



**K.R. MANGALAM UNIVERSITY**  
THE COMPLETE WORLD OF EDUCATION

**SCHOOL OF ENGINEERING & TECHNOLOGY**  
**Bachelor of Science (Honours) Data Science**  
**B.Sc. (H) Data Science**

**Program Code: 84**

**2019-22**

**Approved in the 20th Meeting of**

**Academic Council Held on 16 July**

**2019**



**Registrar**  
K.R. Mangalam University  
Sohna Road, Gurugram, (Haryana)



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## **About K.R Mangalam University**

The K.R. Mangalam Group has made a name for itself in the field of education. The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education.

K.R. Mangalam University is the fastest-growing higher education institute in Gurugram, India. K. R. Mangalam University was established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

Since its inception in 2013, the University has been striving to fulfil its prime objective of transforming young lives through ground-breaking pedagogy, global collaborations, and world-class infrastructure. Resources at K.R Mangalam University have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly interdisciplinary environment where they grow up with integrative skills through interaction with students from engineering, social sciences, management and other study streams.

### **K.R Mangalam University is unique because of its:**

1. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
2. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

### **Objectives**

- i. To impart undergraduate, post graduate and doctoral education in identified areas of higher education.
- ii. To undertake research programmes with industrial interface.
- iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.
- iv. To act as a nodal center for transfer of technology to the industry.
- v. To provide job oriented professional education to the Indian student community with particular focus on Haryana.

## **About School of Engineering & Technology (SOET)**

School of Engineering and Technology (SOET), K.R. Mangalam University is dedicated to fostering innovation, excellence, and advancement in engineering and technology. Empowering the new generation of change-makers by imparting exceptional understanding and intellect to facilitate the creation of highly sophisticated futuristic solutions. Our well-qualified academicians, accomplished researchers and industry insiders are focused on imparting their extensive knowledge and expertise to students through various lectures, workshops, industrial visits, projects, and competitions throughout the year ensuring that students receive a comprehensive education that blends theory with practical application.

These programs offered at SOET have the distinct objective of equipping the students with knowledge, skills and attitudes in engineering and technology, to make them capable of successfully meeting the present requirements and future challenges in the engineering profession. SOET brings together outstanding academics, industry professionals, and experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

The curriculum of programs has been designed to cater to the ever changing needs and demands of the industry. The curriculum is regularly updated. The school has best infrastructure including domain-specific labs. SOET aims to provide exposure to the principles and practices of Design / Developments and Projects in the area of engineering. SOET is offering Ph.D. programs also.

### **School Vision**

To create, disseminate, and apply knowledge in science and technology to meet the higher education needs of India and the global society, To serve as an institutional model of excellence in scientific and technical education characterized by integration of teaching, research and innovation.

### **School Mission**

M1: To create an environment where teaching and learning are prioritized, with all support activities being held accountable for their success.

M2: To strengthen the institution's position as the school of choice for students across the State & Nation.

M3: To promote creative, immersive, and lifelong learning skills while addressing societal concerns.

M4: To promote co- and extra-curricular activities for overall personality development of the students.

M5: To promote and undertake all-inclusive research and development activities.

M6: To instill in learners an entrepreneurial mindset and principles.

M7: Enhance industrial, institutional, national, and international partnerships for symbiotic relationships.

M8: To help students acquire and develop knowledge, skills and leadership qualities of the 21st Century and beyond.

## Programs Offered by the School

School offers undergraduate B. Tech Program, B.Sc. (Hons) Program, postgraduate M. Tech Program, and Doctoral Program. All these programs are designed to impart scientific knowledge to the students and provide theoretical and practical training in their respective fields.

### B.Sc. (H) (Data Science)

This programme is focuses on three main components: Big Data, Machine Learning, and Modelling in Data Science. It is an interdisciplinary programme which uses scientific processes, approaches, methods, systems and algorithms to extract requisite insights and information from structured and unstructured data. The curriculum is designed in a way to help student apply the tools and statistics to meet organizational challenges. An initiative to make the teaching-learning framework better and enhance the student learning outcomes, Department of Computer Science & engineering (B. Sc.-Data Science) has taken a thoughtful step by introducing the concept of Choice Based Credits System (CBCS) system.

