



ROYAL GLOBAL UNIVERSITY
— GUWAHATI —

**ROYAL SCHOOL OF INFORMATION TECHNOLOGY
(RSIT)**

**Learning Outcomes based Curriculum
Framework (LOCF)**

2021-22

**SYLLABUS
&
COURSE STRUCTURE**

M. Sc. IT

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1. Introduction

Computer Science (CS) has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain.

The shifting of focus from teacher centric to learner centric has been the main focus of new education policy framed by Government. With this moto, UGC has recommended to frame the course curriculum for UG and PG focusing on learning outcomes- based curriculum framework (LOCF). The learning outcomes-based curriculum framework for M.Sc. in Information Technology is prepared keeping focus on learner centric curriculum. The present framework aims to provide a student with knowledge and skills in subject-specific and generic field including transferable global skills and competencies which help in personal development and prepare students for further study in the global world to enhance the chances of employability. This framework would certainly encourage students to involve in discussions, problem-solving and out of box thinking about various concepts of mathematics and their applicability to solve real world problems, which may lead to empowerment and enhancement of the social welfare at large.

2. Learning Outcomes based approach to Curriculum Planning

The Course Curriculum for Master Degree in Information Technology or M.Sc. in Information Technology for the undergraduate students to attain skills and knowledge require for employment. Framing and implementation of curricula and syllabi is envisaged to provide an understanding of the basic connection between theory and experiment and its importance in understanding the foundation of computing. This is very critical in developing a scientific temperament and to venture a career which a wide spectrum of applications as well as theoretical investigations. The curriculum provides students with theoretical foundations and practical experience in both hardware and software aspects of Information Technology. The course learning outcomes are aimed at facilitating the learners to acquire knowledge, skills understanding, values, attributes and academic standards. A student is awarded with M.Sc IT on the basis of the attainment of these outcomes at the end of the programme.

2.1 Nature and extent of the M.Sc.in Information Technology

MSc IT is a two year degree program which develops advanced theoretical and research skills in computer science and information technology. This programme helps in building an advanced professional or academic career. M.Sc. IT follows CBCS structure as mandated by UGC. In accordance with CBCS guidelines the courses are categorized into compulsory courses, elective courses, ability enhancement courses. These categories of courses are discussed later on.

2.2 Aims of Masters of Science Program in Information technology

The main aim of this Master degree is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners. The purpose of this program in computer science is twofold:

(1) to prepare the student for a position involving the design, development , implementation and skillful use of computer software, or hardware

(2) to prepare the student for entry to research and innovation in Computer Science and Information Technology

3. Learner's Attributes

Learner's Attributes (LA) 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.

- **Knowledge of Discipline of IT:** Knowledge of a discipline is defined as "command of a discipline to enable a smooth transition and contribution to professional and community settings. This Learner's Attribute describes the capability of demonstrating comprehensive and considered knowledge of Information Technology. It enables students to evaluate and utilize information and apply their knowledge and their professional skills in the workplace.
- **Creativity:** Creativity is a skill that underpins most activities, although this may be less obvious in some disciplines but it is prominent in IT sector. Students are required to apply imaginative and reflective thinking to design various software architecture and its underlying layout. Students are encouraged to look at the design issue or programming bugs 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.
- **Intellectual Consistency:** Intellectual consistency 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 analyses and construct knowledge with depth, insight and intellectual maturity.
- **Problem Solving and Design:** Problem solving skills empower students not only within the context of their programmers, 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.
- **Ethical Practices:** Ethical practice is a 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 behavior 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.
- **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.
- **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 skill is necessary to convey different technical aspects of projects clearly and precisely. 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.

4. Qualification Descriptor

Qualification descriptors are generic statements of the outcomes of study. Qualification descriptors are a statement of outcomes, achievement of which a student should be able to demonstrate for the award of the MSc IT Degree. It also stated different capabilities a student could be expected to have developed which will be of assistance to employers and others with an interest in the general capabilities of holders of the qualification.

- A systematic, extensive and coherent knowledge and understanding of the field of computer science and IT as a whole and its applications, and links to related disciplinary areas; including a critical understanding of the established theories, principles and concepts, and of a number of advanced and emerging issues in the field of Computer Science
- Procedural knowledge that creates different types of professionals related to Computer Science and IT, including research and development, teaching industry and government and public service;
- Skills in areas related to computer science and usage of tools and current developments, including a critical understanding of the latest developments in the area, and an ability to use established techniques of analysis and enquiry within the area of Computer Science.

- Demonstrate comprehensive knowledge, including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to the chosen disciplinary areas (s) and field of study, and techniques and skills required for identifying problems and issues relating to the disciplinary area and field of study.
- Demonstrate skills in identifying information needs, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, effective analysis and interpretation of data
- Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems and issues relating to the chosen field of study.
- Communicate the results of studies accurately in a range of different contexts using the main concepts, constructs and techniques of the subject(s) of study;
- Address one's own learning needs relating to current and emerging areas of study, making use of research, development and professional materials as appropriate
- Apply IT related knowledge and skills to identify and analyses problems and issues and seek solutions to real-life problems. Related to local area of community
- Demonstrate IT related skills like handling of tools or extensive knowledge of programming knowledge that are relevant to industry and employment opportunities.

5. Programme Learning Outcomes

These outcomes describe what students are expected to know and be able to do by the time of graduation. They relate to the skills, knowledge, and behaviors that students acquire in their graduation through the program. The Master Degree of Science in Information Technology program enables students to attain, by the time of graduation followings

- Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.
- Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation
- Ability to learn and acquire knowledge through online courses available at different
- Ability to link knowledge of Computer Science with other two chosen auxiliary disciplines of study.
- Display ethical code of conduct in usage of Internet and Cyber systems.
- Ability to pursue higher studies of specialization and to take up technical employment.
- Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.
- Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.
- Ability to present result using different presentation tools.
- Apply standard Software Engineering practices and strategies in real -time software project development
- Design and develop computer programs/computer -based systems in the areas related to algorithms, web design, cloud computing and data analytics.

6. Programme Structure: M. Sc. IT

Programme Structure

1st semester							
S. N	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	INT054C101	Advanced Database Management Systems	4	0	0	4	4
2	INT054C102	Data Structures using C++	4	0	0	4	4
3	INT054C103	Object Oriented Programming and Design	4	0	0	4	4
4	INT054C104	Advanced Computer Organisation and Architecture	4	0	0	4	4
5	INT054C111	Advanced Database Management Systems Lab	0	0	2	1	2
6	INT054C112	Data Structures using C++ Lab	0	0	2	1	2
7	INT054C113	Object Oriented Programming and Design Lab	0	0	2	1	2
Department Specific Elective (DSE)							
8	INT054D10X	DSE-I	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
Ability Enhancement Compulsory Courses (AECC)							
9	CEN984A101	Communication: Skills, Concepts and Applications	1	0	0	1	1
10	BHS984A103	Fundamentals of Organizational Behaviour	1	0	0	1	1
		TOTAL	22	0	6	25	28
2nd semester							
SN	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	INT054C201	Computer Networks	4	0	0	4	4
2	INT054C202	Web Technologies	4	0	0	4	4
3	INT054C203	Modern Operating Systems	4	0	0	4	4
4	INT054C204	Multimedia Theory and Applications	4	0	0	4	4
5	INT054C211	Computer Networks Lab	0	0	2	1	2
6	INT054C212	Web Technologies Lab	0	0	2	1	2
7	INT054C213	Modern Operating Systems Lab	0	0	2	1	2
Department Specific Elective (DSE)							
8	INT054D20X	DSE-II	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
9	INT054S20X	AEEC-I	2	0	0	2	2
Ability Enhancement Compulsory Courses (AECC)							
10	CEN984A201	Business Environment and Communication	1	0	0	1	1
11	BHS984A203	Individual and Interpersonal Behaviour	1	0	0	1	1
		TOTAL	24	0	6	27	30
3rd semester							

SN	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	INT054C301	Design & Analysis of Algorithms	4	0	0	4	4
2	INT054C302	Compiler Design	4	0	0	4	4
3	INT054C311	Design & Analysis of Algorithms Lab	0	0	2	1	2
4	INT054C312	Compiler Design Lab	0	0	2	1	2
Department Specific Elective (DSE)							
5	INT054D30X	DSE-III	4	0	0	4	4
6	INT054D30X	DSE-IV	4	0	0	4	4
Ability Enhancement Compulsory Courses (AECC)							
7	CEN984A301	Kinesics and Effective Communication	1	0	0	1	1
Ability Enhancement Elective Courses (AEEC)							
8	INT054S30X	AEEC-II	2	0	0	2	2
Project Dissertation							
9	INT054C326	Minor Project	0	0	8	4	8
		TOTAL	19	0	12	25	31
4th semester							
SN	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	INT054C401	Soft Computing	4	0	0	4	4
2	INT054C402	Cryptography and Network Security	4	0	0	4	4
Department Specific Elective (DSE)							
3	INT054D40X	DSE-V	4	0	0	4	4
4	INT054D40X	DSE-VI	4	0	0	4	4
Ability Enhancement Compulsory Courses (AECC)							
5	CEN984A401	Advance Corporate Communication	1	0	0	1	1
Project Dissertation							
6	INT054C425	Major Project	0	0	16	8	16
		TOTAL	17	0	16	25	34

SEMESTER	CREDITS
I	25
II	27
III	25
IV	25

TOTAL CREDITS = 102

LIST OF DEPARTMENT SPECIFIC ELECTIVES			
Elective No	Sl. No	Subject Code	Name of the Elective
I	1	INT054D101	Theory of Computation
	2	INT054D102	Graph Theory
II	1	INT054D201	Digital Image Processing
	2	INT054D202	Data Warehousing
III	1	INT054D301	Distributed Operating Systems
	2	INT054D302	Artificial Intelligence
	3	INT054D303	Wireless Computing
IV	1	INT054D304	Cloud Computing
	2	INT054D305	Cyber Forensics
	3	INT054D306	Pattern Recognition
V	1	INT054D401	Big Data Analytics
	2	INT054D402	Bioinformatics
	3	INT054D403	Optimization Techniques
VI	1	INT054D404	Mobile Application Development
	2	INT054D405	Python Programming
	3	INT054D406	Robotics
	4	INT054D407	Neural Network and Fuzzy Logic

SUBJECTS UNDER AEEC			
AEEC No	Sl. No	Subject Code	Name of the Elective
I	1	INT054S201	General Aptitude and Quantitative Reasoning-I
II	2	INT054S302	General Aptitude and Quantitative Reasoning-II

***The list of Electives may vary from the following depending upon the recent trends, availability of faculty, resources, etc.

7. Detailed Syllabus of 1st Semester

Paper I/Subject Name: Advanced Database Management Systems Subject Code: INT054C101

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an introduction to Database Management Systems, Relational Model, Relational Algebra and Relational Calculus.
- To impart detailed concepts on Relational Database Modeling and the Structured Query Language.
- To explain advanced concepts on Database Design including Normalization and Functional Dependencies.
- To give students the understanding of the advanced topics like Query Optimization, Transaction Processing.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Relational Database Modeling, Relational Algebra and Relational Calculus	The Relational Data Model and Relational Database Constraints- Concepts, Constraints, Schemas Constraint Violations. The Relational Algebra and Relational Calculus- Unary Relational Operations, Set Theoretic Operations, Binary Relational Operations, additional Relational Operations. Overviews of Tuple Relational Calculus and Domain Relational Calculus. Data Modeling using the Entity-Relationship (ER) Model- Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues. The Enhanced Entity-Relationship (EER) Model- Subclasses, Superclasses, and Inheritance; Specialization and Generalization. Relational Database Design by ER and EER-to-Relational Mapping- Relational Database Design Using ER-to-Relational Mapping, Mapping EER Model Constructs to Relations.	12
II	The Structured Query Language	Basic SQL- SQL Data Definition and Data Types, Specifying Constraints, Basic Retrieval Queries, INSERT, DELETE, and UPDATE Statements, Additional Features, More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables), Schema Change Statements. Introduction to SQL Programming Techniques - Database Programming Techniques and Issues, Embedded SQL, Dynamic SQL, and SQLJ; Database Programming with Function Calls, Database Stored Procedures. Overview of Web Database Programming.	12
III	Advanced Concepts on Database Design	Basics of Functional Dependencies and Normalization for Relational Databases- Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Relational Database Design Algorithms and Further Dependencies- Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design.	12
IV	Query Optimization, Transaction Processing	Query Processing and Optimization- Translating SQL Queries into Relational Algebra, Algorithms for External Sorting, Algorithms for SELECT and JOIN Operations, Algorithms for PROJECT and Set Operations, Implementing Aggregate Operations and OUTER JOINS, Combining	12

	<p>Operations Using Pipelining, Using Heuristics in Query Optimization, Using Selectivity and Cost Estimates in Query Optimization.</p> <p>Transaction Processing- Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL.</p> <p>Concurrency Control Techniques- Two-Phase Locking, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control, Validation (Optimistic) Concurrency Control, Granularity of Data Items and Multiple Granularity Locking, Using Locks for Concurrency Control in Indexes.</p> <p>Database Recovery Techniques- Recovery Concepts, Shadow Paging, The ARIES Recovery Algorithm.</p>	
Total		48

Text Books:

1. *Fundamentals of Database Systems*, Elmasri and Navathe, 7th Edition, 2017, Pearson Education.
2. *Database System Concepts*, Henry F Korth and Abraham Silberschatz, 6th Edition, 2013, McGraw Hill.

