALU and Control unit, Data path in a CPU. Instruction cycle, Organization of a control unit – Block Diagram of Hardwired and Microprogrammed control unit.

UNIT II: Instruction Set and Memory Subsystem:

[15 HRS]

Machine instructions characteristics, Types of operations-data transfer, arithmetic, logical, conversion, I/O, system control, transfer of control; 8086 Instruction Set and Assembly language: Addressing modes-immediate, direct, indirect, register, register indirect, displacement, stack. Instruction formats - instruction length, allocation of bits, variable length instructions, Instruction set architectures – CISC and RISC architectures. Characteristics of memory system, the memory hierarchy, Semiconductor memories, Types of ROM & RAM, Cache memory unit - Concept of cache memory, Organization of a cache memory unit, Mapping methods, replacement algorithms, write policy, block size.

UNIT III: Input/Output Subsystem and Parallel Processing:

[15 HRS]

General block diagram of External device & I/O module, Programmed I/O, Interrupt driven I/O, DMA, I/O channels and I/O processors. I/O interfaces – Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewire and Infiniband. Classifications, Introduction to pipeline processing: Instruction pipeline & Arithmetic pipeline, Introduction to Array & Vector processors, Introduction to Multiprocessors.

REFERENCES:

MANDATORY:

1. Stallings, W. (2003). Computer organization and architecture: designing for performance. Pearson Education India..

SUPPLEMENTARY:

1. Mano, M. M. (2005). Computer system architecture. Dorling Kindesley Pearson.
2. Patterson, D. A., & Hennessy, J. L. (2013). Computer organization and design MIPS edition: the hardware/software interface. Newnes.
3. Douglas V. Hall, (2012), Microprocessors and its Interfacing, McGraw Hill Education (India) Private Limited.

WEB BASED:

1. <http://williamstallings.com/ComputerOrganization/>
2. https://www.tutorialspoint.com/computer_fundamentals/index.htm
3. <http://www.ecs.umass.edu/ece/koren/architecture/>
4. <http://www.cs.colby.edu/djskrien/CPUSim/>
5. <https://teachcomputerscience.com/little-man-computer/>
6. <https://vivaxsolutions.com/web/lmc.aspx>

Practicals: Computer Architecture and Organization

Credits: 1

Marks: 25

Duration: 30 Hrs

1. Study of Motherboard, Peripherals and the Computer System: O.S. Installation (Dual Boot): BIOS; Manage disk partitions: understand MBR-style partitions, (primary, extended, logical); list/create/delete partitions; Manage logical volumes: create/remove physical volumes, create/delete logical volumes, Boot loader. Installation of drivers; updating software packages
2. DOS Commands, Tools for Computer Management (Disk Management, Disk Cleanup, Defragmentation, Performance Monitor, System Restore etc).
Assembly language programs for 8086 using MASM / compatible assembler or Simulator, either in Windows or Linux.
3. Study of addressing modes.
4. Programs for arithmetic operations1
5. Programs for arithmetic operations2
6. Programs for arithmetic operations3
7. Programs for data transfer operations
8. Programs for logical operations1
9. Programs for logical operations2
10. Programs code conversion1
11. Programs code conversion2
12. Programs on sorting
13. Programs on searching
14. DOS/BIOS – Programming1
15. DOS/BIOS – Programming2

Course Title: Design and Analysis of Algorithms

Course Code : COM-E5

Marks :75

Credits :3

Duration :45 Hrs

Prerequisite Courses: Nil

Course Objectives:

- To study paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.

- To ensure that students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms and compare with one another, and how there are still some problems for which it is unknown whether there exist an efficient algorithm, and how to design efficient algorithms.

Course Outcomes:

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

CO1: To analyze the performance of algorithms.

CO2: Choose appropriate algorithm design techniques for solving problems.

CO3: Analyze empirical results to get a deeper understanding of the algorithmic solutions.

CO4: Apply important algorithmic design paradigms and methods of analysis.

SYLLABUS:

UNIT I: Algorithm Analysis and Divide and Conquer Strategy

[15 HRS]

What is an Algorithm?, Rules for writing Algorithms, Properties of Algorithms, Framework for design and analysis of algorithms(RAM model of computation),Recursive Algorithms, Space and Time Complexity by Tabular method(Performance Analysis) Elements of Divide and Conquer Algorithms, QuickSort algorithm, Merge sort analysis, Strassen's algorithm for matrix multiplication, Analysis of Binary Search,The Maximum subarray Problem.

UNIT II: Dynamic programming and Greedy Techniques

[15 HRS]

General Method, caching v/s computation, Fibonacci numbers by recursion, Fibonacci numbers by caching, Fibonacci numbers by dynamic programming,Optimal Binary Search Tree,Rod Cutting Problem. Elements of greedy strategy, Activity-selection problem, Job sequencing with deadlines.Knapsack problem.

UNIT III: Graphs and Complexity Classes

[15 HRS]

Elementary graph algorithms- Minimum spanning tree, growing a spanning tree, Kruskal and Prim algorithms, Breadth First search and Depth First Search, Travelling salesman problem. Introduction to polynomial time algorithms, NP, NP Complete, NP Hard, Approximation and Randomisation algorithms.

REFERENCES:

MANDATORY:

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms. MIT press.

SUPPLEMENTARY:

1.Horowitz.T, Sahni.S, Rajasekaran.S,(2010) "Fundamentals of Computer Algorithms", Universities Press Maryland,

2. A. Aho, J. Hopcroft, J. Ullman (2016). “The Design and Analysis of Computer Algorithms”
Pearson Education India New Delhi,

WEB BASED:

1. <http://www.iitk.ac.in/esc101/2009Jan/lecturenotes/timecomplexity>
2. <https://home.cse.ust.hk/~dekai/271/notes/L12/L12.pdf>
3. <https://nptel.ac.in/courses/106106131/>
4. <https://www.cs.cornell.edu/courses/cs3110/2012sp/lectures/lec20-master/lec20.html>
5. <https://www.cs.indiana.edu/~achauhan/Teaching/B401/LectureNotes/complexityClasses.html>

Practicals: Design and Analysis of Algorithms

Credit : 1

Marks : 25

Duration: 30 Hrs

- 1 Program to find GCD of 2 numbers using Iterative approach and Recursive approach
- 2 Program for quickSort
- 3 Program for Mergesort
- 4 Program to perform Binary Search using Recursive approach
- 5 Program to implement maximum subarray problem.
- 6 Program to generate Fibonacci numbers using Dynamic Programming approach.
- 7 Program to implement Activity Selection Problem.
- 8 Program to implement job sequencing with Deadlines.
- 9 Program to implement Knapsack Problem
- 10 Program to implement Rod Cutting Problem.
- 11 Program to implement Binary Tree.
- 12 Program to represent graph using matrix/ Linked List.
- 13 Program to implement BFS/DFS Traversal on graph.
- 14 Program to implement Kruskal's Algorithm
- 15 Program to implement Prim's Algorithm

Course Title: Mobile Application Development

Course Code: COM-E10

Marks: 75

Credits: 3

Duration: 45 Hrs

Prerequisite Courses: Nil

Course Objective:

- Students learn how to develop applications for mobile devices, including smart phones and tablets. Students are also introduced to the current mobile platforms, mobile application development environments and mobile device input methods. Students will design and build a variety of apps on a popular platform throughout the course to reinforce learning and to develop real competency.

Course Outcome :

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

CO1: Explain mobile devices, including their capabilities and limitations.

CO2: Review current mobile platforms and their architectures.

CO3: Develop mobile applications on a popular mobile platform.

CO4: Evaluate development with another mobile platform.

SYLLABUS:

UNIT I: Introduction to mobile devices:

[15 HRS]

Mobile devices vs. desktop devices, Why we Need Mobile App, Different Kinds of Mobile Apps, ARM and intel architectures, Power Management, Screen resolution, Touch interfaces, Application deployment - App Store, Google Play, Windows Store, Development environments – Android Studio, PhoneGap, Native vs. web app, Browser-detection, Touch interfaces, Geolocation, Screen orientation, Mobile browser ?interpretations? (Chrome/IE). Comparing and Contrasting architectures of Android, iOS and Windows, Underlying OS (Darwin vs. Linux vs. Windows), Kernel structure and native level programming, Runtime (Objective-C vs. Dalvik vs. WinRT), Security. Introduction to Android Operating System, Overview of android stack, Android features. Linux Kernel, Libraries, Android Runtime, Application Framework, Dalvik VM, Multithreading in Android-Async Task, Handler Post

UNIT II: Android Components:

[15 HRS]

Activities, Services, Broadcast Receivers, Creating Broadcast receiver, Receiving System Broadcast, Understanding Broadcast action, category and data, Sending Broadcast. Content Providers, Views, layouts and Common UI components, Creating UI through code and XML, Activity life cycle, Intents, Intent Filters, Intent-matching rules, Filters in your manifest. Communicating data among Activities. Selection components (Grid View, List View, Spinner), Adapters, Custom Adapters, Menus, Toast, Custom Toast, Dialogs, Status bar Notifications. Overview of services in Android, implementing a Service, Service lifecycle, Inter Process Communication (AIDL Services). Web Services and WebView - Consuming web services, Receiving HTTP Response (XML, JSON), Parsing JSON and XML, Using WebView.

UNIT II: Data Storage:

[15 HRS]

Shared Preferences, Android File System, Internal storage, External storage. SQLite- Introducing SQLite, SQLiteOpenHelper and creating a database, Opening and closing a database, working with cursors, inserts, updates, and deletes.

Content Provider-Accessing built in content providers, Content provider MIME types, searching for content, Adding, changing, and removing content, creating content provider, Working with content files.

REFERENCES:

MANDATORY:

1. Lee, W. M. (2010). Beginning iPad application development. John Wiley & Sons.
2. Satya.K, Pro Android 4 ; Dave MacLean (Apress)
3. Burnette, E. (2009). Hello, Android introducing Google's mobile development platform 2nd.
4. Cinar, O. (2012). Android apps with Eclipse. Apress.
- 5., Dimarzio, J.F. Android- A Programmer'S Guide (Tata McGraw Hill)

WEB BASED:

1. <http://developer.android.com/index.html>
2. <http://www.appinventor.org/>

Practicals : Mobile Application Development

Credit: 1

Marks: 25

Duration: 30 Hrs

1. Getting Started with Android – Installing the Development Environment, Configuring Android Stack
2. Creating the First Android Application - Creating a Simple Android Project, Debugging Application through DDMS. setting up environment. AVD Creation, Executing Project on Android Screen.
3. Android application development - Use of GUI components to implement a simple application such as a Calculator.
4. Review the earlier application making use of the advanced UI components.
5. Implementing Data storage application - an application to make Insert , update , Delete and retrieve operation on the database.

Course Title: Server Side Programming

Course Code: COM-E7

Marks: 75

Credits : 3

Duration:45 Hrs

Course Prerequisite: Nil

Course Objectives:

- Provide an in depth understanding of :
- Object oriented approaches to software development, in particular to the development of web applications.
- Server side scripts and their purpose

Course Outcomes:

On completion of the course students will be able to:

CO1:Design and implement server-side scripts.

CO2:Create and manipulate databases using SQL and server side technologies.

CO3:Create data documents using XML/JSON.

CO4:Enhancing web applications using AJAX and XML/JSON.

CO5:Develop dynamic web applications using the object oriented paradigm.

SYLLABUS:

UNIT I: Application of Object Oriented Approach to Software Development [10 HRS]

Review of Object Oriented Concepts - Class, Object, member variable, member function, Inheritance, Polymorphism, overloading, Data Abstraction, Encapsulation.Object oriented design and modeling.

UNIT II: Developing dynamic web applications with Server-side technologies [20HRS]

Static vs. Dynamic web pages, Need for Server Side technologies, Multitier Web Architecture. Common Gateway Interface standard, server-side includes, server APIs,server-side scripting – working principles, and implicit objects. Database and fileaccess. Comparison of Web servers.

UNIT III:Enhancing Web Applications with Ajax and XML/JSON [15HRS]

AJAX – introduction, purpose, advantages and disadvantages. Key elements of AJAX – introduction to XML. XML processing with server sidescript. XSL, transforms and templates. The XML Http Request object–methods and properties. Creating and using XML Http Request objects. Using XSLT with AJAX. JSON – Syntax, mixing literals, Array, object, encoding/decoding, JSON versus XML, server-side JSON tools.