### Program Duration: 3 Years (6 Semesters)

**Eligibility Criteria:** - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board with mathematics as one of the subjects and with an overall aggregate of 50% or more.

**Course Outline:** Python Programming / Data Modelling/ Probability and Statistics / Artificial Intelligence / Databases / Predictive Modelling / Statistical Data Analysis/ Neural Networks.

**Career Options:** Opportunities exist in IT industry, freelancers, education and forensics.

### Class Timings

The classes will be held from Monday to Friday from 9.10 am to 4.10 pm.

### Three Years B. Sc. (H) Data Science Programme at a Glance

	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
Course	9	9	9	8	10	8	53
Credit	24	25	26	22	23	21	141

## Scheme of Studies and Syllabi

For B.Sc.(H) Data Science program scheme attached in Annexure A1.

The scheme of studies and syllabi for the program is given in the following pages. These are arranged as: (a) common course (b) degree specific course, in numeric order of the last three digits of the course code.

For each course, the first line contains; Course Code, Title and Credits (C) of the course. This is followed by the course objectives, syllabus (Unit I to IV), Textbook and Reference books.

### Annexure A1: Scheme of Studies as per Choice based credits System (CBCS)

SO ET		B.SC.(H) DATA SCIENCE : 2019-22 (SCHEME OF STUDIES)															
YE AR	ODD SEMESTER								EVEN SEMESTER								
	SN O	Categ ory	COURSE CODE	COURSE TITLE	L	T	P	C	SN O	Categ ory	COURSE CODE	COURSE TITLE	L	T	P	C	
FIR ST	1	SE	ETME101A	BASICS OF MECHANICAL ENGINEERING	3	1	-	4	1	SE	ETCS501A	LANGUAGES OF DATA MODELING	3	1	-	4	
	2	PEC		OPEN ELECTIVE-I	4	-	-	4	2	PEC		OPEN ELECTIVE-II	4			4	
	3	SE	ETEL 101A	COMMUNICATION SKILLS	4	-	-	4	3	SE	ETEL 402A	SOFT SKILLS AND PERSONALITY DEVELOPMENT	3	0	-	3	
	4	EMP	ETCS103A	PROGRAMMING FOR PROBLEM SOLVING	3	1	-	4	4	SE	ETCH 125A	ENVIRONMENTAL STUDIES	3	-	-	3	
	5	EMP		COMPUTER CENTRE PLANNING & ESTABLISHMENT	3	1	-	4	5	EMP	ETCS316A	WEB TECHNOLOGIES	3	1	-	4	
	6	SE	ETME151A	BASICS OF MECHANICAL ENGINEERING LAB	-	-		2	1	6	EMP	ETCS112A	OBJECT ORIENTED PROGRAMMING	3	1	-	4
	7	SE		COMMUNICATION SKILLS LAB	-	-	2	1	7	SE	ETCS551A	LANGUAGES OF DATA MODELING LAB	-	-	2	1	
	8	EMP	ETCS153A	PROGRAMMING FOR PROBLEM SOLVING LAB	-	-	2		1	8	EMP	ETCS166A	OBJECT ORIENTED PROGRAMMING LAB	-	-	2	1
	9	EMP		COMPUTER CENTRE PLANNING & ESTABLISHMENT LAB	-	-	2	1	9	EMP	ETCA164A	WEB TECHNOLOGIES LAB	0	0	2	1	
				TOTAL	17	2	8	24				TOTAL	19	3	6	25	

SE CO ND	1	EMP	ETCS502A	STATISTICAL DATA ANALYSIS	3	1	-	4
	2	EMP	ETCS217A	DATA STRUCTURES	3	1	-	4
	3	SE	ETMA208A	NUMERICAL ANALYSIS	4	-	-	4
	4	SE	BSMA217A	REAL ANALYSIS	4	-	-	4
	5	EMP	ETCS219A	FOUNDATION OF COMPUTER SYSTEMS	3	1	-	4
	6	EMP	ETCS552A	STATISTICAL DATA ANALYSIS LAB	-	-	2	1
	7	SE	BSMA351A	NUMERICAL ANALYSIS LAB	-	-	2	1
	8	EMP	ETCS 257A	DATA STRUCTURES LAB	-	-	2	1
	9	SE	ETDM301A	Disaster Management	3	-	-	3
				TOTAL	20	3	6	26