Reference Books:

1. Atul Kahate, *Introduction to Database Management System*, 1st Edition, 2004, Pearson Education.
2. C. J. Date, *An Introduction to Database Systems*, 8th Edition, 2012, Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, 2014, McGraw Hill Education.
4. G K Gupta, *Database Management Systems*, 1st Edition, 2011, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Learn about basic database related concepts. • Have an insight on Relational Database Modeling and the Structured Query Language. • Learn about Database Design including Normalization and Functional Dependencies. • Have the understanding of the advanced topics like Query Optimization, Transaction Processing 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<p>(a) Participation in class discussions</p> <p>(b) Continuous Evaluation(30Marks)</p> <p>(i) 15 marks on</p> <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation <p>(ii) Mid-term examinations :10 marks</p> <p>(iii) Class attendance -5 marks</p> <p>(c) End-term examinations: 70 marks.</p>

Objective:

The objectives of the course are:

- To make the students understand the data structures, their advantages and drawbacks, how to implement them in C++ & how they can be overcome.
- To explain their applications and their uses.
- Students will learn about the data structure methods or algorithms mentioned in the course so as to make use of them in a program to enhance their efficiency (i.e. reduce the run-time) or for better memory utilization.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Linear Data Structure-I	Why we need data structure, Concepts of data structures: Data and data structure, Abstract Data Type and Data Type. Representations of Array – row major and column major. Linked List- Definition and uses of linked lists. Types of linked lists- Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.	14
II	Linear Data Structure-II	Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	7
III	Non-Linear Data Structure	Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B-Trees – operations (insertion, deletion with examples only). Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism). Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications. Minimal spanning tree – Prim’s algorithm (basic idea of greedy methods).	15
IV	Searching and Sorting	Basic definition and working principle of sorting algorithms like Bubble sort, insertion sort, selection sort, merge sort, quick sort. Basic definition and working of Searching- Sequential search, binary search, interpolation search.	12
Total			48

Text Book:

1. *Data Structures Using C*, Reema Thareja, 2nd Edition, 2014, Oxford University Press.

Reference Books:

1. S. K. Srivastava and DeepaliSrivastava, *Data Structures Through C in Depth*, 1st Edition, 2004, BPB Publications.
2. Seymour Lipschutz, *Data Structures*, 1st Edition (reprint) 2017, McGraw Hill Education.
3. NarasimhaKarumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5th Edition, 2016, Careermonk Publications.
4. Tenenbaum, *Data Structures Using C*, 2008, Pearson Education India.
5. Yashavant P. Kanetkar, *Data Structure through C*, 2nd Edition, 2003, BPB Publications.
6. A. M. Padma Reddy, *Data Structures*, Revised Edition, 2017, Sri Nandi Publications.
7. Richard F. Gilberg, *Data Structures: A Pseudocode Approach with C*, Indian Edition, 2007, Cengage Learning.
8. Horowitz, Sahni and Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Edition, 2008, Universities Press.
9. E. Balagurusamy, *Data Structures Using C*, 1st Edition, 2017, McGraw Hill Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Have the understanding the data structures, their advantages and drawbacks, how to implement them in C++ & how they can be overcome. •Have the understanding their applications and their uses. •Have an idea of about the data structure methods or algorithms mentioned in the course so as to make use of them in a program to enhance their efficiency 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper III/Subject Name: Object Oriented Programming and Design Subject Code: INT054C103

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To make the students familiar to the basic concepts of Object-Oriented Programming using C++.
- To give students detailed concepts on Object-Oriented Design using UML.
- To explain concepts on Advanced Structural Modeling using UML.
- To give students exposure to the advanced topics in Object-Oriented Design like Behavioral and Architectural Modeling.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to OOP using C++	Conventional(Procedural) Programming versus Object Oriented Programming, Advantages of OOP, Structure of a C++ Program, Functions, Recursions. Classes and Objects in C++, Access Specifiers and their scope, Data Hiding and Encapsulation, Static Members, Objects as Function Arguments, Friend Functions, Overloading Member Functions, Nested Class. Use of Constructors and Destructors, Characteristics of Constructors & Destructors, parameterized Constructor, Overloading Constructors , Constructors with Default Arguments, Copy Constructors, Destructors, Calling Constructors and Destructors, Dynamic Initialization using Constructors.	12
II	Advanced Concepts in OOP using C++	Inheritance- Introduction, Reusability, Access Specifiers, Types, Virtual Base Classes, Abstract classes, Constructors and Destructors in Derived class, Pointers and Inheritance. Binding in C++, Static (Early) Binding, Dynamic(late) Binding, Virtual Functions, Abstract classes. Templates in C++: Need of Template, Class Template, Function Template. Exception Handling in C++: principles, keywords, Exception Handling Mechanism, Catching Multiple Exceptions, Controlling Uncaught Exceptions.	12
III	Object Oriented Design Using UML	Introduction to UML- importance of Modeling, principles of Modeling, object oriented Modeling, conceptual model of the UML, UML Architecture, Software Development Life Cycle. Basic Structural Modeling- Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams- Terms, concepts, Modeling techniques for Class & Object Diagrams.	12
IV	Behavioral and Architectural Modelling	Basic Behavioral Modelling- Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams. Advanced Behavioral Modelling- Events and signals, state chart diagrams. Architectural Modelling - Component, Deployment, Component diagrams and Deployment diagrams.	12
Total			48

Text Books:

1. *Object Oriented Programming with C++*, Reema Thareja, 1st Edition, 2015, Oxford University Press.
2. *Object Oriented Programming with C++*, E. Balaguruswamy, 7th Edition, 2017, McGraw Hill Education.
3. *Object-Oriented Programming in C++*, Robert Lafore, 4th Edition, 2008, Sams Publishing.
4. *The Unified Modeling Language User Guide*, Grady Booch, James Rumbaugh and Ivar Jacobson, 1st Edition, 2002, Pearson Education.

Reference Books:

1. Ray Lischner, *Exploring C++: The Programmer's Introduction to C++ (Expert's Voice in C++)*, 1st Edition, 2008, Apress.
2. Mahapatra P. B., *Programming in C++*, 1st Edition, 2008, S Chand & Company.
3. Meilir Page-Jones, *Fundamentals of Object Oriented Design in UML*, 1st Edition, 2011, Pearson Education.
4. Pascal Roques, *Modeling Software Systems Using UML2*, 1st Edition, 2002, Wiley- Dreamtech India Pvt. Ltd.
5. John W. Satzinger, Robert B Jackson and Stephen D Burd, *Object-Oriented Analysis and Design with the Unified Process*, 1st Edition, 2007, Cengage Learning.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Learn the basic concepts of object oriented paradigm. •Understand concepts on Object-Oriented Modelling using UML diagrams. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> • Assignments • Class tests. • viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To make the students understand the machine instructions and basic computer organization
- To give an idea of representation of information in computers
- To explain memory hierarchy and various memory mapping techniques
- To teach I/O subsystems and pipelining processing.

Prerequisites: Basics of Digital Logic

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Overview of Computer Organization and Architecture	Introduction- Organization versus Architecture, Structure and Function. Computer Evolution and Performance- Designing for Performance, Performance Assessment. Computer Function and Interconnection- Computer Components, Computer Function, Interconnection Structures, Bus Interconnection. Computer Arithmetic- Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic.	12
II	The Computer System	Cache Memory- Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design. Internal Memory Technology- Semiconductor Main Memory, Error Correction, Advanced DRAM Organization. External Memory- Magnetic Disk, RAID, Optical Memory, Magnetic Tape. Input/Output- External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors. Operating System Support- Operating System Overview, Scheduling, Memory Management.	12
III	The Central Processing Unit	Characteristics and Functions of Instruction Sets- Machine Instruction Characteristics, Types of Operands, Types of Operations. Addressing Modes and Formats- Addressing, Instruction Formats, Assembly Language. Processor Structure and Function- Processor Organization, Register Organization, the Instruction Cycle, Instruction Pipelining. Reduced Instruction Set Computers (RISCs)- Instruction Execution Characteristics, the use of a Large Register File, Compiler-Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining. Control Unit Operation- Micro-operations, Control of the Processor, Hardwired Implementation. Micro-programmed Control- Basic Concepts, Microinstruction Sequencing, Microinstruction Execution.	12
IV	Parallel Organization	Instruction-Level Parallelism and Superscalar Processors- Overview, Design Issues. Parallel Processing- the use of Multiple Processors, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors, Clusters, Non Uniform Memory Access Computers, Vector Computation. Multicore Computers- Hardware Performance Issues, Software Performance Issues, Multicore Organization.	12
Total			48

Text Books:

1. *Computer Organization and Architecture: Designing For Performance*, William Stallings, 6th Edition, 2004, Prentice Hall.
2. *Computer System Architecture*, M. Morris Mano, 3rd Edition, 2017, Pearson Education.
3. *Computer Organization*, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition, 2011, McGraw-Hill Higher Education.

Reference Books:

1. V. Rajaraman and T. Radhakrishnan, *Computer Organization and Architecture*, 1st Edition, 2007, Prentice Hall India Learning Private Limited.
2. P. Chakraborty, *Computer Architecture and Organization*, 1st Edition, 2006, Jaico Publishing House.
3. B. Govindarajalu, *Computer Architecture and Organization: Design Principles and Applications*, 2nd Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Understand overview of Computer Organization and Architecture. •Define Computer System and Components •To give students detailed concepts on the Central Processing Unit. •To give students exposure to Multicore computing and Parallel Organization of Computers 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To provide an introduction to Database Management Systems, Relational Model, Relational Algebra and Relational Calculus.
- To give students detailed concepts on Relational Database Modeling and the Structured Query Language.
- To teach advanced Concepts on Database Design including Normalization and Functional Dependencies.
- To give students the understanding of the advanced topics like Query Optimization.

Prerequisites: None

Detailed Syllabus:**Minimum 20 Laboratory experiments based on the following-**

1. Data Modeling using the Entity-Relationship (ER) Model- Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues.
2. Relational Database Design by ER and EER-to-Relational Mapping- Relational Database Design Using ER-to-Relational Mapping, Mapping EER Model Constructs to Relations.
3. Basic SQL- SQL Data Definition and Data Types, Specifying Constraints, Basic Retrieval Queries, INSERT, DELETE, and UPDATE Statements, Additional Features, More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables), Schema Change Statements.
4. Introduction to SQL Programming Techniques - Database Programming Techniques and Issues, Embedded SQL, Dynamic SQL, and SQLJ; Database Programming with Function Calls, Database Stored Procedures.
5. Overview of Web Database Programming.

Text Books:

1. *Fundamentals of Database Systems*, Elmasri and Navathe, 7th Edition, 2017, Pearson Education.
2. *Database System Concepts*, Henry F Korth and Abraham Silberschatz, 6th Edition, 2013, McGraw Hill.

Reference Books:

1. Atul Kahate, *Introduction to Database Management System*, 1st Edition, 2004, Pearson Education.
2. C. J. Date, *An Introduction to Database Systems*, 8th Edition, 2012, Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, 2014, McGraw Hill Education.
4. G K Gupta, *Database Management Systems*, 1st Edition, 2011, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
*Learn Data Modeling through various diagrams •Learn and Practice different Structured Query Language. •Gain knowledge on query processing and optimization *Able to create small DBMS systems	i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields	(a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on <input checked="" type="checkbox"/> Lab Assignments <input checked="" type="checkbox"/> viva-voce (ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To make the students understand the data structures, their advantages and drawbacks, how to implement them in C++ & how they can be overcome.
- To explain their applications and their uses.
- Students will learn about the data structure methods or algorithms mentioned in the course so as to make use of them in a program to enhance their efficiency.

Prerequisites: None

Detailed Syllabus:**Minimum 20 Laboratory experiments based on the following-**

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem.
3. Evaluation of expressions operations on Multiple stacks & queues.
4. Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists.
5. Sparse Matrices: Multiplication, addition.
6. Recursive and Nonrecursive traversal of Trees.
7. Threaded binary tree traversal. AVL tree implementation.
8. Application of Trees. Application of sorting and searching algorithms.

Text Book:

1. *Data Structures Using C*, Reema Thareja, 2nd Edition, 2014, Oxford University Press.

Reference Books:

1. S. K. Srivastava and Deepali Srivastava, *Data Structures Through C in Depth*, 1st Edition, 2004, BPB Publications.
2. Seymour Lipschutz, *Data Structures*, 1st Edition (reprint) 2017, McGraw Hill Education.
3. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5th Edition, 2016, Careermonk Publications.
4. Tenenbaum, *Data Structures Using C*, 2008, Pearson Education India.
5. Yashavant P. Kanetkar, *Data Structure through C*, 2nd Edition, 2003, BPB Publications.
6. A. M. Padma Reddy, *Data Structures*, Revised dition, 2017, Sri Nandi Publications.
7. Richard F. Gilberg, *Data Structures: A Pseudocode Approach with C*, Indian Edition, 2007, Cengage Learning.
8. Horowitz, Sahni and Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Edition, 2008, Universities Press.
9. E. Balagurusamy, *Data Structures Using C*, 1st Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Learn the implementation of various data structures through C++. • Understand the applications and uses of data structures in real world. • Learn to analyze the efficiency of algorithms. 	i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields	(a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on ☑ Lab Assignments ☑ viva-voce (ii) Skill Test carries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students an in-depth practical experience on various advanced concepts in OOP using C++.
- To give students detailed practical experience on Object-Oriented Design using UML.
- To give students practical exposure to the advanced topics in Object-Oriented Design like Behavioral and Architectural Modeling.