Web Services - Introduction, its role. Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service. SOAP – introduction, requests and responses. Role of UDDI – accessing registries. REST based webservices – building, deploying and consuming

REFERENCES:

MANDATORY:

1. Steelman, Murach & S Java Servlets & JSP, 2/E, PHI

SUPPLEMENTARY:

1. Chappell.D, Jewell.T, “Java Web Services : Using Java in Service Oriented Architectures”, O’Reilly
2. DT Editorial Services, (2018). Web Technologies, Black Book, DreamTech

WEB BASED:

1. https://docs.oracle.com/cd/E14571_01/web.1111/e13712/basics.htm#WBAPP117

Practicals: Server Side programming

Credit : 1

Marks : 25

Duration: 30 Hrs

List of suggested PRACTICALS (the numbers in brackets indicate number of practicals)

- 1) Perform OOAD of a given system using the following diagrams: [3 P]
 - a) use case diagram b) class diagram
- 2) Using server side programming and following OOAD principles develop a dynamic web application. [6 P]
- 3) Add AJAX and Web service(s) to the application. [3 P]

Course Title: Human Computer Interface

Course Code: COM-E8

Marks: 75

Credits: 03

Duration: 45 Hours

Pre-requisite course: Nil

Course Objectives:

- To study the different aspects of human computer interaction.
- To study computer interface design concepts.

Course Outcomes:

Upon completion of the course student will be able to:

CO 1: To understand the intricacies of human interaction with a computer System.

CO 2: To understand the concept of a graphical user interface, and its design characteristics.

CO 3: To recognize the human element its strengths and weakness for computer interaction.

CO 4: To know the principles of good screen design and layouts.

CO 5: To know the different navigation schemes on windows-based interface; learn the different types of selection devices and components of a window-based interface.

CO 6: To know the different types of interaction devices and media.

SYLLABUS:

UNIT I: Introduction to Human Computer Interaction:

[10 HRS]

Human-Computer Interaction, Evaluating Designs, The Birth of HCI. Importance of user Interface, Importance of good design, Benefits of good design, principles & heuristics of good design. Importance of: Human characteristics, Human consideration, Human interaction speeds, Understanding business functions. User centered design- Need-finding: Participant Observation, Interviewing, Additional Need finding, contextual inquiry & persona.

UNIT II: Rapid Prototyping and Graphical Interface Design:

[20 HRS]

Rapid Prototyping: Story boarding. Paper Prototyping and Mockup, Video Prototyping, Creating and Comparing Alternatives.

Direct Manipulation. Mental Models. Heuristics (guidelines) for design.

Graphical Interface Design: Graphical user interface, standards such as Microsoft windows HCI guidelines, Windows: Navigation schemes selection of window; Selection of devices based and screen-based controls, Components, Text and messages, Icons, Multimedia, Colors., controls, help & error messages design.

UNIT III: Heuristic Evaluation and Visualization

[15 HRS]

Web user interface design – Jessy James Garette five layers of user experience.
Heuristic Evaluation: Heuristic Evaluation — Why and How?
Visualization, Amount of information, Focus and emphasis, Presentation information simply and meaningfully, Information retrieval on web, Statistical graphics.

REFERENCES:

Mandatory:

1. Cooper, A., Reimann, R., & Dubberly, H. (2003). About face 2.0: The essentials of interaction design. John Wiley & Sons, Inc..
2. Alan.D, Janet.F, Gregory D. and Russell,B. (2012) Human-Computer Interaction, Prentice Hall.

Supplementary:

1. Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: strategies for effective human-computer interaction. Pearson Education India.
2. Donald.A.N. (2010) The Design of Everyday Things Basic Books.

WEB BASED:

1. <http://hcibib.org/>
2. https://www.tutorialspoint.com/human_computer_interface/index.htm.
3. https://www.academia.edu/4955516/Wiley_The_Essential_Guide_to_User_Interface_Design_3rd_Edition_Apr_2007?auto=download.
4. https://www.slideshare.net/busaco/hci-2015-110-humancomputer-interaction-overview?qid=1c116f30-ec87-4eb4-a375-49b2bbe65d75&v=&b=&from_search=2

Practicals: Human Computer Interface

Credit : 1

Marks : 25

Duration: 30 Hrs

Suggested list of practical (Numbers in brackets indicate number of practicals)

1. Paper Prototyping using templates (1)
2. Conducting survey interview and summarizing the result(1)
3. Persona- conducting contextual interview and developing persona(1)
4. GUI design- form design, menu design, help, error messages(2)
5. Web UI design- pages, navigation, controls, Page submission – Asynchronous (2)
6. Report designs (2)
7. Visualization and info graphics (1)
8. Heuristic evaluation(2)
9. Story boarding (1)

SEMESTER V

Course Title: Operating Systems

Course Code: COM-V.C-7

Marks: 75

Credits: 3

Duration: 45 Hrs

Prerequisite Courses :

- Introduction to Programming (COM-I.C-2)

Course Objectives:

- To understand different functions of an operating system.
- To study various aspects of operating system like Process Management, Memory Management, Storage management etc.
- To understand different algorithms used for CPU scheduling, Memory allocation.

Course Outcomes:

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

CO1: Explain the role of operating system.

CO2: Differentiate between different types of operating system.

CO3: Describe process management and process coordination.

CO4: Implement various CPU scheduling algorithms and compare their performance.

CO5: Explain deadlock handling.

CO6: Describe features of Virtual memory.

CO7: Implement various Memory Allocation algorithms.

CO8: Implement various page replacement algorithms.

CO9: Describe different file organization and access methods.

SYLLABUS:

UNIT I : Introduction to Operating System and Process Management [15HRS]

Introduction to Operating System: Basic elements of a computer system: Processor, Main Memory, I/O Modules, System Bus, Instruction Execution; Operating Systems: Definition, Operating system Structure, operating system operations, Relationship between Kernel, OS, and Hardware, Operating system services, System calls, Types of system calls, System programs.

Process Management: Process Definition, Process Control Block, Process States, Operations on Process; Interprocess communication, Threads and Microkernels: Definition, Multi-threading Model Process Scheduling, Scheduling Criteria, Scheduling Algorithms, Multi-Processor Scheduling.

UNIT II : Process Coordination

[15HRS]

Process Coordination

Process Synchronization, Principles, Mutual Exclusion, The Critical-Section Problem, Petersons Solution, Semaphores, Monitors, Readers/Writers Problem; Classic Problems of Synchronization, Dining Philosopher's problem

Deadlocks- system models, Deadlock characterization , Deadlock Handling Methods, Prevention, Avoidance, Detection, Recovery From Deadlock

UNIT III: Memory Management and Storage Management

[15HRS]

Memory Management: Introduction, Swapping, Contiguous Memory Allocation, Paging, Page Table, Segmentation, Virtual Memory: Introduction, Demand Paging, Page Replacement, Allocation of Frames, Thrashing

Storage Management : File System, Concepts, File Organization and Access Methods, Directory and Disk Structure.

Secondary Storage Structure : Overview, disk structure, Disk attachment, Disk scheduling Reading.

MANDATORY:

1. Silberchatz, A., Galvin, , & Gagne. (2008). Operating System Concepts (8th ed.). Wiley publication.

SUPPLEMENTARY:

1. Stallings, W. (2001). Operating systems: Internals and design principles.(6th ed.). Upper Saddle River, N.J: Prentice Hall.

WEB BASED:

1. <https://www.geeksforgeeks.org/operating-systems/>

2. Video Links and Animations

3. <https://www.youtube.com/watch?v=WP3uDglbPiI>

4. <http://williamstallings.com/OS-Animation/Animations.html>

5. Linux Tutorials for Practical

6. <https://www.tutorialspoint.com/unix/index.htm>

Practical : Operating Systems

Credit : 1

Marks : 25

Duration:30 Hrs

Any 8 from the following can be done.

- Demo/Review of Installing Linux / Windows Operating System, Partitioning and formatting disk, Installing applications device drivers, working with files, mounting file systems, checking system space, creating, modifying and deleting user accounts
- Study of Basic commands of Linux.
- Shell Programming in Unix/Linux, arithmetic operations, loops
- Shell Programming – advanced
- Menu Driven Shell scripting
- Filters and Pipes in LINUX
- Implementation of Inbuilt Linux/UNIX commands like cp, rename etc.
- Implementation of CPU scheduling policies.
- Implementation of Memory allocation techniques:
- Implementation of Banker's algorithm. (Resource Allocation Graph)

Course Title: Embedded Systems

Course Code: COM-V.E-9

Marks: 75

Credits: 3

Duration: 45Hours

Prerequisite Courses :

- Introduction to Programming COM-I.C-2

Course Objectives:

- To have a thorough understanding of major components of Embedded Systems.
- Implement small modules of programs to solve well defined problems in an Embedded Systems.
- To familiarize with the tools to develop applications in an Embedded Environment.

Course Outcomes:

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

CO1: Describe Embedded Systems and its characteristics.

CO2: Classify the Embedded processors and their design metrics.

CO3: Summarize the performance of ARM processors and various components of Embedded Systems.

CO4: Classify Sensors and Actuators and identify their functions and applications.

CO5: Categorize I/O devices, I/O Interfacing and Communication protocols along with their functions.

CO6: Generalize the functionality of IoT and RTOS.

CO7: Design and develop Embedded / IoT Applications using Arduino/Raspberry-Pi boards.

SYLLABUS

UNIT I: Introduction to Embedded Systems and System Hardware

[15 HRS]

Introduction to Embedded Systems, Microprocessors and Micro-controllers. Components of Embedded System & its Classification, Characteristic of embedded system. Introduction to embedded processor, Digital Signal Processor, Application Specific System Processor, Design Process in Embedded System, Design metrics, Steps in design process. Challenges in Embedded System design, Design Examples. Advances in Embedded Systems.

System hardware, Interrupt structure and Applications, ARM Processor - Architecture, Programmer's model, Modes of operation, Interrupt, Handling Interrupts, Comparison of ARM7 & ARM9.

Components of Embedded Systems-Management of Power Supply, Clocking Unit, Real Time Clock and Timers, Reset Circuitry and Watchdog Timer. Processor and Memory Selection, Memory Map of Embedded System, Interfacing Processors, Memories and I/O – Analog vs Digital. Overview of Arduino, Intel Edison and Raspberry Pi boards.

UNIT II: Input/Output Devices and Internet of Things [15 HRS]

I/O interfacing and Communication Buses, Serial vs Parallel Communication, Serial Data Communication RS-232/UART.

I/O devices, ADC / DAC, Optical Devices such as LED / LCD Display devices, Opto-Isolator, Relays, DC motor, Stepper motor, Timers/Counters, Parallel ports - Device interfacing. Serial communication Protocols - UART Protocols, I2C, CAN, USB & ZigBee – Protocol Architecture, Topology, Packets, Communication Cycle, Arbitration, Applications and comparison.

Introduction to IoT, M2M to IoT-The Vision-Introduction, M2M towards IoT- the global context, IoT Architectural Overview, Potential and Challenges.

UNIT III: Sensors, Actuators and RTOS [15 HRS]

Sensors / Transducers: Principles – Classification – Parameters – Characteristics –Environmental Parameters (EP) – Characterization.

Thermal Sensors: Introduction – Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors.

Magnetic sensors: Introduction – Sensors and the Principles Behind – Magneto-resistive Sensors, Semiconductor Magnetoresistors.

Smart Sensors: Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation – Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation.

Sensors Applications: Introduction – On-board Automobile Sensors (Automotive Sensors) – Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing – Sensors for environmental Monitoring.

Actuators: Overview of Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

RTOS: Introduction to RTOS, architecture of kernel, task and task scheduler, interrupt service routines in RTOS Environment.

REFERENCES:

MANDATORY:

1.Rajkamal, (2010), Embedded Systems – Architecture, Programming and Design, (2nd ed.), Tata McGraw Hill.

2.D. Patranabis, (2013), Sensors and Actuators, (2nd ed), PHI.

SUPPLEMENTARY:

1. David E Simon, (2004), An Embedded Software Primer, (1st ed.), Pearson India.
2. Tammy Noergaard, (2012), Embedded Systems Architecture, (2nd ed.), Elsevier
3. D. Patranabis, (2010), Sensors and Transducer, (2nd ed.), PHI Learning Private Limited.
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatias Karnouskos, David Boyle, (2014), From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, (1st ed), Academic Press,.

WEB BASED:

- 1.https://www.tutorialspoint.com/internet_of_things/index.htm
- 2.<https://www.arduino.cc/>
- 3.<http://www.zdnet.com/article/m2m-and-the-internet-of-things-a-guide>
- 4.<https://www.raspberrypi.org/>
- 5.www.thingspeak.com
- 6.<https://blynk.io/>

Practicals: Embedded Systems

Credit: 1

Marks: 25

Duration:30 Hrs

Programs to be executed on some of the embedded boards like Arduino, Intel Edison, Raspberry Pi, Bolt, etc that covers the following tasks (Any 10 experiments):

- 1) Interfacing sensors (3P)
- 2) Interfacing output devices (1P)
- 3) Interfacing input devices (1P)
- 4) Interfacing actuators (1P)
- 5) Building obstacle avoiding Robot (1P)
- 6) Line Following Robot (1P)
- 7) Programming with Raspberry Pi (2P)
- 8) Monitoring Data over Cloud (1P)
- 9) Building Web app to control devices (1P)
- 10) Mini Project.

Course Title: Mobile Application Development

Course Code: COM-IV.E-10

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses:

- Object Oriented Programming(COM-III.C-5A)

Course Objective:

- To develop applications for mobile devices, including smart phones and tablets.
- To familiarize with current mobile platforms, mobile application development environments and mobile device input methods.
- To design and build a variety of apps on a popular platform throughout the course to reinforce learning and to develop real competency.

Course Outcomes :

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

CO1: Explain mobile devices, including their capabilities and limitations.

CO2: Review current mobile platforms and their architectures.

CO3: Develop mobile applications on a popular mobile platform.

CO4: Evaluate development with another mobile platform.

SYLLABUS:

Unit I :Introduction to mobile devices, mobile operating systems

[15 HRS]

Mobile devices vs. desktop devices, Why we Need Mobile App, Different Kinds of Mobile Apps, ARM and intel architectures, Power Management, Screen resolution, Touch interfaces, Application deployment - App Store, Google Play, Windows Store.

Development environments – Android Studio, PhoneGAP.

Native vs. web app, Browser-detection, Touch interfaces, Geolocation, Screen orientation, Mobile browser —interpretations || (Chrome/IE).

Comparing and Contrasting architectures of Android, iOS and Windows, Underlying OS(Darwin vs. Linux vs. Windows), Kernel structure and native level programming, Runtime (Objective-C vs. Dalvik vs. WinRT), Security.

Introduction to Android Operating System, Overview of android stack, Android features. Linux Kernel, Libraries, Android Runtime, Application Framework, Dalvik VM ,Multithreading in Android- Async Task,Handler Post.

Unit II :Android Components

[15 HRS]

Activities, Services, Broadcast Receivers, Creating Broadcast receiver, Receiving System Broadcast, Understanding Broadcast action, category and data, Sending Broadcast. Content Providers, Views, layouts and Common UI components, Creating UI through code and XML, Activity life cycle, Intents-,Intent Filters, Intent-matching rules, Filters in your manifest.

Communicating data among Activities. Selection components (Grid View, List View, Spinner), Adapters, Custom Adapters, Menus, Toast, Custom Toast, Dialogs, Status bar Notifications.

Overview of services in Android, implementing a Service, Service lifecycle, Inter Process Communication (AIDL Services). Web Services and WebView - Consuming web services, Receiving HTTP Response (XML, JSON), Parsing JSON and XML, Using WebView.

Unit III : Data Storage

[15 HRS]

Shared Preferences, Android File System, Internal storage, External storage.SQLite- Introducing SQLite, SQLiteOpenHelper and creating a database, Opening and closing a database, working with cursors, inserts, updates, and deletes.

Content Provider-Accessing built in content providers, Content provider MIME types, searching for content, Adding, changing, and removing content, creating content provider, Working with content files.

REFERENCES:

MANDATORY:

1. Wei-Ming Lee (2012) .Beginning Android 4 Development.John Wiley & Sons.

SUPPLEMENTARY:

1. Satya Komateneni,(2015).Pro Android 5.Springer Nature. (5th ed).
2. Ed Brunette.(2015).Hello Android - Introducing Google's Mobile Development platform -(4th ed.)The Pragmatic Bookshelf
3. Dimarzio, J.F.(2010). Android- A Programmer's Guide. Tata McGraw Hill

WEB BASED:

1. <https://developer.android.com>
2. <https://www.appinventor.org>

3. <https://codelabs.developers.google.com>
4. <https://www.udacity.com>
5. <https://www.w3school.in>

Practicals: Mobile Application Development

Credit: 1

Marks: 25

Duration:30 Hrs

1. Getting Started with Android – Installing the Development Environment, Configuring Android Stack
2. Creating the First Android Application - Creating a Simple Android Project, Debugging Application through DDMS. setting up environment. AVD Creation, Executing Project on Android Screen.
3. Android application development - Use of GUI components to implement a simple application such as a Calculator.
4. Review the earlier application making use of the advanced UI components.
5. Implementing Data storage application - an application to make Insert , update , Delete and retrieve operation on the database.

Course Title: Introduction to Data Science

Course Code: COM-V.E-11

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite courses:

- Statistical Methods
- Basic probability and statistics.

Course Objectives:

- Become familiar with methods of data science and their practical usefulness.
- To learn, understand, and practice machine learning approaches.
- To analyze large and unstructured data with different tools.

Course outcomes:

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

CO1: Describe what Data Science is and the skill sets needed to be a data scientist.

CO2: Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.

CO3: Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools(plots, graphs, summary statistics) to carry out EDA.

CO4: Describe the Data Science Process and how its components interact.
CO5: Apply basic machine learning algorithms for predictive modeling.
CO6: Identify common approaches used for Feature Generation. Identify basic Feature Selection.
CO7: Reason around ethical and privacy issues in data science conduct and apply ethical practices.
CO8: Create effective visualization of given data (to communicate or persuade).
CO9: Use of Mining Social-Network Graphs in Data science out basic statistical modeling and analysis.

SYLLABUS:

UNIT I: [10HRS]

Introduction to Data Science

What is Data Science? Big Data and Data Science hype -and getting past the hype, Why now? –Datafication, Current landscape of perspectives, Skill sets needed.

Statistical Inference:

Populations and samples, Statistical modeling, probability distributions, fitting a model, Intro to R.

UNIT II: [20HRS]

Exploratory Data Analysis and the Data Science Process:

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm).

Three Basic Machine Learning Algorithms:

Linear Regression, k-Nearest Neighbors (k-NN), k-means

Feature Generation and Feature Selection (Extracting Meaning From Data):

Motivating application: user (customer) retention, Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms, Filters; Wrappers; Decision Trees; Random Forests.

UNIT III: [15HRS]

Mining Social-Network Graphs:

Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs

Data Visualization:

Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects, Exercise: create your own visualization of a complex data set.

Data Science and Ethical Issues:

Discussions on privacy, security, ethics, A look back at Data Science, Next-generation data scientists

REFERENCES:

MANDATORY:

1. O'Neil, C., & Schutt, R. (2013). Doing data science: Straight talk from the frontline. " O'Reilly Media, Inc."

SUPPLEMENTARY:

1. Jure.L., Anand.R,Jeffrey.U(2014). Mining of Massive Datasets v2.1(2nd ed.).Cambridge University Press.
2. Kevin P. Murphy,(2012).Machine Learning: A Probabilistic Perspective.MIT Press.
- 3.Provost, F., & Fawcett, T. (2013). Data Science for Business: What you need to know about data mining and data-analytic thinking. " O'Reilly Media, Inc."
- 4.Hastie, T., Tibshirani, R., & Friedman, J. (2009). The elements of statistical learning: data mining, inference, and prediction. Springer Science & Business Media..
- 5.Blum, A., Hopcroft, J., & Kannan, R. (2020). Foundations of data science. Cambridge University Press.
6. Zaki, M. J., Meira Jr, W., & Meira, W. (2014). Data mining and analysis: fundamental concepts and algorithms. Cambridge University Press.
7. Han, J., Pei, J., & Kamber, M. (2011). Data mining: concepts and techniques. Elsevier.

WEB BASED:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline, O'Reilly
<https://classroom.google.com/u/0/w/NDA4ODg4MTQ3MjZa/t/all>
2. Data Science E-Learning Course:
https://onlinecourses.nptel.ac.in/noc19_cs60/unit?unit=5&lesson=6
3. Simple Linear Regression Example:
<https://www.spss-tutorials.com/simple-linear-regression/>
4. <https://www.kaggle.com/pavansanagapati/a-simple-tutorial-on-exploratory-data-analysis>
5. Data visualization
6. <https://paldhous.github.io/ucb/2016/dataviz/week2.html>
7. <https://www.targetprocess.com/articles/visual-encoding/>

Practicals : Introduction to Data Science**Credit: 1****Marks: 25****Duration:30 Hrs**

1. Implementation of probability distribution
2. Sampling and re-sampling.
3. Linear Models
4. K-Nearest neighbour
5. K-Means
6. Feature Selection Algorithm
7. Filters and Wrappers
8. Decision Trees

All the experiments will be implemented using Excel /R-Tool/ or equivalent.

Course Title: Software Testing

Course Code: COM-V.E-12

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite courses:

- Software Engineering (COM-III.E-1)

Course Objectives:

- To understand the fundamental concepts in software testing
- To study the various software testing strategies
- To learn how to design test cases and execute them.

Course Outcomes:

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

CO1 : Understand the different software testing strategies.

CO2 : Apply testing strategies to live projects.

CO3 : Design test cases

CO4: Execute test cases using software testing tools.

SYLLABUS:

UNIT I:

[15HRS]

Software testing principles - Software Testing- Need for testing, Psychology of testing, Testing economics, SDLC and Testing, Verification & Validation. Quality Assurance, Quality Control.

Testing strategies and types - White box testing techniques - Statement coverage, Branch Coverage, Condition coverage, Decision/Condition coverage, Multiple condition coverage, Dataflow coverage, Automated code coverage analysis, Inspections, Walkthroughs Code Review Black box testing techniques - Boundary value analysis, Robustness testing, Equivalence partitioning, Syntax testing, Finite state testing, Levels of testing, Unit, Integration and System Testing, Compatibility Testing, Domain Testing, Adhoc Testing, Use of Requirement, Traceability Matrix.

UNIT II:

[20HRS]

Integration Testing Waterfall - Top-down, Bottom up, Big bang, Sandwich System and Performance Testing - Types of system testing, Functional and non-functional testing Acceptance Testing, Setting entry and exit criteria for phases and typical product release scenarios, Basic factors governing performance testing, Methodology for performance testing, Tools for performance testing.

Regression Testing - Purpose, Timing, Choice of tests, Smoke tests, Best practices Internationalization and Localization testing - Preliminary concepts, Adhoc testing, Pair testing, Extreme testing, Agile testing, Exploratory testing, Defect seeding.

Usability Testing - Factors in usability testing, Aesthetics testing, Accessibility testing, Tools for usability testing.

Testing object oriented software - Definitions and Challenge differences from testing non-OO Software, Class testing strategies Class Modality, State-based Testing, Message Sequence Specification.

UNIT III:

[10HRS]

People and organizational issues in testing - Common people issues and myths in testing, Providing career paths in testing, Organizational structures for testing teams, Geographically distributed testing teams and success factors.

Test Management and Automation- Test

Planning, Test Management, Test Process, Test Reporting, Test Automation, Factors to consider in automation, Challenges in test automation, Test Metrics, Product Metrics, Process Metrics, Progress Metrics. Use of metrics in ascertaining product release.

REFERENCES:

MANDATORY:

1. Srinivasan D. ,Gopalaswamy R.:(2009)Software Testing- Principles and Practices , 4th Edition: Pearson Publication.

SUPPLEMENTARY:

1. Jalote P., (2010)An Integrated Approach to Software Engineering, 3rd Edition :Narosa Publishing House
2. Pressman R., (2017) ,Software Engineering: A Practitioners Approach, 6th Edition:McGraw Hill Publication.

WEB BASED:

1. <https://www.guru99.com>

Practicals: Software Testing

Credit: 01

Marks: 25

Duration:30 Hrs

1. Planning Test Cases
2. Generating Test Cases/Test Suite
3. Enhancing Tests
4. Debugging Tests
5. Running Tests
6. Analyzing Results
7. Reporting Defects

SEMESTER VI

Course Title: Computer Networks

Course Code: COM-VI. C-8

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses :

- Introduction to Programming (COM-I.C-2)

Course Objectives:

- To understand the basic concepts of Computer Networking.
- To understand the layered architecture of computer networks.

- To understand various transmission media used for networking.
- To understand working of various protocols in different layers.

Course outcomes:

At the end of the course students will be able to

- CO1:** Understand the need for Network and various layers of OSI and TCP/IP reference model.
- CO2:** Explain various Data Communications media.
- CO3:** Identify the different types of network topologies and Switching methods.
- CO4:** Describe various Data link Layer Protocols.
- CO5:** Identify the different types of network devices and their functions within a network.
- CO6:** Differentiate between various Classless and Classful IP addresses with Subnetting concept.
- CO7:** Analyze and Interpret various Network and Transport Layer protocols.
- CO8:** Explain different application layer protocols.