Prerequisites: None

Detailed Syllabus:**Minimum 10 Laboratory experiments based on the following-**

1. Structure of a C++ Program, Functions, Recursions.
2. Classes and Objects in C++, Access Specifiers and their scope, Data Hiding and Encapsulation, Static Members, Objects as Function Arguments, Friend Functions, Overloading Member Functions, Nested Class.
3. Use of Constructors and Destructors, Characteristics of Constructors & Destructors, parameterized Constructor, Overloading Constructors, Constructors with Default Arguments, Copy Constructors, Destructors, Calling Constructors and Destructors, Dynamic Initialization using Constructors.
4. Overloading Unary Operators, Overloading Binary Operators, Overloading with Friend Function, Type Conversions.
5. Inheritance- Introduction, Reusability, Access Specifiers, Types, Virtual Base Classes, Abstract classes, Constructors and Destructors in Derived class, Pointers and Inheritance.
6. Binding in C++, Static (Early) Binding, Dynamic (late) Binding, Pointer to Base and Derived class objects, Virtual Functions, Abstract classes.
7. Templates in C++: Need of Template, Class Template, Function Template.
8. Exception Handling in C++: principles, keywords, Exception Handling Mechanism, Catching Multiple Exceptions, Exceptions in Constructor and Destructors, Controlling Uncaught Exceptions.
9. UML Modeling- principles, object oriented Modeling. Use of any software tool for UML modeling.
10. Basic Structural Modeling- Classes, Relationships, common Mechanisms, and diagrams.
11. Advanced Structural Modeling- Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.
12. Class & Object Diagrams- Terms, concepts, Modeling techniques for Class & Object Diagrams.
13. Basic Behavioral Modeling- Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.
14. Advanced Behavioral Modeling- Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modeling- Component, Deployment, Component diagrams and Deployment diagrams.

Text Books:

1. *Object Oriented Programming with C++*, Reema Thareja, 1st Edition, 2015, Oxford University Press.
2. *Object Oriented Programming with C++*, E. Balaguruswamy, 7th Edition, 2017, McGraw Hill Education.
3. *Object-Oriented Programming in C++*, Robert Lafore, 4th Edition, 2008, Sams Publishing.
4. *The Unified Modeling Language User Guide*, Grady Booch, James Rumbaugh and Ivar Jacobson, 1st Edition, 2002, Pearson Education.

Reference Books:

1. Ray Lischner, *Exploring C++: The Programmer's Introduction to C++ (Expert's Voice in C++)*, 1st Edition, 2008, Apress.
2. Mahapatra P. B., *Programming in C++*, 1st Edition, 2008, S Chand & Company.
3. Meilir Page-Jones, *Fundamentals of Object Oriented Design in UML*, 1st Edition, 2011, Pearson Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Learn programming through C++. •Learn data modelling through UML diagrams. •Be able to differentiate between procedural and object oriented programming paradigm. 	<ul style="list-style-type: none"> i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields 	<ul style="list-style-type: none"> (a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Lab Assignments ☑ viva-voce (ii) Skill Test carries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students an exposure to the basics of communication improving their business writing skills, group communication and speaking skills in English by engaging them for meaningful discussion and interactive activities.

Prerequisites: Basic understanding of English.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Basics of Communication	Nature, Process of Communication, Definition, Classification, Purpose, Channels and Methods , Communication Networks, Organizational Communication (Formal, informal, grapevine), External communication (formal, informal) , Types/forms of Communication (Oral-written, Formal- Informal, Interpersonal-Intrapersonal, Mass- Group, Verbal- Non-Verbal) Non-verbal Communication (types and cross-cultural significance), Barriers to Communication, Communication Breakdown: 7 Cardinal mistake managers make	3
II	Focus on Business Writing Skills	Introduction , Planning & Execution of Messages, Writing different messages Characteristics of Good Writing Business Letters <ul style="list-style-type: none"> ✓ Format, Language and Types, essentials of good Business letters ✓ Writing routine and good-news letters ✓ Writing a persuasive letter Memorandum (how to write a memo, uses of a memo) Emails (how to write an email, netiquettes, emails and intercultural communication)	3
III	Understanding Group communication	Group Discussion - Definition , Advantages, Qualities/skills required/assessed, General Do's & Don'ts, Participating in a GD (Leadership, GD protocol, discussion techniques, Listening)	3
IV	Mastering Speaking Skills	Presentation Skills - Introduction, Importance and Types, Common Problems with Presentations, Presentation Strategies (purpose, Audience, Context, Technique), Preparation and Delivery (Collecting information, Organizing Information), Structure of a Presentation, Delivering the Presentation (Delivery outline, stage fright and speech anxiety, how to deal with stage fright successfully, body language, visual cues, vocal and verbal elements, handling questions, preparing visual aids)	3
Total			12

Text Books:

- Business Communication: Concepts, Cases and Applications*, Chaturvedi, P. D. and Chaturvedi Mukesh, 2nd Edition, 2011, Dorling Kindersley(India) Pvt. Ltd.

Reference Books:

1. Raman, Meenakshi and Sharma, Sangeet, *Technical Communication: Principles and Practices*. 2nd Edition, 2011, Oxford University Press.
2. Rizvi, M. Ashraf, *Effective Technical Communication*, 11th reprint. 2008, Tata McGraw Hill Publishing Company Limited.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Be familiar with the basics of writing, speaking and group communication.	<ol style="list-style-type: none">i) Each topic to be expounded with adequate examples.ii) Class discussions and question- answer rounds are encouragediii) theoretical problems solving is part of the class to grasp the underlying conceptsiv) Students have to go through case studies for real time experiencev) Students to be encouraged to give short presentations.	<ol style="list-style-type: none">(a) Participation in class discussions(b) Continuous Evaluation(30Marks)<ol style="list-style-type: none">(i) 15 marks on<ul style="list-style-type: none">☑ Assignments☑ Class tests.☑ viva-voce or presentation(ii) Mid-term examinations :10 marks(iii) Class attendance -5 marks(c) End-term examinations: 70 marks.

Paper X/Subject Name: Fundamentals of Organizational Behaviour Subject Code: BHS984A103

L-T-P-C – 1-0-0-1

Credit Units: 01

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To provide students with a better understanding of organizational behavior and insight into the vital parts of an organization, namely, communication and culture

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Understanding Organizational Behaviour	Fundamental concepts: The nature of people, The nature of organizations. Limitations of organizational behaviour: Behavioural bias, The law of diminishing returns Unethical manipulation of people	3
II	Modes of Organizational Behaviour	Autocratic, Custodial, Supportive, Collegial and System	3
III	Communication Fundamentals	The importance of communication, The two-way communication process, Potential problems, Communication barriers, Communication symbols, The impact of barriers on the communication process	3
IV	Social System and Organizational Culture	Understanding a social system, Social equilibrium Functional and dysfunctional effects, Psychological and economic contracts, Social culture, Cultural diversity, Social culture values, Organizational culture, Characteristics of culture, Measuring organizational culture, Communicating and changing culture	3
Total			12

Text Books:

1. *Organizational Behaviour: Human behavior at work*, Newstrom, J. W., 2007, Tata McGraw-Hill, New Delhi.

Reference Books:

1. Robbins, S. P., Judge, T. A. & Sanghi, S., *An Essentials of Organizational Behaviour*, 2010, Dorlilings Kindersley, India

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Have a better understanding of organizational behavior and insight into the vital parts of an organization, namely, communication and culture.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b) Continuous Evaluation(30Marks) (i)15 marks on ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

8. Detailed Syllabus of Semester II

Paper I/Subject Name: Computer Networks

Subject Code: INT054C201

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an overview of Computer Networks and introduction to the Physical Layer.
- To provide detailed concepts on the Data-Link Layer
- To explain detailed concepts on the Network Layer.
- To give students the understanding of the Transport Layer and the Physical Layer.

Prerequisites: Basics of trees and graphs

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Overview of Computer Networks and the Physical Layer	Introduction- Data Communications, Network Criteria and Structures, Network Types. Network Models- Protocol Layering, TCP/IP Protocol Suite, the OSI Model. Introduction to Physical Layer- Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance. Digital Transmission- Digital-To-Digital Conversion, Analog-To-Digital Conversion, Transmission Modes. Analog Transmission- Digital-To-Analog Conversion, Analog-To-Analog Conversion. Bandwidth Utilization: Multiplexing And Spectrum Spreading- Multiplexing, Spread Spectrum. Transmission Media- Guided Media, Unguided Media. Switching- Introduction, Circuit-Switching, Packet Switching.	12
II	The Data-Link Layer	The Data-Link Layer- Introduction, Link-Layer Addressing. Error Detection and Correction- Basic concepts, Block Coding, Cyclic Codes, Checksum, Forward Error Correction. Data Link Control (DLC)- DLC Services, Data-Link Layer Protocols. Media Access Control (MAC)- Random Access, Controlled Access, Channelization. Wired LANs: Ethernet- Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs- Introduction, IEEE 802.11 Project, Bluetooth, WiMAX. Connecting Devices and Virtual LANs- Connecting Devices, Virtual Lans.	12
III	The Network Layer	Introduction to Network Layer- Network-Layer Services, Packet Switching, Performance, IPv4 Addresses, Forwarding of IP Packets. Network-Layer Protocols- INTERNET PROTOCOL (IP), ICMPv4, MOBILE IP. Unicast Routing- Basic concepts, Routing Algorithms, Unicast Routing Protocols. Multicast Routing- Unicasting versus Multicasting versus Broadcasting, Multicasting Basics, Intradomain Multicast Protocols, Interdomain Multicast Protocols. Next Generation IP- IPv6 Addressing, The IPv6 Protocol, The ICMPv6 Protocol, Transition From IPv4 to IPv6.	12
IV	The Transport Layer and The Physical Layer	The Transport Layer- Introduction, Transport-Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP. The Application Layer- Introduction, Client-Server Programming. Standard Client-Server Protocols- HTTP, Electronic Mail, TELNET, SSH, DNS.	12
Total			48

Text Books:

1. *Data Communications and Networking*, Forouzan, 4th Edition, 2017, McGraw Hill Education.
2. *Computer Networks*, Andrew. S. Tanenbaum and David J. Wetherall, 5th Edition, 2013, Pearson Education India.
3. *Computer Networking: A Top - Down Approach*, James F. Kurose, 6th Edition, 2017, Pearson Education.

Reference Books:

1. Sanjay Sharma, *Computer Networks*, 1st Edition, 2013, S. K. Kataria & Sons.
2. Forouzan, *Computer Networks: A Top - Down Approach*, 1st Edition, 2017, McGraw Hill Education.
3. Narasimha Karumanchi, *Elements of Computer Networking: An Integrated Approach*, 1st Edition, 2017, Careermonk Publications.
4. Peterson, *Computer Networks - A System Approach*, 5th Edition, 2011, Elsevier.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Independently understand basic computer network technology and identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer. • Identify the different types of network devices and their functions within a network • Understand and building the skills of subnetting and routing mechanisms. • Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students an introduction to the Internet and Web Page Design.
- To provide detailed concepts on Web Browsers, Markup Language Basics and XML.
- To impart detailed concepts on Web Server Side technologies.
- To give students exposure to some Advanced Web Technologies and the Web Security.

Prerequisites: Fundamentals of Computer Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Internet and Web Page Design	Internet basics: History and basic idea of Internet; Internet services: telnet, e-mail, ftp, WWW. Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages. Use of Cascading Style Sheet in web pages. Creating interactive and dynamic web pages with JavaScript: JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.	12
II	Web Browsers, Markup Language Basics and XML	Web Browsers: functions and working principle of web browsers; plug-ins & helper applications; conceptual architecture of some typical web browsers. Markup language basics: Standard Generalized Markup Language (SGML)- structures, elements, Content models, DTD, attributes, entities. Extensible Markup Language (XML): Introduction- using user-defined tags in web pages; displaying XML contents; XML DTDs; use of XSL.	12
III	Web Server Side	Introduction to Client/Server Computing: client-server computing basics; types of Client/Server systems; middleware; N-tiered systems: 2-tier/3-tier/4-tier systems; Fat Clients versus Fat Servers. Web Servers: Web services and web server functionality; web server composition; registration; HTTP, IP address, DNS & ports; conceptual architecture of some typical web servers. Server-side scripting: overview of CGI, ASP, and JSP. Server side scripting using PHP; PHP basics, HTML form data handling, Web database connectivity- introduction to ODBC; PHP with database connectivity.	12
IV	Advanced Web Technologies and Web Security	Exposure to Advanced Web Technologies: Distributed Object based models- DCOM, CORBA, EJB; Web services and Related Technologies- ISAPI, SOAP, UDDI, WSDL; Other Advanced Web Technologies- AJAX, ISAPI, .NET. Web Security: Firewalls- definition and uses, network layer firewalls and application layer firewalls; Proxy servers, HTTPS for secure web communication.	12
Total			48

Text Book:

1. *Web Technologies*, Godbole and Khate, 3rd Edition, 2017, McGraw Hill Education.

Reference Books:

1. Kogent Learning Solutions Inc., *Web Technologies: HTML, Javascript, PHP, Java, JSP, XML and AJAX*, Black Book, 1st Edition, 2009, Dreamtech Press.
2. Uttam K. Roy, *Web Technologies*, 1st Edition, 2010, Oxford.
3. N. P. Gopalan and J. Akilandeswari, *Web Technology: A Developer's Perspective*, 2nd Edition, 2014, Prentice-Hall of India Pvt. Ltd.
4. Jackson, *Web Technologies: A Computer Science Perspective*, 1st Edition, 2007, Pearson Education India.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> Analyze a web page and identify its elements and attributes. Create web pages using HTML and Cascading Style Sheets. Build dynamic web pages using JavaScript (Client side programming). Create XML documents and Schemas. Build interactive web applications using AJAX. 	<ol style="list-style-type: none"> Each topic to be expounded with adequate examples. Class discussions and question- answer rounds are encouraged theoretical problems solving is part of the class to grasp the underlying concepts Students have to go through case studies for real time experience Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> Participation in class discussions Continuous Evaluation(30Marks) <ol style="list-style-type: none"> 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation Mid-term examinations :10 marks Class attendance -5 marks End-term examinations: 70 marks.

Paper III/Subject Name: Modern Operating Systems

Subject Code: INT054C203

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an introduction to Operating Systems and Process Management.
- To explain detailed concepts on the CPU, Deadlocks, and Memory Management.
- To teach the concepts of Storage and Input/ Output Management.
- To provide an understanding of the advanced topics like Protection, Security, Virtual machines and Distributed Systems.