SYLLABUS:

UNIT I

[20HRS]

Introduction

Basics of Computer Networks, Classification: transmission technology, scale; Applications; Data Communications: data, signal, bandwidth, bit interval and bit rate, Modes of Communication. Layered network architecture, Networks models: OSI model, TCP / IP protocol suite; Guided and Unguided Transmission media, Multiplexing: FDM, TDM. Switching: Circuit switching, message switching, Packet Switching.

Data link layer

Data link control: Framing: Character Count, Character Stuffing, Bit Stuffing; , Error Detection and correction, Flow and error control, HDLC; Multiple access: Random access – Controlled access, ALOHA, CSMA, CSMA/CD and CSMA/CA; Ethernet : IEEE standards, standard Ethernet, Fast Ethernet, Gigabit Ethernet.

UNIT II

[15 HRS]

Network layer

Connecting devices: repeater/hub, bridge, router and gateway, Backbone networks - Virtual LANS. Functions of Network layer; Network Service types: Virtual Circuits, Datagrams; Logical addressing: IPv4, private and public IP addressing, special IP addresses, subnetting, IPV6 addressing Internet Protocol: Internetworking: IPv4, Fragmentation and reassembly , Address mapping : ARP, RARP, BOOTP, DHCP, ICMP . Routing: classification of routing, Shortest path routing, Distance Vector routing, Link State routing;

UNIT III : Transport layer, Application layer and Wireless network

[10HRS]

Transport layer : Process-to-Process delivery: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Quality of services (QoS)

Application Layer: Domain Name System (DNS) , E-mail, FTP, HTTP.
Basics of Wireless Networking

REFERENCES:

MANDATORY:

1. Tanenbaum A., W.(2010) Computer Networks (5th ed.) . Pearson Education.

SUPPLEMENTARY:

1. Behrouz A. Forouzan B.(2017) Data communication and Networking(5th ed.). McGraw Hill Education
2. Kurose J, K.(2017) Computer Networking – A Top-Down Approach (6th ed.) Pearson Education,
3. Mir N. (2006) Computer and Communication Networks, Prentice Hall Publishers.

WEB BASED:

- 1.<https://www.youtube.com/watch?v=tj7f244tubM>
 - 2.<https://www.youtube.com/watch?v=vFypCugyFoM>
 - 3.<https://www.geeksforgeeks.org/computer-network-tutorials/>
 4. Slides of the Book . Andrew S. Tanenbaum, David J. Wetherall“Computer Networks”, Prentice-Hall, 5th Edition.:<https://www.pearson.com/us/higher-education/product/Tanenbaum-Power-Point-Lecture-Slides-for-Computer-Networks-5th-Edition/9780132127066.html?tab=downloadable-resources>
 - 5.https://www.tutorialspoint.com/data_communication_computer_network/index.htm
 - 6.https://www.cisco.com › training-events › netacad › course_catalog › docs
- Slides for the book Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw – Hill,2011, 4th Edition : 8.<http://www.mhhe.com/engcs/compsci/forouzan/dcn/index.mhtml>

Practicals: Computer Networks

Credits : 1

Marks : 25

Duration:30 Hrs

Practical (Any 6 practical):

- Setting up of LAN Network (2P)
- IP address manipulation -Extract network id and Host id given netmask (2P)/Mini Project
- Configuring routing tables

- TCP Socket programming (2P)
- UDP Socket programming (2P)
- Mini Project / Simulation of IP fragmentation
- Mini Project/Configuring E-Mail/DNS
- Installing virtual machines, Ethernet cabling

Course Title: Network Security

Course Code: COM-VI. E-13

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses:

- Introduction to Programming(COM-I.C-2)
- Object Oriented Programming(COM-II.C-3)

Course Objectives:

- To understand the theory and concepts of Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

Course Outcomes:

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

CO1: classify the symmetric encryption techniques

CO2 : Illustrate various Public key cryptographic techniques

CO3 : Evaluate the authentication and hash algorithms.

CO4 : Discuss authentication applications.

CO5: Summarize the intrusion detection and its solutions to overcome the attacks.

CO6 : Basic concepts of system level security

SYLLABUS

UNIT I:

[15HRS]

Concepts of Security & Classical Encryption Techniques:

Introduction, The need for security, Security Approaches, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Classical Encryption Techniques :Substitution techniques, Transposition techniques, Steganography.

Design Principle of Block Cipher:

Block Cipher Operation: Electronic Code Book, Cipher Block Chaining, Cipher Feedback, Output Feedback, Counter, Feistel Cipher, The Data Encryption Standard.

Cryptography:

Mathematical Tools

Introduction to Number Theory, Modular Arithmetic, Prime Numbers, Euler's Totient Function.

UNIT II:

[15HRS]

Public Key Cryptography:

Principles of Public Key Cryptosystems, The RSA Algorithm, Other Public key cryptosystems, Diffie Hellman Key Exchange.

Cryptographic Hash Functions:

Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Hash Functions Based on Cipher Block Chaining, MD5 Message Digest Algorithm, Secure Hash Algorithm SHA 512.

Message Authentication Codes and Digital Signatures:

Message Authentication Requirements – Message Authentication Functions –Requirements for Security of MACs,MACs Based on Hash Functions, HMAC, MACs Based on Block Ciphers, Data Authentication Algorithm. Digital Signatures, Digital Signature Standard.

UNIT III:

[15 HRS]

Key Management & Distribution And User Authentication:

Introduction, Digital Certificate, Private key Management, The PKIX Model, Public key cryptographic standards ,XML, PKI and security.

Program Security:

Flaws, Malicious code: viruses, Trojan horses, worms, Program flaws: buffer overflows, time-of check to time-of-use flaws, incomplete mediation.

Firewall and Virtual Private Network:

Introduction to network security techniques: IP Security, firewalls, virtual private networks.

REFERENCES:

MANDATORY:

1.William.S,(2017).Cryptography and Network Security – Principles and Practices(7th ed.).Prentice Hall of India.

SUPPLEMENTARY:

- 1.Charles P. Pfleeger and Shari L. Fleeger(2015).Security in Computing(7th ed.). Prentice-Hall.
- 2.Atul.K,(2007).Cryptography and Network Security(2nd ed.).Tata McGraw-Hill.
- 3.Menezes A. J., P.C. Van Oorschot and S.A. Vanstone(1997) —Handbook of Applied Cryptography(2nd ed.).Jaypee medical.

WEB BASED:

1. [Cryptography and Network Security - Nptel](https://nptel.ac.in/courses/106/105/106105031/)
<https://nptel.ac.in/courses/106/105/106105031/>
2. William Stallings, —Cryptography and Network Security – Principles and Practices || ,
Prentice Hall of India
<http://www.amorena.com.ar/PAG%20DE%20MATERIAS%20Y%20LIBROS/LIBROS%20TODOS/CRYPTOGRAPHY%20AND%20NETWORK%20SECURITY,%20PRINCIPLES%20AND%20PRACTICE.pdf>
3. [Cryptography Tutorial](https://www.tutorialspoint.com/cryptography/index.htm)
<https://www.tutorialspoint.com/cryptography/index.htm>
4. [IPSec, VPN, and Firewall Concepts](http://www.cs.unh.edu/~it666/reading_list/Networking/firewall_concept_terms.pdf)
http://www.cs.unh.edu/~it666/reading_list/Networking/firewall_concept_terms.pdf
5. [Implementation of Hill Cipher](https://www.tutorialspoint.com/cplusplus-program-to-implement-the-hill-cypher)
<https://www.tutorialspoint.com/cplusplus-program-to-implement-the-hill-cypher>

Practicals :Network Security

Credits : 1
Marks : 25
Duration:30 Hrs

1. Implementation of Caesar Cipher
2. Implementation of One-Time Pad
3. Implementation of Playfair Cipher
4. Implementation of Hill Cipher
5. Implementation of Data Encryption Standard Algorithm
6. Implementation of Image Steganography
7. Implementation of RSA Algorithm
8. Implementation of Digital Signatures using RSA Algorithm
9. Design Network protocol analyzer tool to analyze network traffic.
10. Mini Project/ Case Study

Course Title: Cloud Computing

Course Code: COM-VI. E-14

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses:

- Operating Systems(COM-V.C-7)

Course Objectives:

- To make students understand the key elements of cloud computing.
- To understand the difference between deploying applications on the cloud and the local infrastructure.
- To understand various cloud service models.

Course Outcomes:

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

CO1: Explain the core concepts of the cloud computing paradigm.

CO2: Characterize the different cloud services ie. Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS).

CO3: Deploy application in a production environment.

CO4: Host a cloud platform like Apache OwnStack and Owncloud.

SYLLABUS:

UNIT I: Introduction to cloud computing

[15HRS]

Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Cloud Computing definition, History of Cloud Computing, How Cloud Computing Works, Benefits and challenges of cloud computing, Issues for Cloud Computing.

UNIT II: Cloud Computing Architecture and Infrastructure as a Service(IaaS)

[15HRS]

Comparison with traditional computing architecture (client/server), Cloud Computing Service Models, Deployment Models- Public cloud, Private cloud, Hybrid cloud and Community cloud, Key drivers to adopting cloud, Impact of cloud on users, Governance in the cloud. Introduction to IaaS: IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM). Resource Virtualization: Server, Storage, Network. Examples: Amazon EC2.

UNIT III: Platform as a Service(PaaS) and Software as a Service(SaaS)

[15HRS]

Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management: Computation, Storage, Examples: Google App Engine, Microsoft Azure, [SalesForce.com](https://www.salesforce.com). Introduction to SaaS, Web services, Web 2.0, Web OS, Introduction to MapReduce, Case Study on SaaS.

REFERENCES:

MANDATORY:

- Tim mather, subra kumarswamy and sharhed Latif, “Cloud Computing Security and Privacy”, O’Reilly publication.
- Richard Hill, Laurie Hirsch, Peter Lake, SiavashMoshiri, “Guide to Cloud Computing Principles and Practices”, Springer.
- Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). (2010). Cloud computing: Principles and paradigms (Vol. 87). John Wiley & Sons.
- Nikos Antonopoulos, Lee Gillam “Cloud Computing: Principles, Systems and Applications”, Springer.
- Vines, R. L. K. R. D., & Krutz, R. L. (2010). Cloud security: A comprehensive guide to secure cloud computing (pp. 35-41). Wiley Publishing, Inc.

Practicals: Cloud Computing

Credit : 1

Marks : 25

Duration:30 Hrs

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Install a C compiler in the virtual machine and execute a sample program.
4. Working on tools used in cloud computing online-
 - a) Storage
 - b) Sharing of data
 - c) Manage your calendar, to-do lists,
 - d) A document editing tool
5. Working with any cloud service to make spreadsheet and notes and collaborate online in real time and chat with other collaborators.
6. Exploring Public Cloud.
7. Exploring Cloud IDE’s.
8. Installation and Working of Google App Engine
9. Web Service deployment and usage over cloud.

Course Title: Multimedia Techniques

Course Code: COM-VI. E-15

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses: Nil

Course Objectives:

- To understand basic concept of Multimedia.
- To develop skills for designing graphical images.
- To develop skills for audio and video editing.
- To acquire skills in using audio/video editing software.

Course Outcomes:

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

CO1 :Understand the concept of Multimedia – Team members and their roles.

CO2 :Identify and describe the function of the general skill sets in the multimedia industry.

CO3 : Classify and realize the types of Authoring tools and their functions.

CO4 : Identify basic components of a multimedia project.

CO5 : Analyze the requirements of Multimedia product.

CO6: Assemble and deliver multimedia projects

SYLLABUS:

UNIT I: Introduction to Multimedia and Computer Graphics: [15HRS]

Commonly used terms associated with multimedia like CDROM, Storyboard, Script and Authoring tools. Stages of a Multimedia Project-Planning and Costing, Designing and Producing, Testing and Delivering. The Multimedia team and their roles- Project Manager, Writer, Video specialist, Audio specialist and Multimedia programmer. Multimedia Software. Multimedia Hardware. Social & Ethical considerations, Digital Representations & Standards.

Multimedia Authoring Tools:

Types of Authoring tools; Card and Page based tools; Icon-based; Time-based; Object-Oriented Tools.

TEXT: Text in graphics, character set, fonts, layout.

Vector graphics fundamentals, shapes, transforms and filters, Bitmapped graphics: resolution, image compression, manipulation, Geometrical transformations.

UNIT II : Sound and Color [15HRS]

Basic Sound Concepts, Digitizing and processing sound, Music, Speech, Compression, formats, MIDI and Digital Audio Human vision, Camera systems, Gamma correction, Color matching, different Color models – RGB, CYMK, Transformations among color model.

UNIT III : Video, Animation and Data compression

[15HRS]

Digitizing video, streamed video, video standards, Introduction to Animation: Principles of Animation-Animation techniques-persistence of vision, animation file formats, Computer animation-kinematics and morphing

Data Compression: Types of compression: Lossy & Lossless, Symmetrical & Asymmetrical, Intraframe & Interframe, Hybrid. Study of different compression techniques for Text (Huffman coding, LZ & LZW), Image, Audio, Video (MPEG and AVI).

Multimedia on the Web: Bandwidth relationship, broadband technologies, Text in the web – Dynamic and embedded font technology, Audio on the Web – Real Audio and MP3/MP4, Audio support in HTML, Graphics – HTML safe color palette, Interlaced V/s Non interlaced model, Graphics support in HTML, Image Map, Video on the Web – Streaming video.

REFERENCES:

MANDATORY:

1. Chapman, N., & Chapman, J. (2005). Digital multimedia. John Wiley & Sons, Inc..
2. Li, Z. N., Drew, M. S., & Liu, J. (2004). Fundamentals of multimedia (pp. 253-265). Upper Saddle River (NJ):: Pearson Prentice Hall.
3. Vaughan, Tay; Multimedia: Making it Work; Tata McGraw-Hill, 9th edition.

SUPPLEMENTARY:

1. Jeffcoate, J. (1995). Multimedia in practice. *Technology and Applications. Great Britain: Prentice Hall.*

WEB BASED:

1. <https://www.gimp.org/>
2. <https://www.audacityteam.org/>
3. https://swayam.gov.in/nd2_ugc19_hs42/
4. <https://www.tutorialspoint.com/multimedia>

Practicals: Multimedia Techniques

Credit: 01

Marks: 25

Duration:30 Hrs

Practical can be done using Proprietary or FOSS for Text, Image, Audio and Video Editing. For example Scribus, GIMP, Audacity, Movie maker, Openshot, etc.

1. Design a Brochure for a given product, give details. Learn about different Image file Formats
2. Design a Poster with given information and learn about Image compression
3. Image Enhancements/ mixing and prepare images for web.
4. Edit the Sound file and Learn about Effects and Filters of sound
5. Record Your voice and learn about Audio Compression.
6. Record an Audio Program and Learn about streaming an audio content.
7. Learn about Video editing – Prepare video with rough cut
8. Prepare Video content with title and special effects.

9. Prepare multimedia content for web.

Course Title: Digital Marketing

Course Code: COM-VI.E-16

Marks: 75

Credits: 3

Duration:45 Hrs

Prerequisite Courses:

- Web Designing (COM-III.E-4)

Course Objectives:

- To build Optimized and Accessible Websites for the Search Engines.
- To study various online Marketing Strategies.
- Analyze and research Internet to improve the quality and marketability of the Websites.

Course Outcomes:

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

CO1: Optimize the website for various search engines.

CO2: Market the products/services/facilities using Search Engine.

CO3: Market the products/services/facilities using Social Media.

CO4: Market the products/services/facilities using Email.

CO5: Analyze the Web for improving the marketing strategy.

CO6: Understand the concept of Marketing Automation.

CO7: Use various software tools to implement Digital Marketing.

UNIT I: Search Engine Optimisation and Marketing (SEO & SEM)

[15 HRS]

SEO: Introduction to Online Search; Function of Search Engines Google Page Rank; Introduction to Search Engine Optimisation; Building Accessible Site; Keyword Research and Optimisation; Link Building Strategies; Useful Tools for SEO; The Past, Present and Future of SEO.

SEM: Introduction to Internet and Search Engine Marketing; Google Adwords; Adwords Account Structure; Navigating in Google Adwords; Working with Keywords; Creating Ads in Google Adwords; Creating and Managing your First Ad Campaign; Adwords Reporting and Account Performance Reports.

UNIT II: Social Media and Email Marketing (SMM & EM)

[15 HRS]

SMM: Introduction to the World of SMM; Why Social Media?; Getting Started with Social Media; Building Relationships via Facebook, Twitter, LinkedIn, YouTube; Handling Positive and Negative Comments; Social Media Content Base Creation.

EM: Importance of Email marketing; Email Marketing Software's; Subscriber List; Email Marketing Campaign; Newsletters; Measuring the results.

UNIT III: WEB Analytics and Marketing Automation

[15 HRS]

Web Analytics and Intelligence Tools; Basic Metrics Demystified; Introduction to Google Analytics; Goals and Actionable Insights; Data Management; Social Media Analytics; Social Media Goals and KPI's; Tools for Social Media Analytics.

Marketing Automation: Introduction to Marketing Automation; Advantages of using Marketing Automation Software; Issues with Marketing Automation.

REFERENCES:

MANDATORY:

1. Ryan, D. (2014). The best digital marketing campaigns in the World II. Kogan Page Publishers.

SUPPLEMENTARY:

1. Smith, N. (2013). Successful SEO and search marketing in a week: teach yourself. Hodder & Stoughton.
2. Odden, L. (2012). Optimize: How to attract and engage more customers by integrating SEO, social media, and content marketing. John Wiley & Sons.
3. Kaushik, A. (2009). Web analytics 2.0: The art of online accountability and science of customer centricity. John Wiley & Sons.

WEB BASED:

1. https://www.tutorialspoint.com/digital_marketing/index.htm
2. www.iab.net/resources/ad_revenue.asp
3. www.searchenginestrategies.com/sew/winter06/index.html
4. <https://developers.google.com/products/>
5. www.freewebsubmission.com
6. <https://www.semrush.com/analytics/seomagic/lists>
7. <https://neilpatel.com/ubersuggest/>
8. <https://adwords.google.com/home>
9. <https://hootsuite.com/>
10. www.googleanalytics.com

Practicals: Digital Marketing

Credit: 1

Marks: 25

Duration: 30 Hrs

1. Using Search Engine Optimization tools (like google & bing search console, hubspot, webceo, google page speed) [3P]
2. Using Search Engine Marketing tools (like google adwords, google adwords certifications, search, display, remarketing formats, facebook marketing, linkedin advertising) [2P]
3. Using Social Media Marketing tools (like hootsuite, buffer, sproutsocial, klear, twitonomy, socialmention, google alerts, mention) [2P]

4. Using Email Marketing tools (like mailchimp, campaign monitor, mailgun, mandrill, phplist, amazon ses) [1P]
5. Using Web Analytics tools (like google analytics, compete.com, crazyegg, facebook insights, twitter insights) [2P]

10. Teaching-Learning-Evaluation Pedagogies:

The following approach should be adopted for conducting the different modes of Assessment:

1. Open Book Exam (OBE)
2. Multiple Choice Questions (MCQ)
3. Student Presentations
4. Short –Answer Questions
5. Assignments
6. Portfolios
7. Case study
8. Gobbet
9. Poster/ Chart/ Model
10. Concept /Mind Maps

These modes can be chosen based on the intended learning outcome of the course.

1.Open Book Exam (OBE): Allows the students to take notes, texts or resource materials into an Exam hall. It is focused on one's ability to find and apply information and knowledge and think critically (Assessing higher cognitive abilities of a student).

2. Multiple Choice Questions (MCQ): Are forms of Assessment for which students are asked to select one or more of the choices from the list of answers. MCQs are typically used for assessing knowledge only, MCQs are usually used as formative assessments during class.

3.Student Presentations: Presentation is the process of showing and explaining the content of a topic to an audience or a group of audiences. It is often used to assess student learning in individual or group work/research projects. Presentation is an effective method to improve students at public speaking.

4.Short –Answer Questions: Are open-ended questions that require students to create an answer. They are commonly used in examinations to assess the basic knowledge and understanding (low cognitive levels) of a topic.

5. Assignments: It is a technique which can be usually used in teaching and learning process. It is an instructional technique comprises the guided information, self learning, writing skills and report preparation among the learner.

6. Portfolios: Is a collection of students work which gives evidence to show how the student can meet the specified learning outcomes. A typical portfolio consists of work selected by the student, reasons for selecting these works and self reflection on the learning process. Portfolio is a development process, thus it is not only the product that the student or teacher assess upon but also the learning process in which the student develops during the given period. Portfolio is an assessment method that monitors the growth and development of the student learning.

7. Case study: The aim of case study is to help the students demonstrate the theoretical concepts in real life issues. Students can also develop various generic skills, such as decision making and practical skills through the case study.

8. Gobbet: A Gobbet can often be a passage of literature, an image, a cartoon, a photograph, a map or an artefact which provides a context for analysis, translation or discussion in an assessment.

9. Poster/ Chart/ Model: Poster process of showing the content and the findings of a topic to an audience or a group of audiences at different times. It is often used to assess student learning in group research projects. Peer and tutor assessment can be used as part of the grading process.

10. Concept /Mind Maps: A concept map is a hierarchical form of structure diagram that illustrates conceptual knowledge and their relationships within a specific topic from general to specific concepts. It consists of concept label which are connected together by lines, these lines are labeled with directions. The core element of a concept map is a proposition, which consists of two or more concepts connected by a labeled link which are then branched out to form a larger structure that provides the whole picture. This may be considered as a component of other modes of assessment. (e.g. Component of assignment, component of portfolio etc).

11. Activities of the Department:

- Certificate Programs
- Workshops / Training on recent technologies
- Techweek
- I-Rix
- Newsletter

13.Matrix 1:

Components	Course 1	Course Code/Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
			1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
Component A	Course 1	COM-I.C-1 Mathematical foundation of Computer Science – I	√				√		√	
	Course 2	COM-I.C-2 *Introduction to Programming	√		√		√	√		
	Course 3	COM-II.C-3 A**Database Mangement System I	√		√		√	√	√	
	Course 4	COM-II.C-4 *Data Structures	√				√	√	√	
	Course 5	COM-III.C-5A*Object Oriented Programming	√		√		√	√	√	
	Course 6	COM-E1 Software Engineering	√		√		√	√	√	
	Course 7	COM-E2 Digital Logic Design	√				√		√	
	Course 8	COM-E3 Mathematical Foundation of Computer Science – II								
	Course 9	COM-E4 Web Designing	√		√		√	√	√	√
	Course 10	COM-IV.C-6 Computer Architecture and Organization	√		√			√	√	
	Course 11	COM -E5 Design & Analysis of Algorithms	√				√	√	√	
	Course 12	COM E-10 Mobile Application Development	√		√		√	√	√	√
	Course 13	COM-E7 Server Side Programming	√		√		√	√	√	√
	Course 14	COM-E8 HCI	√	√	√		√	√		√
	Course 15	COM-V.C-7* Operating Systems	√				√		√	
	Course 16	COM- E9 Embedded Systems	√		√		√	√	√	
	Course 17	COM E-17 Data Base Management System II	√				√	√	√	
	Course 18	COM E-11 Introduction to Data Science	√	√		√	√	√	√	
	Course 19	COM-E12 Software Testing	√		√		√	√	√	
	Course 20	COM-VI.C-8*Computer Networks	√						√	√
	Course 21	COM-E13 Network Security	√	√				√	√	√
	Course 22	COM- E14 Cloud Computing	√		√	√	√	√	√	√
	Course 23	COM -E15 Multimedia Techniques	√		√			√	√	
	Course 24	COM E-16 Digital Marketing	√	√	√	√	√	√	√	
	GENERIC ELECTIVE COURSES (GEC)									
	Course 1	COM-GEC.2 E-Learning	√		√		√	√		
	SKILL ENHANCEMENT COURSE (SEC)									
Component B	Course 1	COM-SEC1 Python Programming	√				√	√	√	

Matrix 2:

MATRIX – 2 (<i>Course - Wise</i>) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (<i>Core</i>) Course Code: COM-I.C-1

Course Title: Mathematical foundation of Computer Science – I

(use (✓) if linked, (X) if not linked)

<div> <div>PLOs</div> <div>CLOs</div> </div>	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply conceptual network security in design system
1.Explain various fundamental concepts.	✓							
2.Convert a given number from one base to another.	✓				✓			
3.Apply counting principles to determine probabilities.	✓				✓			
4.Demonstrate an understanding of relations and functions and determine their properties.	✓							
5.Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.	✓				✓		✓	
6.Write an argument using logical notation and determine if the argument is valid or not.	✓				✓		✓	
7.Construct and analyze finite state automata.	✓				✓		✓	

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-I. C-2 * Course Title: Introduction to Programming <i>(use (✓) if linked, (X) if not linked)</i></p>								
<div> <div>PLOs</div> <div>CLOs</div> </div>	1.Use of Technology and Problem Analysis and solutions	2 Environment and Sustainability , Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Explain problem solving strategies.	✓		✓		✓	✓		
2.Draw a flowchart for a given problem.	✓		✓		✓	✓		
3.Write an algorithm for a given problem.	✓		✓		✓	✓		
4.Explain and Apply sorting and searching algorithms.	✓		✓		✓	✓		
5.Recognize and incorporate programming elements such as loops, decision making, functions, arrays,strings.	✓		✓		✓	✓		

6. Recognize and incorporate programming elements such as structures, pointers and files into applications that solve real world problems.	✓		✓		✓	✓		
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MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-II. C-3A ** Course Title: Database Management System I <i>(use (✓) if linked, (X) if not linked)</i>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2 Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Explain the various database concepts and the need for database systems.	✓		✓		✓	✓	✓	
2.Identify different entities and relationship between them.	✓		✓		✓	✓	✓	

3. Represent the given system using ER diagram.	✓		✓		✓	✓	✓	
4. Convert an ER diagram to a database schema.	✓		✓		✓	✓	✓	
5. Formulate queries in Relational Algebra, SQL to manipulate the database.	✓		✓		✓	✓	✓	
6. Analyze the schema to see if they fulfill Normalization criterion								
7. Design database using appropriate RDBMS.	✓		✓		✓	✓	✓	
8. Design User Interface for Database.								
9. Design Reports for Database.								