Prerequisites: Fundamentals of Computer Organization and Architecture

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Operating Systems Overview	Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot, OS Operations, Kernel Data Structures, OS Services	12
II	Process Management	Processes – Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	12
III	Memory Management and File Systems	Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory. File-System Interface- The concept of Files, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection. File-System Implementation- File-System Structure, Directory Implementation, Allocation Methods, Free-Space Management, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage.	12
IV	Case Study	OS Security, Unix Primer, Search and sort tools, AWK tool in Unix, Unix Kernel Architecture, Shell Script in Unix, AWK tool in Unix, Make tool in UNIX, System Administration in Unix, Source Code control system in Unix, X Windows in Unix, Linux System – Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication;	12
Total			48

Text Books:

1. *Operating System Concepts*, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 7th Edition, 2006, Wiley.

Reference Books:

1. William Stallings, *Operating Systems: Internals and Design Principles*, 7th Edition, 2013, Pearson Education India.
2. Andrew S. Tanenbaum and Herbert Bos, *Modern Operating Systems*, 4th Edition, 2014, Pearson Education India
3. Achyut Godbole and Atul Kahate, *Operating Systems*, 3rd Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Learn the fundamentals of Operating Systems and the mechanisms of OS to handle processes and threads and their communication. •Learn the mechanisms involved in memory management in contemporary OS. •Gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols. •Know the components and management aspects of concurrency management. •Learn programmatically to implement simple OS mechanisms. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To explain technical aspect of Multimedia Systems.
- To teach the standards available for different audio, video and text applications.
- To make the students understand various networking aspects used for multimedia applications.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Introduction To Multimedia Systems	Define Multimedia Signal, Elements Of Multimedia Communication Systems, Challenges Involved With Multimedia Communication, Types Of Multimedia (Image, Text, Audio, and Video).	12
II	Image and Text Compression Techniques	Fundamentals of Image, Redundancy In Image, Lossless And Lossy Image Compression Techniques, Measurements Quality of Reconstructed Image (MSE, SNR, PSNR), Huffman Coding, GIF,TIFF, JPEG. Recent advancements in Image Compression. Compression Principles, Entropy And Source Encoding, Static Huffman Coding, Dynamic Huffman Coding, Arithmetic Coding, LZW Coding.	12
III	Audio and Video Compression	Audio Compression, PCM, DPCM, ADPCM, Adaptive Predictive Coding, Linear Predictive Coding, Code-Excited Coding, Perceptual Coding, Mpeg Audio Coder, Digital Video Coding Fundamentals, Video Compression Principles, Video Compression Standards.	12
IV	Multimedia Networking and Applications	Networking Systems- Multimedia communication Systems; Database Systems. Multimedia Architecture- Multimedia Documents, Hypertext and MPEG. User Interfaces- Synchronization, Abstractions For Programming; Multimedia Application Development. Virtual Reality- Applications, Future Directions.	12
Total			48

Text Books:

1. *Multimedia Systems Design*, Prabhat K. Andleigh, Kiran Thakrar, 1st Edition, 2015, Pearson India.
2. *Multimedia Communications: Application, Network, Protocols and Standards*, Fred Halsall, 1st Edition, 2002, Pearson Education.
3. *Multimedia Computing Communications & Applications*, 1st Edition, 2002, Ralf Steinmetz and Klara Nahrstedt, Pearson Education.

Reference Books:

1. Parekh Ranjan, *Principles of Multimedia*, 2nd Edition, 2017, Tata McGraw-Hill.
2. Steinmetz, *Multimedia: Computing Communications & Applications*, 1st Edition, 2002, Pearson Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Developed understanding of technical aspect of Multimedia Systems. • Understand various file formats for audio, video and text media. • Apply various networking protocols for multimedia applications. • To evaluate multimedia application for its optimum performance 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) (i) 15 marks on <ul style="list-style-type: none"> ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students practical experience on the use of various devices as well as simulation tools for Computer Networking.
- To provide a practical experience on the implementation on various protocols of Computer Networks.
- To teach the analysis of the performance of the protocols in different layers.
- To give a practical experience on the analysis of various routing algorithms.

Prerequisites: None

Detailed Syllabus:**Minimum 10 Laboratory experiments based on the following-**

1. Installation of Operating System, Installation of Utility Software and Applications.
2. Study of Local Area Network (LAN) with emphasis to the following-
 1. Study of different network cables and devices.
 2. Study of college LAN with references to network IP and design a LAN for it.
 3. Study of basic network command and network configuration command.
 4. Study of LAN transmission media's, topologies, interconnection devices & LAN standards.
 5. Implementation of Subnetting.
3. Token bus and token ring protocol to create scenario and study the performance of token bus and token ring protocols through simulation.
4. Case study of client/server scenario. Observing the difference between UDP and TCP servers. Study of Socket Programming and Client – Server model.
5. To observe the working of TCP three-way hand-shaking procedure. Locating different packets like, SYN, SYN-ACK and ACK. Comparing different fields of these packets.
6. Write a program for Hamming Code generation for error detection and correction.
7. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
8. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
9. Write a code simulating ARP /RARP protocols.
10. Write a code simulating PING and TRACEROUTE commands.
11. Create a socket for HTTP for web page upload and download.
12. Write a program to implement RPC (Remote Procedure Call).
13. Applications using TCP Sockets like Echo client & echo server, Chat etc.
14. File Transfer Applications using TCP and UDP Sockets like DNS, SNMP, File Transfer.
15. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
16. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer, like Link State routing, Flooding, Distance vector, etc.

Text Books:

1. *Data Communications and Networking*, Forouzan, 4th Edition, 2017, McGraw Hill Education.
2. *Computer Networks*, Andrew. S. Tanenbaum and David J. Wetherall, 5th Edition, 2013, Pearson Education India.
3. *Computer Networking: A Top - Down Approach*, James F. Kurose, 6th Edition, 2017, Pearson Education.

Reference Books:

1. Sanjay Sharma, *Computer Networks*, 1st Edition, 2013, S. K. Kataria & Sons.
2. Forouzan, *Computer Networks: A Top - Down Approach*, 1st Edition, 2017, McGraw Hill Education.

3. Narasimha Karumanchi, *Elements of Computer Networking: An Integrated Approach*, 1st Edition, 2017, Careermonk Publications.
4. Peterson, *Computer Networks - A System Approach*, 5th Edition, 2011, Elsevier.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Know about different Network components. •Learn about client-server programming •Learn and differentiate between TCP and UDP servers •Learn about network simulators. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students a practical introduction to the Internet and Web Page Design.
- To explain practical concepts on Web Browsers, Markup Language Basics and XML.
- To teach concepts on Web Server Side technologies.
- To give students hands-on exposure to some Advanced Web Technologies and the Web Security.

Prerequisites: Computer Programming Fundamentals

Detailed Syllabus:**Minimum 10 Laboratory experiments based on the following-**

1. Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages.
2. Use of Cascading Style Sheet in web pages.
3. Creating interactive and dynamic web pages with JavaScript: JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.
4. Extensible Markup Language (XML): Introduction- using user-defined tags in web pages; displaying XML contents; XML DTDs; use of XSL.
5. Server-side scripting: overview of CGI, ASP, and JSP.
6. Server side scripting using PHP; PHP basics, HTML form data handling, Web database connectivity- introduction to ODBC; PHP with database connectivity.
7. Exposure to Advanced Web Technologies (as far as possible; not to be made compulsory): Distributed Object based models- DCOM, CORBA, EJB; Web services and Related Technologies- ISAPI, SOAP, UDDI, WSDL; Other Advanced Web Technologies- AJAX, ISAPI, .NET. Web Security.

Text Book:

1. *Web Technologies*, Godbole and Kahate, 3rd Edition, 2017, McGraw Hill Education.

Reference Books:

1. Kogent Learning Solutions Inc., *Web Technologies: HTML, Javascript, PHP, Java, JSP, XML and AJAX, Black Book*, 1st Edition, 2009, Dreamtech Press.
2. Uttam K. Roy, *Web Technologies*, 1st Edition, 2010, Oxford.
3. N. P. Gopalan and J. Akilandeswari, *Web Technology: A Developer's Perspective*, 2nd Edition, 2014, Prentice-Hall of India Pvt. Ltd.
4. Jackson, *Web Technologies: A Computer Science Perspective*, 1st Edition, 2007, Pearson Education India.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Learn web page designing in detail using various client side and server side scripting. •Learn CSS. •Understand the development of XML documents. <p>Know about AJAX</p>	<ul style="list-style-type: none"> i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields 	<ul style="list-style-type: none"> (a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Lab Assignments ☑ viva-voce (ii) Skill Test carries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students a practical introduction to Operating System Structures, Shell Scripts, and System Calls.
- To provide a practical experience on management of Processes and Threads including synchronization.
- To explain implementation of CPU scheduling and Deadlock handling.
- To give students a practical exposure to File System management.

Prerequisites: Computer Programming Fundamentals

Detailed Syllabus:**Minimum 20 Laboratory experiments based on the following-**

1. Introduction- OS Structure, OS Operations, Shell Scripts, Kernel Data Structures.
2. Operating-System Structures- OS Services, User Interface to OS, System Calls, System Programs.
3. Processes- Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Communication in Client–Server Systems.
4. Threads- Overview, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.
5. Process Synchronization- Introduction, Mutex Locks, Semaphores.
6. CPU Scheduling- Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time Scheduling.
7. Deadlocks- Algorithms for Deadlock Detection/Prevention/Avoidance/Recovery.
8. File-System Interface- The concept of Files, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection.

Text Books:

1. *Operating System Concepts*, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 7th Edition, 2006, Wiley.

Reference Books:

1. William Stallings, *Operating Systems: Internals and Design Principles*, 7th Edition, 2013, Pearson Education India.
2. Andrew S. Tanenbaum and Herbert Bos, *Modern Operating Systems*, 4th Edition, 2014, Pearson Education India
3. Achyut Godbole and Atul Kahate, *Operating Systems*, 3rd Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I. Learn Shell Scripting.	i) Familiarization with essential tools , language and software has been inducted	(a) Participation in Practical Assignments
II. To perform scheduling operations on the OS.	ii) Related concept are discussed before each practical	(b)Continuous Evaluation(30Marks)
III. Learn the use of system calls.	iii) student are encourage to take up real problem and solve in group	(i)15 marks on ☑ Lab Assignments ☑ viva-voce
IV. Understand practically about threads, process synchronization, deadlocks, etc.	iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields	(ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give a comprehensive view of corporate communication, cross cultural communication by engaging them to meaningful discussion and interactive activities

Prerequisites: Basic understanding of communication in organizations.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Corporate Communication	Focus areas of Corporate Communication, Crisis Communication (Conceptual understanding, Dealing with a Crisis, Role of Internal Communication in handling Crisis), Cross Cultural Communication (Understanding Culture, Workplace Culture, Culture and Non-Verbal, Managing Global Teams)	3
II	Communication in Teams	Definition, Understanding Team and Group, Stages of Group Formation , Johari Window and Team Communication, Roles in a Team, Advantages and Challenges of Working in a Team, Essential Facts about being a part of a Team, Types of Teams, Team Conflicts	3
III	Business Etiquettes Cross Cultural Communication	Constituents of Etiquettes and Importance, Conduct at the workplace, Dining and gifts, Meeting, Customers and clients, Business Etiquettes and Modern Technology, Communicating in a Diverse Work Environment - Concepts of Culture, Cultural Nuances -Hierarchy & Status, Individualism and Teamwork, Punctuality, Technology, cultural contexts International Communication - Proverbs and Culture, Intercultural Communication and the Workplace, Cultural Conflicts, Resolving Cultural Conflicts	3
IV	Improving Technical Writing Skills	Report Writing - Importance and use, Characteristics of Reports. Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscript format), Types of Reports, Writing the Report	3
Total			12

Text Books:

1. *Business Communication for Managers*, Mehra, Payal, 1st Impression, 2012, Dorling Kindersley (India) Pvt. Ltd.

Reference Books:

1. Mukherjee, Hory Sankar, *Business Communication: Connecting At Work*, 1st Edition, 2013, Oxford University Press.
2. Verma, Shalini, *Business Communication: Essential Strategies for Twenty-first Century Managers*, 2nd Edition, 2014, Vikas Publishing House Pvt. Ltd.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<p>•Know communication skills required in corporation and work as a team, comprehend cross cultural communication and improve their technical writing skills.</p>	<p>i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.</p>	<p>(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.</p>

Objective:

The objectives of the course are:

- To provide students with a platform to understand individual and interpersonal behavior within an organization, thus building insight into the dynamics of employee attitudes, satisfaction, conflict and power politics.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Nature and Effects of Employee Attitudes	Nature of employee attitudes: job satisfaction, job involvement, organizational commitment, work moods Effects of employee attitudes: employee performance, turnover, absences and tardiness, theft, violence, other effects	3
II	Organizations and Individuals	Quality of work life, A rationale, Job enlargement versus job enrichment, Applying job enrichment, Core dimensions: A job characteristics, Approach, Enrichment versus motivation, Social cues affect perceptions, Contingency factors affecting enrichment, Individual's responsibilities to the organization, Organizational citizenship, Dues-Paying, Blowing the whistle on unethical behaviour, Mutual trust	3
III	Conflict in Organization	The nature of conflict, Levels of conflict, Sources of conflict, Effects of conflict	3
IV	Assertive Behaviour, Power, politics	Assertive behavior: interpersonal orientations, facilitating smooth relations, stroking Power and Politics: types of power, effects of power bases, organizational politics, influence and political power	3
Total			12

Text Books:

- Organizational Behaviour: Human behavior at work*, Newstrom, J. W., 2007, Tata McGraw-Hill, New Delhi.