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme : B.Sc (Computer Science)

Type of Course: (Core)

Course Code: COM-II.C-4 *

Course Title: Data Structures

(use (✓) if linked, (X) if not linked)

<div style="display: flex; flex-direction: column; align-items: center;"> <div>PLOs</div> <div>CLOs</div> </div>	1.Use of Technology and Problem Analysis and solutions	2 Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Define relevant standard algorithms for various data structures. Learn various applications of data structures.	✓				✓			
2.Implementation of data	✓				✓			

structures.								
3. Use various data structures for sorting and searching.	✓				✓			
4. Analyze and compare algorithms for efficiency using Big-O notation.	✓				✓			
5. Formulate new solutions for programming problems.	✓				✓	✓	✓	

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-III.C-5A * Course Title: Object Oriented Programming <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2.Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Apply fundamental object-oriented concepts in problem	✓				✓		✓	

solving .								
2. Analyze problem scenario and identify classes/objects, their properties/functionalities and associations.	✓				✓	✓		
3. Analyze the problem scenario and model the system using UML diagrams.	✓				✓	✓	✓	
4. Implement the object oriented model in any object oriented language.	✓		✓		✓	✓	✓	

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM-E1
Course Title: Software Engineering

(use (✓) if linked, (X) if not linked)

PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and (✓) Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. Understand the various Software	✓				✓			

Develo pment Metho dologi es.								
2.Appl y Estima tion techniq ues to live project s.	✓		✓		✓			
3. Analyz e Softwa re Project s.	✓		✓		✓	✓		
4.Desi gn Softwa re Project s.	✓		✓		✓	✓	✓	

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM-E2
Course Title: Digital Logic Design
(use (✓) if linked, (X) if not linked)

PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. Convert values between various number systems/codes.	✓				✓			
2. Simplify the logical	✓				✓			

express ion using Boolea n algebra .								
3. Design , simplif y and imple ment combin ational logic circuits .	✓				✓		✓	
4.Desi gn and imple ment the sequen tial logic circuit and their applica tions.	✓				✓		✓	
5.Expl ain the method s of D/A convert er and A/D convert ers (Succe ssive Appro ximati on method).	✓							
6.Expl ain the classifi cations and	✓							

characteristics of semiconductor memories with memory expansion.								
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<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM-E3 Course Title: Mathematical Foundation of Computer Science – II <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.System of linear equations in solving the								

problems								
2. Apply the Interpolation methods for solving the problems numerically.								
3. Demonstrate the process of curve fitting of data.								
4. Determine the roots of polynomial equations.								

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM-E4
Course Title: Web Designing

(use (✓) if linked, (X) if not linked)

CLOs	PLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. Design Content for a web application.		✓		✓		✓	✓	✓	✓

2.Style content so as to provide an effective User Interface.	✓		✓		✓	✓	✓	
3.Provide for dynamism in the User Interface to enhance usability.	✓		✓		✓	✓	✓	✓
4.Develop a static web application.	✓		✓		✓	✓	✓	✓

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM-IV.C-6 Course Title: Computer Architecture and Organization <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.

					customer needs and Software standard.			
1. Identify various components of the Computer System.	✓		✓			✓	✓	
2. Explain the detailed function of a typical microprocessor and its control unit.	✓					✓	✓	
3. Implement Assembly Language Program for 8086 processor for a given task.	✓							
4. Differentiate the function and role of semiconductor memories and map the cache memory for the given scenario.	✓					✓	✓	
5. Appraise the importance of input/output modules and Interrupts and their functions.	✓					✓	✓	
6. Distinguish the characteristics and function of I/O interfaces to computer system.	✓					✓	✓	

7. Illustrate the function of pipelined architecture and classify the Multiprocessor systems.	✓					✓	✓	
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<p align="center">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM- E5 Course Title: Design & Analysis of Algorithms <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1. Use of Technology and Problem Analysis and	2. Environment and Sustainability, Ethics	3. Individual Team work, Communication	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and	6. Use and Apply appropriate current technologies, techniques and modern tools	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue	8. Apply the concept of networking and security features in designing the

	solutions	and Social Responsi bility	skills and Life skills		evaluate the proposed solution to ensure that it meets customer needs and Software standard.	necessary for computing practice.	higher education.	systems.
1.To analyze the performan ce of algorithms .	✓				✓	✓	✓	
2.Choose appropriat e algorithm design techniques for solving problems.	✓				✓	✓	✓	
3.Analyze empirical results to get a deeper understan ding of the algorithmi c solutions.	✓				✓	✓	✓	
4.Apply important algorithmi c design paradigms and methods of analysis.	✓				✓	✓	✓	

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM- E10
Course Title: Mobile Application Development
(use (✓) if linked, (X) if not linked)

	1.Use	2.	3.In	4.Resear	5.Analyze a	6.Use and	7.Embark on an	8.Apply the
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PLOs CLOs	of Technology and Problem Analysis and solutions	Environment and Sustainability, Ethics and Social Responsibility	dividual Team work, Communication skills and Life skills	ch Aptitude	Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	concept of networking and security features in designing the systems.
1.Explain mobile devices, including their capabilities and limitations.	✓							
2.Review current mobile platforms and their architectures.	✓						✓	
3.Develop mobile applications on a popular mobile platform.	✓		✓		✓	✓	✓	✓
4.Evaluate development with another mobile platform.	✓		✓		✓	✓	✓	✓

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM-E7 Course Title: Server Side Programming</p>

(use (✓) if linked, (X) if not linked)								
PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. Design and implement server-side scripts.	✓		✓		✓	✓	✓	✓
2. Create and manipulate databases using SQL and server side technologies.	✓		✓		✓	✓	✓	✓
3. Create data documents using XML/JSON.	✓		✓		✓	✓	✓	✓
4. Enhancing web applications using AJAX and XML/JSON.	✓		✓		✓	✓	✓	✓
5. Develop dynamic web applications using the object oriented paradigm.	✓		✓		✓	✓	✓	✓

<p align="center">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective)</p>
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Course Code: COM -E8
Course Title: Human Computer Interface

(use (✓) if linked, (X) if not linked)

<div style="text-align: center;">PLOs CLOs</div>	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. To understand the intricacies of human interaction with a computer System.	✓				✓	✓		
2. To understand the concept of a graphical user interface, and its design characteristics.	✓		✓		✓	✓		
3. To recognize the human element its strengths and weakness for computer interaction.	✓	✓	✓		✓			
4. To know the principles of good screen design and layouts.	✓	✓	✓		✓	✓		✓
5. To know the different navigation schemes on windows-based	✓		✓		✓	✓		

interface; learn the different types of selection devices and components of a window- based interface.								
6.To know the different types of interaction devices and media.	✓		✓		✓	✓		

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme : B.Sc (Computer Science)

Type of Course: (Elective)

Course Code: COM-V.C-7 *

Course Title: Operating Systems

(use (✓) if linked, (X) if not linked)

<div style="display: flex; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">CLOs</div> <div style="margin-left: 10px;"> PLOs 1.Use of Technology and Problem Analysis and solutions 2. Environment and Sustainability, Ethics and Social Responsibility 3.Individual Team work,Communication skills and Life skills 4. Research Aptitude 5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard. 6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice. 7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education. 8.Apply the concept of networking and security features in designing the systems. </div> </div>								
1.Explain the role of operating system.	✓							
2.Differentiate between different types of operating system.	✓							
3.Describe process management and process coordination .	✓				✓			
4.Implement various CPU scheduling algorithms and compare their performance .	✓				✓		✓	
5.Explain deadlock handling.	✓				✓		✓	
6.Describe features of Virtual memory.	✓				✓		✓	

7.Implement various Memory Allocation algorithms.	✓				✓		✓	
8.Implement various page replacement algorithms.	✓				✓		✓	
9.Describe different file organization and access methods.					✓			

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM-E9 Course Title: Embedded Systems <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Describe Embedded Systems and its characteristics.	✓					✓	✓	
2.Classify the Embedded processors and their design metrics.	✓					✓	✓	

3.Summarize the performance of ARM processors and various components of Embedded Systems.	✓					✓	✓	
4.Classify Sensors and Actuators and identify their functions and applications.	✓					✓	✓	
5.Categorize I/O devices , I/O Interfacing and Communication protocols along with their functions.	✓					✓	✓	
6.Generalize the functionality of IoT and RTOS.	✓					✓	✓	

7.Design and develop Embedded / IoT Applications using Arduino/Raspberry-Pi boards.	✓		✓		✓	✓	✓	
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MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme : B.Sc (Computer Science)

Type of Course: (Elective)

Course Code: COM-E17

Course Title: Data Base Management System II

(use (✓) if linked, (X) if not linked)

PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Formulate complex queries for	✓				✓		✓	

databas e updatio n								
2.Imple ment stored proced ure and functio ns	✓				✓		✓	
3.Unde rstand concurr ent transact ion and recover y mechan isms.					✓	✓	✓	
4.Devel op a full databas e applica tion.					✓	✓		
5.Unde rstand and apppre ciate the NoSQL databas es.					✓	✓	✓	

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM-E11 Course Title: Introduction to Data Science <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem , design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard .	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply the concept of networking and security features in designing the systems.
1.Describe what Data				✓				

Science is and the skill sets needed to be a data scientist .								
2.Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.	✓			✓		✓		
3.Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools(plots, graphs, summary statistics) to carry	✓			✓		✓		

out EDA.								
4.Describe the Data Science Process and how its components interact.				✓				
5.Apply basic machine learning algorithms for predictive modeling.	✓			✓		✓	✓	
6.Identify common approaches used for Feature Generation. Identify basic Feature Selection.	✓			✓		✓		
7.Reason around ethical and privacy issues in data science conduct and apply ethical practices.		✓						

8.Create effective visualization of given data (to communicate or persuade).	✓						✓	
9.Use of Mining Social-Network Graphs in Data science out basic statistical modeling and analysis .	✓			✓			✓	

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM-E12
Course Title: Software Testing
(use (✓) if linked, (X) if not linked)

PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
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					ensure that it meets customer needs and Software standard.			
1.Understand the different software testing strategies.	✓				✓			
2.Apply testing strategies to live projects.	✓		✓		✓			
3.Design test cases	✓		✓		✓	✓		
4.Execute test cases using software testing tools.	✓		✓		✓	✓	✓	

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Elective)
Course Code: COM-VI.C-8 *
Course Title: Computer Networks

(use (✓) if linked, (X) if not linked)

PLOs CLOs	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and	6.Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry	8.Apply the concept of networking and security features in designing the systems.
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					Software standard.		or pursue higher education.	
1.Understand the need for Network and various layers of OSI and TCP/IP reference model.	✓							
2.Explain various Data Communications media.	✓							
3.Identify the different types of network topologies and Switching methods.	✓							
4.Describe various Data link Layer Protocols.	✓							
5.Identify the different types of network devices and their functions within a network.	✓							
6.Differentiate	✓						✓	✓

between various Classele ss and Classfull IP addresse s with Subnetin g concept.								
7.Analy ze and Interpret various Network and Transpo rt Layer protocol s.								
8.Explai n different applicati on layer protocol s.	✓							✓