Reference Books:

- Robbins, S. P., Judge, T. A. & Sanghi, S., *An Essentials of Organizational Behaviour*, 2010, Dorllings Kindersley, India

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Understand individual and interpersonal behavior within an organization, thus building insight into the dynamics of employee attitudes, satisfaction, conflict and power politics.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

9. Detailed Syllabus of Semester-III

Paper I/Subject Name: Design & Analysis of Algorithms

Subject Code: INT054C301

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To teach the fundamental algorithms
- To explain how to analyse the performance of algorithms
- To teach the fundamental algorithmic design strategies

Prerequisites: Fundamentals of Data Structures and Basic Mathematics

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Fundamental characteristics of an algorithm. Basic algorithm analysis – Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms. Using recurrence relations to analyse recursive algorithms – illustrations using recursive algorithms.	12
II	Fundamental Algorithm Strategies	Brute-Force, Greedy, Branch-and-Bound, Backtracking and Dynamic Programming methodologies as techniques for design of algorithms – Illustrations of these techniques for Problem-Solving. Heuristics – characteristics and their domains of applicability. Design of algorithms for String/ Texmatching problems, Huffman Code and Data compression problems, Subset-sum and Knapsack problems.	12
III	Graph and Tree Algorithms	Depth- and Breadth- First traversals. Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sort, Network Flow problems.	12
IV	Tractable and Intractable Problems	Computability. The Halting problem. Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem. Standard NP complete problems Reduction techniques. Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.	12
Total			48

Text Book:

1. *Introduction to Algorithms*, T. H. Cormen, C. E. Leiserson, R. L. Rivest, 3rd Edition, 2009, The MIT Press, Cambridge, Massachusetts.

Reference Books:

1. Aho, Hopcroft & Ullman, *The Design and Analysis of Algorithms*, Addison- Wesley
2. Horowitz & Sahani, *Fundamentals of Algorithms*, 2nd Edition, 2009, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Describe the major modern algorithms and selected techniques that are essential to today's computers. •Decide on the suitability of a specific algorithm design technique for a given problem. •Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students an exposure to the basic concepts of Compiler Design.
- To explain the concepts of syntax analysis.
- To teach in detail practical concepts on various kinds of parsing.
- To provide hands-on concepts on machine code generation and optimization.

Prerequisites: Concepts of Theory of Computation

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Introduction Compilation and Syntax Analysis	The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs. Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non- context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.	8
II	Parsing and Syntax Directed Definitions	FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR(0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications. Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, dependency graphs. S-tributed and L-attributed SDDs and their implementation using LR-parsers and recursive descent parsers respectively.	11
III	Semantic Analysis	Symbol tables and their data structures. Representation of "scope". Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery. Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.	14
IV	Run Time Environments, Machine Code Generation and Optimization	Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures. Simple machine code generation, examples of machine-independent code optimizations.	6
Total			39

Text Books:

1. *Compilers: Principles, Techniques, and Tools*, A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman, 2nd Edition, 2006, Addison Welsley
2. *Engineering a Compiler*, K.D. Cooper, and Linda Torczon, 2nd Edition, 2011, Morgan Kaufmann

Reference Books:

1. K.C. Louden, *Compiler Construction: Principles and Practice*, 1st Edition, Cengage Learning
2. D. Brown, J. Levine, and T. Mason, *LEX and YACC*, 2nd Edition, 2011, O'Reilly Media

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Have a practical introduction to the basic concepts of Compiler Design. •Have practical exposure to the concepts of syntax analysis. •Have detailed practical concepts on various kinds of parsing. •Have detailed hands-on concepts on machine code generation. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To teach the fundamental algorithms
- To explain how to analyze the performance of algorithms
- To teach the fundamental algorithmic design strategies

Prerequisites: Concepts of Computer Programming and Data Structures

Detailed Syllabus:**Minimum 20 Laboratory experiments based on the following-**

1. Implementation of different sorting algorithms.
2. Implementation of KRUSKAL ALGORITHM.
3. Implementation of PRIM'S ALGORITHM
4. Implementation of KNAPSACK PROBLEM
5. Implementation of MULTISTAGE GRAPH
6. Implementation of ALL PAIR SHORTEST PATH ALGORITHM
7. Implementation of EIGHT QUEEN PROBLEM
8. Implementation of TRAVELING SALES MAN Problem

Text Book:

1. *Introduction to Algorithms*, T. H. Cormen, C. E. Leiserson, R. L. Rivest, 3rd Edition, 2009, The MIT Press, Cambridge, Massachusetts.

Reference Books:

1. Aho, Hopcroft & Ullman, *The Design and Analysis of Algorithms*, Addison- Wesley
2. Horowitz & Sahani, *Fundamentals of Algorithms*, 2nd Edition, 2009, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Describe the major modern algorithms and selected techniques that are essential to today's computers. •Decide on the suitability of a specific algorithm design technique for a given problem. •Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions. 	<ol style="list-style-type: none"> i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields 	<ol style="list-style-type: none"> (a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Lab Assignments ☑ viva-voce (ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To provide a practical introduction to the basic concepts of Compiler Design.
- To explain the concepts of syntax analysis.
- To provide practical concepts on various kinds of parsing.
- To give hands-on concepts on machine code generation and optimization.

Prerequisites: Fundamentals of Theory of Computation and computer programming

Detailed Syllabus:**Minimum 20 Laboratory experiments based on the following-**

1. Familiarization with LEX by writing simple specifications for tokens such as, identifiers, numbers, comments in C/C++, etc. All LEX specifications must be compiled and executed with appropriate inputs.
2. LEX specification for tokens of the small language
3. Complete the specifications in Experiment No. 2 above to make a complete lexical analyzer.
4. Familiarization with YACC by writing simple specifications for desk calculator, variable declarations in C (only numbers and array). All YACC specifications must be compiled and executed with appropriate inputs. Note that this exercise also requires LEX specifications of the tokens involved.
5. YACC specifications for the syntax of the small language.
6. Adding error recovery to Experiment No. 5 above to make a complete parser.
7. S-attributed specification of the semantics of the small language to be incorporated into YACC specifications produced in Experiment No. 6 above.
8. Adding semantic error recovery to the semantic analyzer in Experiment No. 7 above to make a complete semantic analyzer.
9. Intermediate code generation for the constructs of the small language to be incorporated into the semantic analyzer of Experiment No. 8 above.

Text Books:

1. *Compilers: Principles, Techniques, and Tools*, A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman, 2nd Edition, 2006, Addison Welsley
2. *Engineering a Compiler*, K.D. Cooper, and Linda Torczon, 2nd Edition, 2011, Morgan Kaufmann

Reference Books:

1. K.C. Loudon, *Compiler Construction: Principles and Practice*, 1st Edition, Cengage Learning
2. D. Brown, J. Levine, and T. Mason, *LEX and YACC*, 2nd Edition, 2011, O'Reilly Media

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Have a practical introduction to the basic concepts of Compiler Design. •Have practical exposure to the concepts of syntax analysis. •Have detailed practical concepts on various kinds of parsing. •Have detailed hands-on concepts on machine code generation. 	<ol style="list-style-type: none"> i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields 	<ol style="list-style-type: none"> (a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Lab Assignments ☑ viva-voce (ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To enhance communication skills by giving adequate exposure in Non-verbal communication, conversation skills, group discussions and other related skills.

Prerequisites: Basic awareness of tools of communication.

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Non-verbal Communication	Kinesic Communication, Characteristics of non-verbal communication, Classification of non-verbal communication (Ekman's classification of communicative movements, face facts, positive genres, negative genres, lateral genres, Responding to power posturing, Guidelines for developing non-verbal communication, Communication breakdown	8
II	Conversations, Dialogues and Debates	Purpose of general conversation (Tips and features of good conversation), Short conversations, Telephonic skills, Situational Dialogues and Role plays	11
III	CVs, Personal Interviews and Group Discussions	Applying for jobs, Writing a CV, The relationship between a Resume and an Application Letter, Guidelines for preparing a good CV, Guidelines for preparing a good application letter, Interviews, Group Discussion – Practical	14
IV	Developing Reading Skills	Introduction, Purpose of reading, Soft skills for reading, Reading Comprehension: types of texts, Reading Practice	6
Total			39

Text Books:

- Business Communication: Concepts, Cases and Applications*, Chaturvedi, P.D. and Chaturvedi, Mukesh, 2nd Edition, 2011, Dorling Kindersley (India) Pvt. Ltd, pp: 99-108, 217-230

Reference Books:

- Kumar, Sanjay and Lata, Pushp, *Communication Skills: A Workbook*, 1st Edition, Oxford University Press, pp: 329-348.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Have a sound knowledge of non-verbal communication and develop skills like Conversation, Group discussions and Reading skills	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b) Continuous Evaluation (30 Marks) (i) 15 marks on <input type="checkbox"/> Assignments <input type="checkbox"/> Class tests. <input type="checkbox"/> viva-voce or presentation (ii) Mid-term examinations : 10 marks (iii) Class attendance - 5 marks (c) End-term examinations: 70 marks.

10. Detailed Syllabus of Semester-IV

Objectives:

The objectives of the course are:

- To make the students understand the basics of soft computing and fuzzy logic
- To give an idea of artificial neural networks and its applications
- To explain genetic algorithms with example
- Introduction to Rough set and understand different soft computing tools to solve real life problems.

Prerequisites: Basics of Digital Logic and Artificial Intelligence

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Soft Computing and Fuzzy Logic	Introduction- Overview of Soft Computing, Difference between Soft and Hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithms. Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.	12
II	Artificial Neural Network	Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.	12
III	Genetic Algorithm	Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GA, analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications.	12
IV	Rough Set	Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.	12
Total			48

Text Books:

1. *Neural Fuzzy Systems*, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR.
2. *Fuzzy Sets and Fuzzy Logic*, Klir & Yuan, PHI, 1997.
3. *Neural Networks*, S. Haykin, Pearson Education, 2ed, 2001.
4. *Genetic Algorithms in Search and Optimization, and Machine Learning*, D. E. Goldberg, Addison-Wesley, 1989.

Reference Books:

1. Jang, Sun, & Mizutani, *Neuro-Fuzzy and Soft Computing*, PHI.
2. , V. Kecman, *Learning and Soft Computing*, MIT Press, 2001.
3. Z. Pawlak, *Rough Sets*, Kluwer Academic Publisher, 1991.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience • Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems • Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations • Develop some familiarity with current research problems and research methods in Soft Computing Techniques. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Assignments <input checked="" type="checkbox"/> Class tests. <input checked="" type="checkbox"/> viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper II/Subject Name: Cryptography and Network Security

Subject Code: INT054C402

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To provide basic concepts of Cryptography.
- To provide the basic difference between the symmetric and asymmetric encryption techniques.
- To explain various threats in the network.

Prerequisites: Concepts of Networking

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Introduction	Need for Security, Security Approaches, Principles of Security, Types of Attacks, Brute Force Attack, Encryption, Decryption, Crptosystem, Cryptographic Techniques: Substitution Ciphers, Transposition Ciphers, Product Ciphers, Stegenography, Block Cipher, Stream Cipher.	12
II	Symmetric and Asymmetric Key Cryptography	Overview, Algorithm Modes and Types, Data Encryption Standard: Simplified DES, The Strength of DES, Differential and Linear Cryptanalysis. Triple DES, Blowfish. Confidentiality using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation. Modular Arithmetic, Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, Difference with Symmetric Key Cryptography, The RSA Algorithms, Key Management, Diffie Hellman Key Exchange.	12
III	Authentication Protocols	Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MD5 Message Digest Algorithms, Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standards.	12
IV	Security Protocols	Security Applications and Protocols- Authentication Applications: Secure HTTP, HTTPS, ERT, SSH, Kerberos. Email Security: PGP, S/MIME. IP Security: Overview, IPSec architecture.	12
Total			48

Text Book:

1. *Cryptography and Network Security- Principles and Practice*, William Stallings, 6th Edition, 2013, Pearson Education.

Reference Books:

1. Behrouz A. Forouzan, *Cryptography & Network Security*, 3rd Edition, 2016, Tata McGraw Hill.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Grasp complete knowledge of various issues in the network. •Solve problems based on symmetric and asymmetric cryptography techniques. •Have network management capabilities. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To enhance communication skills by giving adequate exposure in Negotiation skills, organizational communication and other related skills.

Prerequisites: Basic understanding of 3rd semester syllabus.