<p align="center">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Elective) Course Code: COM- E-13 Course Title: Network Security <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technol ogy and Problem Analysi	2. Environ ment and Sustaina	3.Indivi dual Team work,C ommuni	4.Resea rch Aptitud e	5.Analy ze a Softwar e problem	6.Use and Apply appropriate current technologies, techniques and modern tools	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue	8.Apply the concept of networking and security features in

	s and solution s	bility, Ethics and Social Respons ibility	cation skills and Life skills		, design, implem ent a solution and evaluate the propose d solution to ensure that it meets custome r needs and Softwar e standard .	necessary for computing practice.	higher education.	designing the systems.
1. Classif y the symme tric encrypt ion techniq ues						✓		✓
2.Illustr ate various Public key cryptog raphic techniq ues								✓
3.Evalu ate the authent ication and hash algorith ms.	✓					✓	✓	✓
4.Discu ss authent ication applica tions.		✓						

5. Summarize the intrusion detection and its solutions to overcome the attacks.								✓
6. Basic concepts of system level security								✓

MATRIX – 2 (Course - Wise)
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES
Programme : B.Sc (Computer Science)
Type of Course: (Core)
Course Code: COM- E-14
Course Title: Cloud Computing
(use (✓) if linked, (X) if not linked)

PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply the concept of networking and security features in designing the systems.
1. Explain the core concepts of the cloud computing paradigm.			✓	✓	✓			

2.Characterize the different cloud services ie. Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS).				✓	✓			
3.Deploy application in a production environment.	✓				✓	✓	✓	✓
4.Host a cloud platform like Apache OwnStack and Owncloud	✓				✓	✓	✓	✓

<p align="center">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-. E-15 Course Title:Multimedia Techniques <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1.Use of Technology and Problem Analysis	2. Environment and Sustainable	3.Individual Team work,Communication	4.Research Aptitude	5.Analyze a Software problem	6.Use and Apply appropriate current technologies, techniques and modern tools	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue	8.Apply the concept of networking and security features in

	s and solution s	bility, Ethics and Social Respons ibility	cation skills and Life skills		, design, implem ent a solution and evaluate the propose d solution to ensure that it meets custome r needs and Softwar e standard .	necessary for computing practice.	higher education.	designing the systems.
1. Unders tand the concept of Multim edia – Team membe rs and their roles.	✓		✓				✓	
2. Identi fy and describ e the functio n of the general skill sets in the multim edia industr y.	✓		✓				✓	
3. Class ify and realize the types of Authori	✓		✓			✓		




ng tools and their functions.								
4. Identify basic components of a multimedia project.	✓						✓	
5. Analyze the requirements of Multimedia product.	✓						✓	
6. Assemble and deliver multimedia projects	✓						✓	

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-VI. E-16 Course Title: Digital Marketing <i>(use (✓) if linked, (X) if not linked)</i></p>								
PLOs CLOs	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment	8. Apply the concept of networking and security features in designing the systems.

		nsibilit y					yment in IT industr y or pursue higher educat ion.	
1. Optim ize the websit e for variou s search engin es.	✓	✓	X	X	✓	✓	✓	X
2.Mar ket the produ cts/ser vices/ faciliti es using Searc h Engin e.	✓	X	✓	X	✓	✓	X	X
3.Mar ket the produ cts/ser vices/ faciliti es using Social Media .	✓	✓	✓	X	X	✓	X	X
4.Mar ket the produ cts/ser vices/ faciliti es using Email.	✓	✓	✓	X	X	✓	X	X












































































































































































5. Analyze the Web for improving the marketing strategy.	✓	X	✓	✓	✓	✓	✓	X
6. Understand the concept of Marketing Automation.	✓	X	✓	X	✓	✓	✓	X
7. Use various software tools to implement Digital Marketing.	✓	X	✓	X	✓	✓	✓	X

Matrix 3:

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Mathematical foundation of Computer Science – I <i>(use  if linked,  if not linked and  if mode not used)</i>																
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8

1,2	Traditional Lecture Method															
2	Interactive Lecture Method															
2,3	Group Discussion															
	Debate															
1,2,3	Experiential Learning															
	Out-door Experiments															
3,4,5	Laboratory Work															
	POGIL															
	Flipped Classroom															
	Field Based studies															
3,4,5	Problem Based Learning															
	Project based Learning															

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3															
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs															
PROGRAMME: B.Sc (Computer Science)															
Course: Introduction to Programming															
(use  if linked,  if not linked and  if mode not used)															
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method														
2,3,4	Interactive Lecture Method														
	Group Discussion														
	Debate														
1,2,3	Experiential Learning														
	Out-door Experiments														
2,3,4,5	Laboratory Work														
	POGIL														
	Flipped Classroom														
	Field Based studies														
2,3,4,5	Problem Based Learning														
	Project based Learning														
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-															

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

























































































































PROGRAMME: B.Sc (Computer Science)

Course: Database Management System I

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	CLO 9	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method																	
	Interactive Lecture Method																	
	Group Discussion																	
	Debate																	
	Experiential Learning																	
	Out-door Experiments																	
	Laboratory Work																	
	POGIL																	
	Flipped Classroom																	

	Field Based studies																	
	Problem Based Learning																	
	Project based Learning																	
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating																		

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Data Structures <i>(use  if linked,  if not linked and  if mode not used)</i>														
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
2,3,4	Traditional Lecture Method													
2,3,4	Interactive Lecture Method													
	Group Discussion													
	Debate													
3,4,5	Experiential Learning													
	Out-door Experiments													
2,3,4,5	Laboratory Work													
	POGIL													
	Flipped Classroom													

	Field Based studies													
2,3,4,5	Problem Based Learning													
	Project based Learning													




















Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Object Oriented Programming <i>(use if linked, if not linked and if mode not used)</i>														
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	
1,2	Traditional Lecture Method													
1,2,3,4	Interactive Lecture Method													
1,2,3,4	Group Discussion													
	Debate													
1,2,3,4,5	Experiential Learning													
	Out-door Experiments													




1,2,3,4,5	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
1,2,3,4,5	Problem Based Learning												
1,2,3,4,5,6	Project based Learning												
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating													

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Software Engineering <i>(use if linked, if not linked and if mode not used)</i> 													
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												




	Experiential Learning													
	Out-door Experiments													
	Laboratory Work													
	POGIL													
	Flipped Classroom													
	Field Based studies													
	Problem Based Learning													
	Project based Learning													
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating														

MATRIX 3															
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs															
PROGRAMME: B.Sc (Computer Science)															
Course: Digital Logic Design															
(use  if linked,  if not linked and  if mode not used)															
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method														
	Interactive Lecture Method														

	Group Discussion														
	Debate														
	Experiential Learning														
	Out-door Experiments														
	Laboratory Work														
	POGIL														
	Flipped Classroom														
	Field Based studies														
	Problem Based Learning														
	Project based Learning														
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating															

MATRIX 3													
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs													
PROGRAMME: B.Sc (Computer Science)													
Course: Mathematical Foundation of Computer Science – II													
(use  if linked,  if not linked and  if mode not used)													
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8

	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												
	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
	Problem Based Learning												
	Project based Learning												
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Appling, 4-Analysing, 5-Evaluating, 6-Creating													

<p style="text-align: center;">MATRIX 3</p> <p style="text-align: center;">MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs</p> <p style="text-align: center;">PROGRAMME: B.Sc (Computer Science)</p> <p style="text-align: center;">Course: Web Designing</p> <p style="text-align: center;">(use  if linked,  if not linked and  if mode not used)</p>

Level of Blooms Taxonomy (1-6)	T-L-E modes	C L O 1	C L O 2	C L O 3	C L O 4	P L O 1	P L O 2	P L O 3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8
	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												
	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
	Problem Based Learning												
	Project based Learning												
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating													

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: **Computer Architecture and Organization**

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method															
	Interactive Lecture Method															
	Group Discussion															
	Debate															
	Experiential Learning															
	Out-door Experiments															
	Laboratory Work															
	POGIL															
	Flipped Classroom															
	Field Based studies															
	Problem Based Learning															
	Project based Learning															

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs
PROGRAMME: B.Sc (Computer Science)

Course: Design & Analysis of Algorithms

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	C L O 1	C L O 2	C L O 3	C L O 4	P L O 1	P L O 2	P L O 3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8
	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												
	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
	Problem Based Learning												
	Project based Learning												
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating													

















































































































































MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Mobile Application Development

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method												
2	Interactive Lecture Method												
2,3	Group Discussion												
	Debate												
1,2,3	Experiential Learning												
	Out-door Experiments												
3,4,5	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
3,4,5	Problem Based Learning												
3,4,5,6	Project based Learning												

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Server Side Programming

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method													
	Interactive Lecture Method													
	Group Discussion													
	Debate													
	Experiential Learning													
	Out-door Experiments													
	Laboratory Work													
	POGIL													
	Flipped Classroom													
	Field Based studies													
	Problem Based Learning													
	Project based Learning													

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating









































































































































































MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Human Computer Interface

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method														
1,2,3	Interactive Lecture Method														
2,3	Group Discussion														
	Debate														
1,2,3	Experiential Learning														
	Out-door Experiments														
3,4,5	Laboratory Work														
	POGIL														
	Flipped Classroom														
	Field Based studies														
3,4,5	Problem Based Learning														
3,4,5,6	Project based Learning														

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating




























































































































































































MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)
























































































Course: Operating Systems

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	CLO 9	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2,	Traditional Lecture Method																	
2	Interactive Lecture Method																	
2,3	Group Discussion																	
	Debate																	
1,2	Experiential Learning																	
	Out-door Experiments																	
3,4,5	Laboratory Work																	
	POGIL																	
	Flipped Classroom																	
	Field Based studies																	
3,4,5	Problem Based Learning																	

					1	✓	✓	✓	✓	✓	✓						✓	✓	✓	
	Project based Learning																			

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3																
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs																
PROGRAMME: B.Sc (Computer Science)																
Course: Embedded Systems																
(use  if linked,  if not linked and  if mode not used)																
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method															
	Interactive Lecture Method															
	Group Discussion															
	Debate															
	Experiential Learning															
	Out-door Experiments															
	Laboratory Work															
	POGIL															
	Flipped Classroom															
	Field Based studies															
	Problem Based Learning															
	Project based Learning															
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating																

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Data Base Management System II

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1- 6)	T-L-E modes	C L O 1	C L O 2	C L O 3	C L O 4	C L O 5	P L O 1	P L O 2	P L O 3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8
	Traditional Lecture Method													
	Interactive Lecture Method													
	Group Discussion													
	Debate													
	Experiential Learning													
	Out-door Experiments													
	Laboratory Work													
	POGIL													
	Flipped Classroom													
	Field Based studies													
	Problem Based Learning													
	Project based Learning													

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Appling, 4-Analysing, 5-Evaluating, 6-Creating

























































































































































































































MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Introduction to Data Science

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	CLO 9	CLO 10	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method																		
1,2,3,4	Interactive Lecture Method																		
1,2,3,4	Group Discussion																		
	Debate																		
1,2,3,4,5	Experiential Learning																		
	Out-door Experiments																		
1,2,3,4,5	Laboratory Work																		
	POGIL																		
	Flipped Classroom																		
	Field Based studies																		
6	Problem Based Learning																		
6	Project based Learning																		

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

















































































































































MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Software Testing

(use  if linked,  if not linked and  if mode not used)






































Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												
	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
	Problem Based Learning												
	Project based Learning												

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course:Computer Networks

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method																
	Interactive Lecture Method																
	Group Discussion																
	Debate																
	Experiential Learning																
	Out-door Experiments																
	Laboratory Work																
	POGIL																
	Flipped Classroom																
	Field Based studies																
	Problem Based Learning																
	Project based Learning																

<p>Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating</p>															

MATRIX 3

MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Network Security
































(use if linked, if not linked and if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	C L O 1	C L O 2	C L O 3	C L O 4	P L O 1	P L O 2	P L O 3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8
1,2	Traditional Lecture Method												
1,2,3,4	Interactive Lecture Method												
1,2,3,4	Group Discussion												
	Debate												
1,2,3,4,5	Experiential Learning												
	Out-door Experiments												
1,2,3,4,5	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												




1,2,3,4,5	Problem Based Learning												
1,2,3,4,5	Project based Learning												
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating													

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Cloud Computing <i>(use if linked, if not linked and if mode not used)</i>													
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Traditional Lecture Method												
	Interactive Lecture Method												
	Group Discussion												
	Debate												
	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												

	POGIL													
	Flipped Classroom													
	Field Based studies													
	Problem Based Learning													
	Project based Learning													
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating														


















































































































































































































































