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Introduction to Modern Communication Media	Introduction, Technology-based communication tools (Telephone and Voicemail, Fax, Computers, Internet, Conferencing, instant messaging, Emails, Types of instructions (Oral & written), Outsourcing Technology for Managing Communication , Latest trends in Technology, Online Etiquettes	8
II	Negotiation Skills	Nature & need of negotiation, Factors affecting negotiation, Stages in the negotiating process, Negotiating strategies	11
III	Organisational Communication	The importance of communication in management, Communication concerns of the Manager, Communication training for managers, Information to be communicated in a workplace, Etiquettes and Professionalism, Applying Ethics	14
IV	Conducting Meetings and Writing Proposals and Business Plan	Why do teams meet, arranging a meeting, preparing for a meeting, writing notices for a meeting, leading a meeting, writing the notes and minutes of a meeting, agenda Definition and Characteristics , Types of Proposals, Making a proposal, What is an RFP and How do you respond to it, Elevator Pitch, Techniques of Proposal writing Making a Itinerary, Business Plans	6
Total			39

Text Books:

- Business Communication: Concepts, Cases and Applications*, Chaturvedi, P.D. and Chaturvedi, Mukesh, 2nd Edition, 2011, Dorling Kindersley (India) Pvt. Ltd, pp: 99-108, 217-230

Reference Books:

- Raman, Meenakshi and Sharma, Sangeeta, *Technical Communication: Principles and Practice*, 2nd Edition, 2011, Oxford University Press, pp 579-560
- Verma, Salini, *Business Communication: Essential Strategies for twenty-first century Managers*, 2nd Edition, 2015, Vikas Publishing House Pvt Ltd. pp 119-165.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> Have a sound understanding of Negotiation skills, Organizational outcomes like conducting meetings writing Business Proposals and Plans. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) <ul style="list-style-type: none"> (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

11. Detailed Syllabus of Department Specific Electives

ELECTIVE-I

Paper VIII/Subject Name: Theory of Computation

Subject Code: INT054D101

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To provide basic concepts of Theory of Computations and Finite Automata.
- To give an exposure to Context-Free Language and Push Down Automata.
- To explain about Turing Machines and Chomsky Hierarchy.
- To teach about Decidability and Complexity Theory.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	Basic Concepts of Theory of Computations and Finite Automata	Introduction- Symbol & Alphabet, Sets, Relations & Functions, Graphs, Strings & Languages. Finite State Machines- Finite State Automata, Transition System, DFA, NFA, Acceptability of a String, Equivalence of NFA & DFA, NFA with λ -transitions. Regular expressions, regular Grammars, Equivalence between Regular Expression and Finite Automata. Regular Sets and Properties- Pumping Lemma.	12
II	Context-Free Language and Push Down Automata	Context-Free Languages- Introduction, Context-Free Grammars, Derivation Trees, Left-most Derivation and Right-most Derivation, Ambiguity in CFG, Simplification of CFG, Normal forms. Push Down Automata- Basic definition and PDA model, Deterministic & Non-deterministic PDA, Equivalence of Acceptance, PDA Lemma for CFL's, Pumping Lemma for CFLs	12
III	Turing Machines and Chomsky Hierarchy	Turing Machines- Turing Machine Model, Representation, Language Acceptance, Design of TM, Recursively enumerable languages, Church's Hypothesis, Types of TMs, Halting Problem.	12
IV	Decidability and Complexity Theory	Decidable and Undecidable Languages- Decidability, Countable sets, Rice's Theorem, Enumerability, the relationship between decidable and enumerable languages. Complexity Theory- the running time of algorithms, the complexity classes P & NP, Non-deterministic algorithms, NP-complete languages.	12
Total			48

Text Books:

1. *Theory of Computer Science: Automata, Languages and Computation*, K. L. P. Mishra and N. Chandrasekaran, 3rd Edition, 2006, Prentice Hall India Learning Private Limited.
2. *Theory of Computation: Formal Languages and Automata Theory*, G. P. S. Verma and B. T. Rao, Scitech Publications (India) Pvt. Ltd.
3. *Introduction to the Theory of Computation*, Michael Sipser, 3rd Edition, 2012, Cengage Learning.

Reference Books:

1. Hopcroft, *Introduction to Automata Theory, Languages, and Computation*, 3rd Edition, 2008, Pearson Education India.
2. Vivek Kulkarni, *Theory of Computation*, 2013, Oxford University Press.
3. A.M. Natarajan, A. Tamilarasi and P. Balasubramani, *Theory of Computation*, 2008, New Age Publishers.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none">•Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.•Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.•Prove the basic results of the Theory of Computation.	<ol style="list-style-type: none">i) Each topic to be expounded with adequate examples.ii) Class discussions and question- answer rounds are encouragediii) theoretical problems solving is part of the class to grasp the underlying conceptsiv) Students have to go through case studies for real time experiencev) Students to be encouraged to give short presentations.	<ol style="list-style-type: none">(a) Participation in class discussions(b)Continuous Evaluation(30Marks)<ol style="list-style-type: none">(i) 15 marks on<ul style="list-style-type: none">☑ Assignments☑ Class tests.☑ viva-voce or presentation(ii) Mid-term examinations :10 marks(iii) Class attendance -5 marks(c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To explain the fundamental concepts in graph theory
- To teach how graph theory can be used as tools in solving practical problems
- To enhance the proof writing skills and know its applications

Prerequisites: Concepts of Data Structures

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Definition of Graph, Application of Graphs Finite and Infinite graphs, Incidence and degree of a graph, Isolated Vertex, Pendent Vertex, Null Graph. Isomorphism; Sub graphs and Union of Graphs, walks, Paths and Circuits, Connected Graphs, disconnected graphs and components, Eulerian graph, Chinese postman problem, Konigsberg Bridge Problem, Operations on Graphs, Arbitrarily traceable graphs, Fleury's algorithms, Hamilton graph-necessary and sufficient conditions, Complete Graph, Traveling salesman, bipartite graph	12
II	Trees	Definition of tree, Properties of tree, Pedant vertices in a tree; Center of a tree, Rooted binary trees, On counting trees, Fundamental circuits; Spanning trees, Spanning algorithms Spanning trees of a weighted graph, algorithms for shortest Spanning tree.	12
III	Cut Sets and Vertices, Planar Graph and Matrix Representation of Graph	Cut-sets and cut-vertices; Some properties of Cut-Set, Fundamental Circuits and cut-sets, Connectivity and separativity and different theorems; Network flow, max-flow min-cut theorem, 1-isomorphism and 2-isomorphism. Combinatorial and geometric graphs, planar graphs, Geometric and Combinatorial dual; Kuratowski graph; detection of planarity; Thickness and crossings. Incidence; Adjacency; Circuit, Cut-Set, Path matrices and their properties	12
IV	Graph Coloring, Directed Graphs and Enumeration of Graphs	Chromatic number; Chromatic Partitioning, Chromatic polynomial, Coverings, minimization of Switching Functions. Four Color theorem, five color theorems Digraphs, different types of digraphs, Binary relations, Directed graphs and connectedness, Euler Digraph, Tree with directed graph, Arborescence an Polish method. Types of Enumerations, Counting labeled an Unlabelled trees, Counting Methods, Polay Counting Theory.	12
Total			48

Text Book:

1. *Graph Theory with applications to Engineering and Computer Science*, Narasingh Deo, New Edition, PHI Publications.
2. *Graph Theory*, Franck Harary, 2001, Narosa Publishing House.

Reference Books:

1. Bondy, J. A. and Murty, U.S.R., *Graph Theory with Applications*, 2008, Springer
2. C.L. Liu, *Elements of Discrete Mathematics*, 2nd Edition, 2000, Tata McGraw Hill
3. Harikishan, Shivraj Pundir and Sandeep Kumar, *Discrete Mathematics*, 7th Edition, 2010, Pragati Publication.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •To explain and apply principles and concepts of graph theory in practical situations •To apply the basic concepts of mathematical logic •To describe and solve some real time problems using concepts of graph theory. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

ELECTIVE-II**Paper VIII/Subject Name: Digital Image Processing****Subject Code: INT054D201****L-T-P-C - 4-0-0-4****Credit Units: 04****Scheme of Evaluation: T****Objective:**

The objectives of the course are:

- To explain the image fundamentals and mathematical transforms necessary for image processing.
- To teach the image enhancement techniques and image restoration procedures.
- To explain the image compression procedures

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Scope and application of digital image processing, Image acquisition and display, Mathematical preliminaries, Human visual perception	8
II	Image Transforms, Enhancement and Restoration	Different transforms : 2D-Fourier Transforms, 2D DFT, KLT, 2D DCT, Haar transform and their properties Spatial Filtering, Histogram processing. Frequency Domain Filtering. Degradation Model, Inverse Filtering, Wiener Filtering	15
III	Edge Detection and Segmentation and Binary and Color Image Processing	Edge detection, Line detection, Segmentation, Texture Analysis and Classification. Binarization, morphological image processing, distance transform. Color model. color image processing, color image quantization, histogram of a color image.	15
IV	Image Compression	Lossy Compression. Loss-less compression. Run-length and Huffman Coding. Transform Coding. Image Compression Standards.	10
Total			48

Textbooks:

1. *Digital Image Processing*, R. C. Gonzalez & R. E. Woods, 3rd Edition, 2004, Addison Wesley.

References:

1. A. K. Jain, *Fundamentals of Digital Image Processing*, 1st Edition, 2004 PHI
2. K. R. Castleman, *Digital Image Processing*, 1st Edition, PHI.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Learn the fundamental concepts of a digital image processing system. • Analyze images in the frequency domain using various transforms. • Evaluate the techniques for image enhancement and image restoration. • Categorize various compression techniques. • Interpret Image compression standards, image segmentation and representation techniques. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) <ul style="list-style-type: none"> (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To give students an introduction to data warehouse design.
- To provide detailed concepts on data modeling, data warehouse planning, design and implementation.
- To provide detailed concepts on data marts, data lakes, and schemas.

Prerequisites:**Detailed Syllabus:**

Modules	Topics	Course content	Periods
I	Data Warehouse Fundamentals	OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics of Data Warehouse; Functionality of Data Warehouse: Advantages and Applications of Data Warehouse; Applications: Top- Down and Bottom-Up Development Methodology: Tools for Data warehouse development: Data Warehouse Types, Key Issues, Planning and Project Management in constructing Data warehouse, Data Warehouse development Life Cycle, Kimball Lifecycle Diagram, Requirements Gathering Approaches: Team organization, Roles, and Responsibilities:	12
II	Data Warehouse Architecture	Design Approaches : Top Down, Bottom up, their characteristics, advantages, disadvantages, Types of data, ware house architecture, components, multitier architecture, Operational Data Stores, ETL, ETL vs ELT , Data Warehouse Modelling, Data Warehouse Design, Data Warehouse Implementation, Meta Data, Data Mart, Delivery Process	12
III	OLAP , dimensional Modelling and schemas	OLAP, Characteristics of OLAP, OLTP vs OLAP, OLAP Operations ,Types of OLAP, ROLAP vs MOLAP vs HOLAP, Dimensional Modelling, Multi-Dimensional Data Model, Data Cube, Star Schema, Snowflake Schema, Star vs Snowflake Schemas, Fact Constellation Schema, Process Architecture, Types of Database Parallelism, Data Warehouse Tools, Partitioning strategy,	12
IV	Implementation, maintenance and security	Physical Design Steps, Physical Storage: Storage Area Data Structures ,Optimizing Storage, Using RAID Technology, Estimating Storage ,Sizes, Indexing the Data Warehouse : B-Tree Index, Bitmapmed Index, Clustered Index, Performance Enhancement Techniques: Data Partitioning , Data clustering, Parallel Processing System Managers, Process Managers, Security, Backup, Tuning, Testing, Future Aspects	12
Total			48

Text Books:

1. *Data Mining Techniques*, Arun K Pujari, 3rd Edition, Universities Press.
2. *Data Ware Housing Fundamentals*, Pualraj Ponnaiah, Wiley Student Edition.

Reference Books:

1. Alex Berson and Stephen J.Smith, *Data Warehousing, Data Mining and OLAP*, Tata McGraw – Hill Edition, 35th Reprint 2016.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • have a deeper understanding of database systems and their underlying theory • to be able to improve the decision-making process. • understand the technology of data warehousing. • be able to develop applications of higher order database systems 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To impart knowledge of distributed systems techniques and methodologies.
- To explain the design and development of distributed systems and distributed systems applications.
- To explain the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.

Prerequisites: Concepts of Operating Systems

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Distributed Systems: Introduction and Communication	Definition Of Distributed System. Goals- Advantages Of Distributed Systems, Disadvantages Of Distributed Systems. Hardware Concepts- Bus-Based Multiprocessors, Switched Multiprocessors, Busbased Multicomputers, Switched Multicomputers. Software Concepts- Network Operating Systems, True Distributed Systems, Multiprocessor Timesharing Systems. Design Issues- Transparency, Flexibility, Reliability, Performance, Scalability The Client-Server Model- Clients And Servers, Examples, Addressing, Blocking Versus Nonblocking Primitives, Buffered Versus Unbuffered Primitives, Reliable Versus Unreliable Primitives, Client-Server Model Implementation Issues. Remote Procedure Call- Basic Rpc Operation, Parameter Passing, Dynamic Binding, Rpc Semantics In The Presence Of Failures, Implementation Issues, Problem Areas. Group Communication- Introduction, Design Issues.	12
II	Synchronization	Clock Synchronization- Logical Clocks, Physical Clocks, Clock Synchronization Algorithmscristians Algorithm, The Berkeley Algorithm, Averaging Algorithms, Multiple External Time Sources; Use Of Synchronized Clocks- At-Most-Once Message Delivery. Mutual Exclusion- Centralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison Of The Three Algorithms. Election Algorithms- Bully Algorithm, Ring Algorithm. Atomic Transactions- Introduction To Atomic Transactions, The Transaction Model, Implementation, Concurrency Control. Deadlocks In Distributed Systemsdistributed Deadlock Detection (Centralized Versus Distributed), Distributed Deadlock Prevention	12
III	Processes and Processors	Threads- Introduction, Usage, Design Issues, Implementing A Threads Package, Threads And Rpc. System Models- The Workstation Model, The Processor Pool Model, Hybrid Model. Processor Allocation- Allocation Models, Design Issues, Implementation Issues, Examples. Scheduling In Distributed Systems. Fault Tolerance- Component Faults, System Failures, Synchronous Versus Asynchronous Systems, Use Of Redundancy, Fault Tolerance Using Active Replication, Fault Tolerance Using Primary Backup, Agreement In Faulty Systems. Real-Time Distributed Systemsdefinition, Design Issues, Clock Synchronization, Real-Time Communication, Real-Time Scheduling	12
IV	File System and Shared Memory	Distributed File System Design- The File Service Interface, The Directory Server Interface, Semantics Of File Sharing, Distributed File System Implementation- File Usage, System Structure,	12

		Caching, Replication. Case Study: Suns Network File System- Nfs Architecture, Nfs Protocols, Nfs Implementation. Introduction. Shared Memory- On-Chip Memory, Bus-Based Multiprocessors, Ring-Based Multiprocessors, Switched Multiprocessors, Numa Multiprocessors, Comparison Of Shared Memory Systems.	
Total			48

Text Book:

1. *Distributed Operating Systems*, Andrew S. Tanenbaum, 1st Edition, 2002, Pearson Education India
2. *Distributed Systems: Concepts and Design*, Coulouris, Dollimore, 5th Edition, 2011, Pearson