MATRIX 3															
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs															
PROGRAMME: B.Sc (Computer Science)															
Course: Multimedia Techniques															
(use  if linked,  if not linked and  if mode not used)															
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method														
2	Interactive Lecture Method														

2,3	Group Discussion														
	Debate														
1,2,3	Experiential Learning														
	Out-door Experiments														
3,4,5	Laboratory Work														
	POGIL														
	Flipped Classroom														
	Field Based studies														
3,4,5	Problem Based Learning														
	Project based Learning														
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Aplying, 4-Analysing, 5-Evaluating, 6-Creating															

MATRIX 3																
MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs																
PROGRAMME: B.Sc (Computer Science)																
Course: Digital Marketing																
(use  if linked,  if not linked and  if mode not used)																
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8

	Traditional Lecture Method																
	Interactive Lecture Method																
	Group Discussion																
	Debate																
	Experiential Learning																
	Out-door Experiments																
	Laboratory Work																
	POGIL																
	Flipped Classroom																
	Field Based studies																
	Problem Based Learning																
	Project based Learning																
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating																	

Matrix 4:

<p align="center">MATRIX 4</p> <p align="center">MAPPING ASSESSMENT MODES TO CLOs AND PLOs</p> <p align="center">PROGRAMME: B.Sc (Computer Science)</p> <p align="center">Course: Mathematical foundation of Computer Science – I</p> <p align="center"><i>(use  if linked,  if not linked and  if mode not used)</i></p>																
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning															
	Project based Learning															
	Student Seminars															
	Case Studies															
	Student Presentation															
	Gobbet															
	Assignments															
	Open Book Exam															
	SAQ															
	MCQ															
	Portfolio															
	Concept Maps															
	Research based Analysis															
	Enacting /Roleplay															
	Summative term end Exam															
	Laboratory practical															
	Research project															
	Any other..															





























































































































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Introduction to Programming

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning														
	Project based Learning														
	Student Seminars														
	Case Studies														
	Student Presentation														
	Gobbet														
	Assignments														
	Open Book Exam														
	SAQ														
	MCQ														
	Portfolio														
	Concept Maps														
	Research based Analysis														
	Enacting /Roleplay														
	Summative term end Exam														
	Laboratory practical														
	Research project														
	Any other..														

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Database Management System I

(use  if linked,  if not linked and  if mode not used)

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

























































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Data Structures

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
2,3,4,5	Problem Based Learning													
	Project based Learning													
	Student Seminars													
3,4,5	Case Studies													
	Student Presentation													
	Gobbet													
2,3,4,5	Assignments													
	Open Book Exam													
	SAQ													
	MCQ													
	Portfolio													
	Concept Maps													
	Research based Analysis													
	Enacting /Roleplay													
1,2,3,4,5	Summative term end Exam													
3,4,5	Laboratory practical													
	Research project													
	Any other..													

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Object Oriented Programming

(use  if linked,  if not linked and  if mode not used)

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
















































































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Software Engineering

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning												
	Project based Learning												
	Student Seminars												
	Case Studies												
	Student Presentation												
	Gobbet												
	Assignments												
	Open Book Exam												
	SAQ												
	MCQ												
	Portfolio												
	Concept Maps												
	Research based Analysis												
	Enacting /Roleplay												
	Summative term end Exam												
	Laboratory practical												
	Research project												
	Any other..												

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Digital Logic Design

(use  if linked,  if not linked and  if mode not used)

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Mathematical Foundation of Computer Science – II

(use if linked, if not linked and if mode not used)

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Web Designing

(use if linked, if not linked and if mode not used)

[illegible]































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Computer Architecture and Organization

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning															
	Project based Learning															
	Student Seminars															
	Case Studies															
	Student Presentation															
	Gobbet															
	Assignments															
	Open Book Exam															
	SAQ															
	MCQ															
	Portfolio															
	Concept Maps															
	Research based Analysis															
	Enacting /Roleplay															
	Summative term end Exam															
	Laboratory practical															
	Research project															
	Any other.. Viva															

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Design & Analysis of Algorithms

(use  if linked,  if not linked and  if mode not used)

[illegible]

























































































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Mobile Application Development

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning												
	Project based Learning												
	Student Seminars												
	Case Studies												
	Student Presentation												
	Gobbet												
	Assignments												
	Open Book Exam												
	SAQ												
	MCQ												
	Portfolio												
	Concept Maps												
	Research based Analysis												
	Enacting /Roleplay												
	Summative term end Exam												
	Laboratory practical												
	Research project												
	Any other..												

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Server Side Programming

(use  if linked,  if not linked and  if mode not used)

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Human Computer Interface

(use if linked, if not linked and if mode not used)

[illegible]































































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Operating Systems

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	CLO 9	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2,3,4	Problem Based Learning																	
	Project based Learning																	
	Student Seminars																	
2,3,4	Case Studies																	
	Student Presentation																	
	Gobbet																	
3,4	Assignments																	
	Open Book Exam																	
2,3,4,5	SAQ																	
2,3,4,5	MCQ																	
	Portfolio																	
	Concept Maps																	
	Research based Analysis																	
	Enacting /Roleplay																	
2,3,4,5	Summative term end Exam																	
3,4,5	Laboratory practical																	
	Research project																	

	Any other..																
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MATRIX 4 MAPPING ASSESSMENT MODES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: Embedded Systems <i>(use if linked, if not linked and if mode not used)</i>																
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning															
	Project based Learning															
	Student Seminars															
	Case Studies															
	Student Presentation															
	Gobbet															
	Assignments															
	Open Book Exam															
	SAQ															
	MCQ															
	Portfolio															
	Concept Maps															
	Research based Analysis															
	Enacting /Roleplay															
	Summative term end Exam															
	Laboratory practical															
	Research project															
	Any other..															

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science

Course: Data Base Management System I

(use if linked, if not linked and if mode not used

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Introduction to Data Science

(use  if linked,  if not linked and  if mode not used)

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course:Computer Networks

(use if linked, if not linked and if mode not used)

[illegible]

























































































































































































































MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Software Testing

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
	Problem Based Learning												
	Project based Learning												
	Student Seminars												
	Case Studies												
	Student Presentation												
	Gobbet												
	Assignments												
	Open Book Exam												
	SAQ												
	MCQ												
	Portfolio												
	Concept Maps												
	Research based Analysis												
	Enacting /Roleplay												
	Summative term end Exam												
	Laboratory practical												
	Research project												
	Any other..												

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Network Security

(use  if linked,  if not linked and  if mode not used)

[illegible]

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Cloud Computing

(use if linked, if not linked and if mode not used)





























































































































































































































































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MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science)

Course: Multimedia Techniques

(use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	C L O 1	C L O 2	C L O 3	C L O 4	C L O 5	C L O 6	P L O 1	P L O 2	P L O 3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8
	Problem Based Learning														
	Project based Learning														
	Student Seminars														
	Case Studies														
	Student Presentation														
	Gobbet														
	Assignments														
	Open Book Exam														
	SAQ														
	MCQ														
	Portfolio														
	Concept Maps														
	Research based Analysis														
	Enacting /Roleplay														
	Summative term end Exam														
	Laboratory practical														
	Research project														
	Any other..														

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: Digital Marketing

(use if linked, if not linked and if mode not used

[illegible]

Matrix 2:

<p>MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-GEC.2 Course Title: E-Learning <i>(use (✓) if linked, (X) if not linked)</i></p>								
<div> <div>PLOs</div> <div>CLOs</div> </div>	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work, Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply concept network security in design system
1.Explain the working of an E-learning module.	✓	X	X	X	X	X	X	
2.Explain the various Instructional Design Principles.	✓	X	X	X	X	✓	X	
3.Develop own course material and upload it using an appropriate LMS.	✓	X	✓	X	✓	X	X	

4.Evaluate and apply appropriate Assessment techniques to the E-content	✓	X	✓	X	X	✓	X	
5.Differentiate between Summative and Formative assessment.	✓	X	X	X	X	X	X	
6.Write Learning and Course objectives.	✓	X	X	X	X	X	X	

<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-SEC1 Course Title: Python Programming <i>(use (✓) if linked, (X) if not linked)</i></p>								
<div>PLOs</div> <div>CLOs</div>	1.Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3.Individual Team work,Communication skills and Life skills	4.Research Aptitude	5.Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6.Use and Apply appropriate current technologies , techniques and modern tools necessary for computing practice.	7.Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8.Apply conceptual network security in design system
1.Understand syntax of Python Programming.	X	X	X	X	X	X	✓	
2.Write program using conditional statements, loops.	✓	X	X	X	X	X	✓	
3. Apply required List function.	✓	X	X	X	✓	✓	✓	

4. Write Python program specific to the domain of the given problem.	✓	X	X	X	✓	✓	✓	
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<p style="text-align: center;">MATRIX – 2 (Course - Wise) MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES Programme : B.Sc (Computer Science) Type of Course: (Core) Course Code: COM-SEC3 Course Title: Scilab Programming <i>(use (✓) if linked, (X) if not linked)</i></p>								
<div> <div>PLOs</div> <div>CLOs</div> </div>	1. Use of Technology and Problem Analysis and solutions	2. Environment and Sustainability, Ethics and Social Responsibility	3. Individual Team work, Communication skills and Life skills	4. Research Aptitude	5. Analyze a Software problem, design, implement a solution and evaluate the proposed solution to ensure that it meets customer needs and Software standard.	6. Use and Apply appropriate current technologies, techniques and modern tools necessary for computing practice.	7. Embark on an Entrepreneurial venture or be eligible for employment in IT industry or pursue higher education.	8. Apply concept network security in design system
1. Develop solutions to problems and implement these solutions in Scilab.	✓		✓		✓	✓		

2. Use Scilab to handle Polynomials.	✓		✓		✓	✓		
3. Use Scilab to implement Numerical Methods.	✓		✓		✓	✓		
4. Plot charts and graphs using Scilab.	✓		✓		✓	✓		




Matrix 3:

MATRIX 3




















































MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: GEC (E-Learning)

(use  if linked,  if not linked and  if mode not used)

	Field Based studies														
	Problem Based Learning														
	Project based Learning														
Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating															

MATRIX 3 MAPPING TEACHING METHODS/PEDAGOGIES TO CLOs AND PLOs PROGRAMME: B.Sc (Computer Science) Course: (SEC)Python Programming <i>(use  if linked,  if not linked and  if mode not used)</i>													
Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
2,3,4	Traditional Lecture Method												
2,3,4	Interactive Lecture Method												
2,3,4	Group Discussion												
	Debate												

	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
1,2,3,4,5	Problem Based Learning												
1,2,3,4,5	Project based Learning												

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

MATRIX 3

PROGRAMME: B.Sc (Computer Science)

(use if linked, if not linked and if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
1,2	Traditional Lecture Method	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1,2,3	Interactive Lecture Method	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1,2,3,4	Group Discussion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Debate												
2,3,4	Experiential Learning												
	Out-door Experiments												
	Laboratory Work												
	POGIL												
	Flipped Classroom												
	Field Based studies												
3,4,5	Problem Based Learning												
3,4,5,6	Project based Learning												

Blooms Taxonomy: 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

Matrix 4:

[illegible]

	Project based Learning														
	Student Seminars														
	Case Studies														
	Student Presentation														
	Gobbet														
	Assignments														
	Open Book Exam														
	SAQ														
	MCQ														
	Portfolio														
	Concept Maps														
	Research based Analysis														
	Enacting /Roleplay														
	Summative term end Exam														
	Laboratory practical														
	Research project														
	Any other..														













MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs

PROGRAMME: B.Sc (Computer Science)

Course: (SEC)Python Programming




use  if linked,  if not linked and  if mode not used)

Level of Blooms Taxonomy (1-6)	T-L-E modes	CLO 1	CLO 2	CLO 3	CLO 4	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
2,3,4,5	Problem Based Learning												

2,3,4,5	Project based Learning													
	Student Seminars													
2,3,4	Case Studies													
1,2,3	Student Presentation													
	Gobbet													
2,3,4,5	Assignments													
	Open Book Exam													
1,2,3	SAQ													
	MCQ													
	Portfolio													
	Concept Maps													
	Research based Analysis													
	Enacting /Roleplay													
1,2,3,4,5	Summative term end Exam													
	Laboratory practical													
	Research project													
	Any other..													

MATRIX 4

MAPPING ASSESSMENT MODES TO CLOs AND PLOs
PROGRAMME: B.Sc (Computer Science)
Course: (SEC)Scilab Programming

(use  if linked,  if not linked and  if mode not used)

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