Reference Books:

1. Andrew S. Tanenbaum, *Distributed Systems: Principles and Paradigms*, 2nd Edition, 2006, Pearson
2. Sunita Mahajan & Seema Shah, *Distributed Computing*, 1st Edition, 2010, Oxford University Press

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •To identify the core concepts of distributed systems: the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way. •To examine how existing systems have applied the concepts of distributed systems in designing large systems. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/Subject Name: Artificial Intelligence

Subject Code: INT054D302

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To present an overview of artificial intelligence (AI) principles and approaches.
- To provide a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction and Informed Search Strategies	What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies. Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning	12
II	Reasoning and Planning	Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints	12
III	Uncertainty and Inductive Learning	Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision theoretic expert systems. Decision trees, rule based learning, current-best-hypothesis search, least-commitment search , neural networks, reinforcement learning, genetic algorithms; Other learning methods - neural networks, reinforcement learning, genetic algorithms.	20
IV	Communication	Communication among agents, natural language processing, formal grammar, parsing, grammar	4
Total			48

Text Book:

1. *Artificial Intelligence – A Modern Approach*, Stuart Russell and Peter Norvig, 3rd Edition, 2009, Pearson Education Press
2. *Artificial Intelligence*, Kevin Knight, Elaine Rich, B. Nair, 3rd Edition, 2008, McGraw Hill

Reference Books:

1. George F. Luger, *Artificial Intelligence*, 6th Edition, 2009, Pearson Education
2. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis*, 1st Edition, Morgan Kaufman

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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<ul style="list-style-type: none"> •Understand the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. •Have read and analyzed important historical and current trends addressing artificial intelligence. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.
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Paper V/Subject Name: Wireless Computing

Subject Code: INT054D303

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To make the students understand the basic concepts of mobile computing.
- To make them familiar with the network protocol stack.
- To teach the basics of mobile telecommunication system.
- To provide an exposure to Ad-Hoc networks.
- To impart knowledge about different mobile platforms and application development

Prerequisites: Concepts of Computer Networks

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	12
II	Mobile Internet Protocol & Transport	Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP route Optimisation. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of tCP Window-Improvement in TCP Performance.	12
III	Mobile Tele-communication	Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	8
IV	Mobile AD-Hoc Networks, Mobile Platforms & Applications	Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.	16
Total			48

Text Book:

1. *Wireless Network and Mobile Computing*, Koushik Sinha, Sasthi C Ghosh, Bhabani P. Sinha, 1st Edition, 2016, CRC Press
2. *Introduction to Wireless and Mobile Technology*, Dharma Prakash Agarval, Qing and An Zeng, 2nd Edition, 2006, Pearson Education

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, *Principles of Mobile Computing*, 2nd Edition, 2002, Springer
2. C.K.Toth, *Ad-hoc Mobile Wireless Networks*, 1st Edition, 2015, Pearson Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Understand the basic concepts of mobile computing and the network protocol stack. •Learn the basics of mobile telecommunication system and Ad-Hoc networks. •Gain knowledge about different mobile platforms and application development 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

ELECTIVE-IV

Paper V/Subject Name: Cloud Computing

Subject Code: INT054D304

Objective:

The objectives of the course are:

- To introduce the students the broad perceptive of cloud architectural model and the concept of Virtualization.
- To make students familiar with the lead players in cloud and understand the features of cloud simulator.
- To give students the concepts on applying different cloud programming model as per need and make them able to set up a private cloud.
- To make students understand the design of cloud Services and trusted cloud Computing system.

Prerequisites: Concepts of Networking and Distributed Systems

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Cloud Architecture and Model	Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models- Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions, Cloud ecosystem, Service management, Computing on demand.	12
II	Virtualization	Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation.	12
III	Cloud Infrastructure and Programming Model	Cloud Infrastructure- Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Programming Model- Parallel and Distributed Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Mapping Applications, Programming Support, Google App Engine, Amazon AWS, Cloud Software Environments, Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.	12
IV	Security in The Cloud And Recent Research Trends	Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control, Autonomic Security. Topics on Recent Research Trends.	12
Total			48

Text Book:

1. *Distributed and Cloud Computing, From Parallel Processing to the Internet of Things*, Kai Hwang, Geoffrey C Fox, Jack G Dongarra, 1st Edition, 2011, Morgan Kaufmann Publishers.

Reference Books:

1. Toby Velte, Anthony Velte and Robert Elsenpeter, *Cloud Computing, A Practical Approach*, 1st Edition, 2009, Tata McGraw Hill.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Understand the fundamental principles of distributed computing •Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing •Understand the business models that underlie Cloud Computing. •Understand concepts of IAAS, SASS, PAAS 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/Subject Name: Cyber Forensics	Subject Code: INT054D305
L-T-P-C - 4-0-0-4	Credit Units: 04
Scheme of Evaluation: T	

Objective:

The objectives of the course are:

- To provide an understanding Computer forensics fundamentals.
- To explain various computer forensics technologies and computer forensics systems.
- To explain methods for data recovery.
- To teach the methods for preservation of digital evidence

Prerequisites: Fundamentals of Networking and Cryptography.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Computer Forensics Fundamentals	Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology.	7
II	Forensics Technologies	Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware. Encryption Methods and Vulnerabilities ,Protecting Data from Being Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls ,Biometric Security Systems.	7
III	Forensics Systems	Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems. Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security	7
IV	Data Recovery, Evidence Collection and Data Seizure, Duplication and Preservation of Digital Evidence	Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data Why Collect Evidence?, Collection Options ,Obstacles ,Types of Evidence ,The Rules of Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of Collection, Artifacts. Preserving the Digital Crime Scene, Computer Evidence Processing Step.Computer Image Verification and AuthenticationSpecial Needs of Evidential Authentication, Practical Considerations	15
Total			48

Text Book:

1. *Computer Forensics and Investigations*, Nelson, Phillips, Enfinger, Steuart, 3rd Edition, 2008, Cengage Learning, India Edition.
2. *Computer Forensics: Computer Crime Scene Investigation*, John R. Vacca, 2nd Edition, 2005, Charles, River Media.

Reference Books:

1. John R.Vacca, *Computer Forensics*, 3rd Edition, 2005, Cengage Learning

2. Richard E.Smith, *Internet Cryptography*, 3rd Edition, 2008, Pearson Education, 2008.
3. Marjie T.Britz, *Computer Forensics and Cyber Crime: An Introduction*, 3rd Edition, 2013, Prentice Hal,.
4. ChristofPaar, Jan Pelzl, *Understanding Cryptography: A Textbook for Students and Practitioners*, 2nd Edition, 2010, Springer's

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Understand the definition of computer forensics fundamentals. •Describe the types of computer forensics technology. •Analyze various computer forensics systems. •Illustrate the methods for data recovery, evidence collection and data seizure. •Summarize duplication and preservation of digital evidence. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/Subject Name: Pattern Recognition

Subject Code: INT054D306

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To explain the design and construction and a pattern recognition system and the major approaches in statistical and syntactic pattern recognition.
- To provide an exposure to the theoretical issues involved in pattern recognition system design.
- To teach the working knowledge of implementing pattern recognition techniques and the scientific Python computing environment.

Prerequisites: Concepts of Data Mining and Digital Image Processing

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Pattern Recognition: Definition, Applications and Examples, Clustering Vs Classification, Supervised Vs Unsupervised, Basic of Linear Algebra, Vector Spaces, Basics of Probability, Basics of Estimation Theory, Decision Boundaries, Decision Regions, Metric Spaces	12
II	Classification	Bayes Decision Rules, Error Probability, Examples, Normal Distribution, Linear Discriminant Function, Non-Linear Decision Boundaries, Mahalanobis Distance, K-NN Classifier, Single and Multi Layer Perceptron, Training Set, Test Set, Standardization and Normalization	12
III	Clustering	Basics, Similarity/Dissimilarity Measures, Clustering Criteria, Different distance functions and similarity measures, within cluster distance criterion, K-means algorithm, Single linkage and complete linkage algorithms, MST,K-medoids, DBSCAN, Data sets: Visualization, Unique Clustering	12
IV	Decision Making, Cluster Analysis and Feature Extraction	Baye's theorem, multiple features, decision boundaries, estimation of error rates, histogram, kernels, window estimators, nearest neighbour classification, maximum distance pattern classifiers, adaptive decision boundaries. Unsupervised learning, hierarchical clustering, graph theories approach to pattern clustering, fuzzy pattern classifiers, application of pattern recognition in medicine. Structural PR, SVMs, FCM ,Soft-Computing and Neuro-Fuzzy Techniques, Real-Life Examples	12
Total			48

Text Book:

1. *Pattern Recognition and Image Analysis*, Earl Gose, Richard Johnsonbaugh, Steve Jost, DSKT Edition, PHI
2. *Pattern Classification and Scene Analysis*, Duda & Hart, 1st Edition, Wiley

Reference Books:

1. K. Fukunaga , *Statistical pattern Recognition*, 2nd Edition, 2000, Academic Press
2. S.Theodoridis and K.Koutroumbas, *Pattern Recognition*, 4th Edition, 2005, Academic Press.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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- Learn the design and construction and a pattern recognition system
- Understand the working knowledge of implementing pattern recognition techniques and the scientific Python computing environment.

Analyze the different features extracted from datasets

i) Each topic to be expounded with adequate examples.
 ii) Class discussions and question-answer rounds are encouraged
 iii) theoretical problems solving is part of the class to grasp the underlying concepts
 iv) Students have to go through case studies for real time experience
 v) Students to be encouraged to give short presentations.

(a) Participation in class discussions
 (b)Continuous Evaluation(30Marks)
 (i)15 marks on
 ☑ Assignments
 ☑ Class tests.
 ☑ viva-voce or presentation
 (ii) Mid-term examinations :10 marks
 (iii) Class attendance -5 marks
 (c) End-term examinations: 70 marks.

ELECTIVE-V

Paper III/Subject Name: Big Data Analytics

Subject Code: INT054D401

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an exposure to Apache Hadoop Architecture and Ecosystem.
- To provide concepts on HDFS and Map reduce.
- To explain querying data using Hive and Pig.
- To expose students to Real Time Databases using HBase.

Prerequisites: Concepts of Databases.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Overview	Challenges to conventional database systems, Big Data Attributes, Operational and Analytical Big Data, Divers of Big Data, Data Structures, Big Data Ecosystems, Categories, 3V/ 4V models of Big Data, Applications of Big Data, Challenges of Big Data, Big Data Security, Big Data Generalization, and Acquisition	9
II	Trends of Computing	Big Data Computing Paradigm, High Performance Computing, Supercomputers, Clusters, Grid Computing, Cloud Computing, Mobile Computing, Big Data Mining, Big Data Storage Techniques.	9
III	Big Data Tools, Techniques and Systems	Introduction to Hadoop, Architecture and Foundation of Hadoop, HDFS, MapReduce, Framework of MapReduce, Processing of Data using MapReduce, Testing and Debugging MapReduce Application, Users of MapReduce, YARN, HBASE, HIVE, Pig, Sqoop, Zookeeper, Oozie	7
IV	Big Data Models	SaaS, IaaS, PaaS, IoT and Big Data, Future of Bi Data Paradigm	11
Total			48

Text Book:

1. *Big Data Analytics with R and Hadoop*, VigneshPrajapati, 1st Edition, 2013, Packet Publishing.

Reference Books:

1. Benjamin Bengfort and Jenny Kim, *Big Data Analytics with Hadoop: An Introduction for Data Scientists*, 1st Edition, 2016, O'Reilly Media.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning	Assessment Tasks
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	Activity	
<ul style="list-style-type: none"> •Identify Big Data and its Business Implications. •List the components of Hadoop and Hadoop Eco-System. •Access and Process Data on Distributed File System. •Manage Job Execution in Hadoop Environment. •Develop Big Data Solutions using Hadoop Eco System. •Apply Machine Learning Techniques using R. 	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i) 15 marks on <input type="checkbox"/> Assignments <input type="checkbox"/> Class tests. <input type="checkbox"/> viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/Subject Name: Bioinformatics

Subject Code: INT054D402

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To improve the programming skills of the student.
- To let the students know the recent evolution in biological science

Prerequisites: Fundamentals of Databases and Data Mining

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction to Bioinformatics and Computational Biology	Biological sequences, Biological databases, Genome specific databases, Data file formats, Data life cycle, Database management system models, Basics of Structured Query Language (SQL).	12
II	Dynamic Programming Algorithms	Sequence Analysis, Pairwise alignment, Dynamic programming algorithms for computing edit distance, string similarity, shotgun DNA sequencing, end space free alignment. Multiple sequence alignment, Algorithms for Multiple sequence alignment, Generating motifs and profiles, Local and Global alignment, Needleman and Wunsch algorithm, Smith Waterman algorithm, BLAST, PSIBLAST and PHIBLAST algorithms.	12
III	Phylogenetics	Introduction to phylogenetics, Distance based trees UPGMA trees, Molecular clock theory, Ultrametric trees, Parsimonious trees, Neighbour joining trees, trees based on morphological traits, Bootstrapping. Protein Secondary structure and tertiary structure prediction methods, Homology modeling, abinitio approaches, Threading, Critical Assessment of Structure Prediction, Structural genomics.	12
IV	Machine Learning Techniques	Machine learning techniques: Artificial Neural Networks in protein secondary structure prediction, Hidden Markov Models for gene finding, Decision trees, Support Vector Machines. Introduction to Systems Biology and Synthetic Biology, Microarray analysis, DNA computing, Bioinformatics approaches for drug discovery, Applications of informatics techniques in genomics and proteomics: Assembling the genome, STS content mapping for clone contigs, Functional annotation, Peptide massFingerprinting	12
Total			48

Text Book:

1. *Introduction to Bioinformatics*, Lesk, A. K., 4th Edition, 2013, Oxford University Press.
2. *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Gusfield, Dan, Cambridge University Press.

Reference Books:

1. Baldi, P, Brunak, S.; *Bioinformatics: The Machine Learning Approach*, 2nd Edition, 2001, MIT Press

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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<ul style="list-style-type: none"> •Develop bioinformatics tools with programming skills. •Apply computational based solutions for biological perspectives. •Practice life-long learning of applied biological science 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.
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Paper IV/Subject Name: Optimization Techniques

Subject Code: INT054D403

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an introduction to various optimization techniques.
- To impart concepts on how to formalize various optimization problems using mathematical concepts.
- To provide students concepts on analyze and appreciate variety of performance measures for various optimization problems.

Prerequisites: Fundamentals of Mathematics

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Operation Research approach, scientific methods, introduction to models and modelling techniques, general methods for Operation Research models, methodology and advantages of Operation Research, history of Operation Research.	12
II	Linear Programming	Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming, Integer linear programming.	12
III	Some Specific Optimization Problems	Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem, introduction to Assignment problems, variations in Assignment problems. Introduction to sequencing problems, processing N jobs through two machines, processing N jobs through three machines, processing N jobs through m machines. Introduction to inventory control, deterministic inventory model, EOQ model with quantity discount.	12
IV	Queuing Models And Simulation	Concepts relating to queuing systems, basic elements of queuing model, role of Poisson & exponential distributions, concepts of birth and death process. Introduction & steps of simulation method, distribution functions and random number generation.	12
Total			48

Text Book:

1. *Operations Research: Theory and Applications*, J.K. Sharma, 5th Edition, 2012, MacMillan India Ltd.
2. *Operations Research- An Introduction*, Hamdy A. Taha, 9th Edition, 2010, Prentice Hall.

Reference Books:

1. N. D. Vohra, *Quantitative Techniques in Management*, 3rd Edition, 2006, Tata McGraw Hill.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem. •Recall Formulae. •Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions. •Interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them. •Critically evaluate various real life situations by resorting to analysis of key issues and factors. 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

ELECTIVE-VI

Paper IV/Subject Name: Mobile Application development

Subject Code: INT054D404

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: TP

Objective:

The objectives of the course are:

- To teach the components and structure of mobile application development frameworks for Android and Windows OS based mobiles.
- To explain how to work with various mobile application development frameworks.
- To explain basic and important design concepts and issues of development of mobile applications.
- To make the students understand the capabilities and limitations of mobile devices.

Prerequisites: Fundamentals of Object Oriented Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction, Architecture and Android Software Development Platform	<p>What is Android, Android versions and its feature set, The various Android devices on the market, The Android Market application store ,Android Development Environment - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs)</p> <p>The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime – Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Creating a New Android Project ,Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application, Reviewing the Layout and Resource Files,</p> <p>Understanding Java SE and the Dalvik Virtual Machine , The Directory Structure of an Android Project , Common Default Resources Folders , The Values Folder , Leveraging Android XML, Screen Sizes , Launching Your Application: The AndroidManifest.xml File ,Creating Your First Android Application</p>	12
II	Android Framework, Views, Groups, Layouts and GUIs	<p>Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components Android Manifest XML: Declaring Your Components</p> <p>Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool</p> <p>Displaying Text with TextView, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users, Adjusting Progress with SeekBar, Working with Menus using views</p>	12
III	Android Pictures, Files, Content Providers, Databases, Intents and Filters	<p>Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation</p> <p>Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Provider</p> <p>Intent Overview, Implicit Intents, Creating the Implicit Intent Example Project, Explicit Intents, Creating the Explicit Intent Example Application, Intents with Activities, Intents with Broadcast Receivers</p>	12

IV	Android Threads and Handlers, Messaging and Location based Services and Multimedia	<p>An Overview of Threads, The Application Main Thread, Thread Handlers, A Basic Threading Example, Creating a New Thread, Implementing a Thread Handler, Passing a Message to the Handler</p> <p>Sending SMS Messages Programmatically, Getting Feedback after Sending the Message Sending SMS Messages Using Intent Receiving, sending email, Introduction to location-based service, configuring the Android Emulator for Location-Based Services, Geocoding and Map-Based Activities</p> <p>Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures</p>	12
Total			48

Text Book:

1. *Hello, Android: introducing Google's Mobile Development Platform*, Ed Burnette, 3rd Edition, 2010, Pragmatic Bookshelf

Reference Books:

1. Pradeep Kothari, *Android Application Development*, 2014, Wiley
2. Zigurd Mednieks, Laird Nornin, Mausumi Nakamura, *Programming Android: Java Programming for the New Generation of Mobile Devices*, 2nd Edition, 2012, O'Reily Media

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> •Design and implement various mobile applications using emulators. •Deploy applications to hand-held devices. 	<ol style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ol style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) <ol style="list-style-type: none"> (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper IV/Subject Name: Python Programming

Subject Code: INT054D405

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: TP

Objective:

The objectives of the course are:

- To provide an understanding of the role that computation can play in solving problems.
- To make the students feel confident of their ability to write small programs that allows them to accomplish useful goals.
- To explain the difference between expressions and statements
- To teach how to write and call a simple function and read from and write to a text file

Prerequisites: Fundamentals of Computer Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	History, Features, Setting up path, working with python, basic syntax, variable data types, operator, If, if-else, nested if, for, while, nested loops, break continue, pass.	12
II	String manipulation, lists, tuple	Accessing string, basic operation, string slices, accessing list, working with lists, accessing tuples, operations, functions, methods.	12
III	Functions and Modules	Defining and calling a function, types of functions, function arguments, anonymous functions, Global and local functions, importing module, math module, random module, packages, and composition.	12
IV	Exception handling and OOPS concept	Exception, except clause, Try? Finally clause, user defined exceptions, class, object, attributes, inheritance, and overloading, overriding, data hiding.	12
Total			48

Text Book:

1. *Think Python: How to Think Like a Computer Scientist*, Downey, Allen B., 2nd Edition, 2012, O'Reilly

Reference Books:

1. Charles Severance, *Python for Everybody: Exploring Data in Python 3*, 1st Edition, 2017, Shorff Publishers

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
i. Understand the modern version control tools with a Linux command line environment. ii. Understand the role of testing in scientific computing, and write unit tests in Python. iii. Use command line tools to write and edit code to perform mathematical calculations and scientific simulations. iv. Produce publication-ready graphics from a dataset.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b) Continuous Evaluation(30Marks) (i) 15 marks on <input checked="" type="checkbox"/> Assignments <input checked="" type="checkbox"/> Class tests. <input checked="" type="checkbox"/> viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper IV/Subject Name: Robotics

Subject Code: INT054D406

L-T-P-C - 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To teach about the basics of robot
- To explain about end effectors and robot controls and Robot Transformations and Sensors

Prerequisites: Fundamentals of Artificial Intelligence

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system	12
II	End Effectors and Robot Controls	Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design- Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.	12
III	Robot Transformation and Sensors	Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.	12
IV	Robot Cell Design and Applications	Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.	12
Total			48

Text Book:

1. *Robotics Technology and flexible automation*, Deb,S. R., 2009, Tata McGraw-Hill Education.
2. *Kinematic Analysis of Robot manipulators*, Crane, Carl D. Duffy, Joseph, 1st Edition, 2008, Cambridge University Press.

Reference Books:

1. Raman, P.A. Janaki, *Robotics and Image Processing an Introduction*, Tata McGraw Hill Publishing
2. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., *Robotics control, sensing, vision and intelligence*, McGraw Hill Book co.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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<ul style="list-style-type: none"> •Learn about Robot cell design and applications •Know about Micro/Nano robotic systems 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.
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Paper IV/Subject Name: Neural Networks and Fuzzy Logic

Subject Code: INT054D407

L-T-P-C – 4-0-0-4

Credit Units: 04

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To teach the concepts of artificial neural networks
- To explain the basic theory and algorithm formulation of Fuzzy logic.

- To describe real world problems

Prerequisites: Concepts of Artificial Intelligence and Mathematics

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Biological neurons and McCulloch and Pitts models of neuron, Types of activation functions, Neural networks architectures, Linearly separable and linearly non-separable systems and their examples, Features and advantages of neural networks over statistical techniques, Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning, Applications of Neural Networks	12
II	Supervised and Unsupervised Learning Neural Networks	Single layer perception and multilayer perceptron neural networks, their architecture, Error back propagation algorithm, generalized delta rule, learning factors, step learning, Momentum learning, Concept of training, testing and cross-validation data sets for design and validation of the networks. Competitive learning networks, kohonen self-organizing networks, K-means and LMS algorithms, RBF neural network, its structure and Hybrid training algorithm for RBF neural networks, Comparison of RBF and MLP networks Learning, Vector Quantization neural network architecture and its training algorithm, Hebbian learning, Hopfield networks.	12
III	Fuzzy Logic	Basic Fuzzy logic theory, sets and their properties, Operations on fuzzy sets, Fuzzy relation and operations on fuzzy relations and extension principle, Fuzzy membership functions and linguistic variables, Fuzzy rules and fuzzy reasoning, Fuzzification and defuzzification and their methods, Fuzzy inference systems, Mamdani Fuzzy models, and Fuzzy knowledge based controllers	12
IV	Applications of Fuzzy Logic and Fuzzy Systems	Fuzzy pattern recognition, Fuzzy image processing, Simple applications of Fuzzy knowledge based controllers like washing machines, traffic regulations, and lift control	12
Total			48

Text Books:

1. *Neural Networks, Fuzzy Logic, and Genetic Algorithms*, Rajsekaran and G. A. Vijaylakshmi Pai, 1st Edition, 2003, PHI
2. *Neural Network- A Comprehensive Foundation*, Simon Haykin, 2nd Edition, 9th Reprint, 2005, Pearson Education

Reference Books:

1. Timothy J. Ross, *Fuzzy Logic with Engineering Applications*, 3rd Edition, 2010, Wiley India Publications
2. Laurence Fausett, *Fundamentals of Neural Networks*, 1st Edition, 2004, Pearson Education
3. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, *Introduction to Neural Network Using MATLAB*, 1st Edition, 2012, Tata McGraw-Hill Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
<ul style="list-style-type: none"> • Know about different neural networks, their architecture and training algorithm. • Learn the concept of Fuzzy logic, Fuzzy Sets, fuzzy rules and fuzzy reasoning • Get exposed to the applicability of neural networks and fuzzy logic 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b) Continuous Evaluation(30Marks) (i) 15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

12. Detailed Syllabus of Ability Enhancement Elective Courses

Paper IX/Subject Name: General Aptitude and Quantitative Reasoning-I Subject Code: INT054S201

L-T-P-C – 2-0-0-2

Credit Units: 02

Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem.
- To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- To interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Quantitative Aptitude-I	Profit loss, ratio, proportion, Sequence and series, permutation, Probability	6
II	Quantitative Aptitude-II	Simple interest, Combination, Number system, Compound Interest, Surds, Logarithm.	6
III	Reasoning-I	Logical Reasoning basics, Coded Inequalities, Alphanumeric series	6
IV	Reasoning-II	Syllogism, Input and Output, Coding and Decoding.	6
Total			24

Text Books:

1. *Quantitative Aptitude*, Dr. R.S. Aggarwal, Old Edition, 2008, S.Chand Publication, New Delhi.
2. *A Modern Approach to Verbal & Non- Verbal Reasoning*, Dr. R.S. Aggarwal, 2016 Edition, S.Chand Publication, New Delhi.

Reference Books:

1. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, 4th Edition, 2014, McGraw Hill Education
2. Arun Sharma, *How to Prepare for Logical Reasoning for the CAT*, 2015, McGraw Hill Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
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- Formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem.
- Recall Formulae.
- Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- Interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them.

Critically evaluate various real life situations by resorting to analysis of key issues and factors

i) Each topic to be expounded with adequate examples.
 ii) Class discussions and question-answer rounds are encouraged
 iii) theoretical problems solving is part of the class to grasp the underlying concepts
 iv) Students have to go through case studies for real time experience
 v) Students to be encouraged to give short presentations.

(a) Participation in class discussions
 (b)Continuous Evaluation(30Marks)
 (i)15 marks on
 Assignments
 Class tests.
 viva-voce or presentation
 (ii) Mid-term examinations :10 marks
 (iii) Class attendance -5 marks
 (c) End-term examinations: 70 marks.

Objective:

The objectives of the course are:

- To formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem.
- To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- To interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them.

Prerequisites: General Aptitude and Quantitative Reasoning-I

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Reasoning Aptitude-I	Logical Reasoning ,Ranking/Direction/Alphabet Test, Data Sufficiency	6
II	Reasoning Aptitude-I	Puzzle, Tabulation, Blood Relations, Seating Arrangement	6
III	Quantitative Aptitude-I	Simplification, Mixtures & Allegations, Work & Time, Time & Distance	6
IV	Quantitative Aptitude-II	Menstruation – Cylinder, Cone, Sphere, Data Interpretation, Ratio & Proportion, Percentage, Number Systems	6
Total			24

Text Books:

1. *Quantitative Aptitude*, Dr. R.S. Aggarwal, Old Edition, 2008, S.Chand Publication, New Delhi.
2. *A Modern Approach to Verbal & Non- Verbal Reasoning* , Dr. R.S Agarwal , 2016 Edition, S.Chand Publication, New Delhi.

Reference Books:

1. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, 4th Edition, 2014, McGraw Hill Education
2. Arun Sharma, *How to Prepare for Logical Reasoning for the CAT*, 2015, McGraw Hill Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning	Assessment Tasks
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	Activity	
<ul style="list-style-type: none"> •Formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem. •Recall Formulae. •Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions. •Interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them. •Critically evaluate various real life situations by resorting to analysis of key issues and factor 	<ul style="list-style-type: none"> i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations. 	<ul style="list-style-type: none"> (a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on <ul style="list-style-type: none"> ☑ Assignments ☑ Class tests. ☑ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.