1	EMP	ETCS503A	DATA MINING AND PREDICTIVE MODELING	3	1	-	4
2	SE	BSMA137A	ALGEBRA	4	-	-	4
3	EMP	ETCS307A	DATABASE MANAGEMENT SYSTEMS	3	1	-	4
4	SE	ETMC 226A	FUNDAMENTALS OF MANAGEMENT	3	-	-	3
5	SE	BSMA326A	OPERATIONAL RESEARCH	4	-	-	4
6	EMP	ETCS553A	DATA MINING AND PREDICTIVE MODELING LAB	-	-	2	1
7	EMP	ETCA365A	LINUX ENVIRONMENT LAB	-	-	2	1
8	EMP	ETCS 355A	DATABASE MANAGEMENT SYSTEMS LAB	-	-	2	1
TOTAL				17	2	6	22

THI RD	1	EMP	ETCS504A	BIG DATA ANALYTICS	3	1	-	4
	2	EMP	ETCS211A	OPERATING SYSTEMS	3	1	-	4
	3	SE	ETEL401A	PERSONALITY DEVELOPMENT AND COMMUNICATION SKILLS	3	-	-	3
	4	EMP	ETCS304A	COMPUTER NETWORKS	3	1	-	4
	5	SE	ETEC210A	DIGITAL ELECTRONICS	3	1	-	4
	6	EMP	ETCS554A	BIG DATA ANALYTICS LAB	-	-	2	1
	7	EMP	ETCS255A	OPERATING SYSTEMS LAB	-	-	2	1
	8	EMP	ETCS365A	COMPUTER NETWORKS LAB	-	-	2	1
	9	SE	ETCS507A	SEMINAR	-	-	2	1
	TOTAL				17	4	8	23

1	EMP	ETCS401A	ARTIFICAL INTELLIGENCE	3	1		4
2	EMP	ETCS202A	SOFTWARE ENGINEERING	3	1	-	4
3	SE	ETCS505A	TECHNICAL WRITING	3	-	-	3
4	EMP	ETCS506A	PYTHON PROGRAMMING	3	1	-	4
5	EMP	ETCS555A	PYTHON PROGRAMMING LAB	-	-	2	1
6	EMP	ETCS451A	ARTIFICAL INTELLIGENCE LAB	-	-	2	1
7	EMP	ETCS252A	SOFTWARE ENGINEERING LAB	-	-	2	1
8	SE	ETCA368A	MAJOR PROJECT	-	-	6	3
TOTAL				12	3	12	21
TOTAL CREDITS				141			



**Abbreviations:****CC: Core Course****SE: Skill Enhancement****OE: Open Elective****EMP: Employability****SEMESTER I**

<b>ETME 101A</b>	<b>BASICS OF MECHANICAL ENGINEERING</b>	<b>C</b>
		<b>4</b>

**Course Overview:**

This is one of the core subjects that introduces the student to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc.

**Objectives and Expected Outcomes**

The subject expects students to achieve the following objectives.

- To analyze, design and improve practical thermal and/or mechanical systems.
- To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of mechanical engineering.
- To enhance students' ability to design by requiring the solution of open ended problems.
- To prepare the students for higher level courses such as courses in Mechanics of Solids, Thermodynamics, Manufacturing, etc.

Upon the completion of this course the students will be able to:

- Know the basics of machine tool and their material properties.
- Understand the basic concepts of thermodynamics and Refrigeration.
- Get the knowledge of application of hydraulic turbines and pumps in various fields.
- Know various Power Transmission Methods and Devices.
- Understand the concept of Stress & Strain which is useful in various streams of engineering.

**Unit I**

**Introduction to Machine Tools and Commonly used Machine Tools in a Workshop:** Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

**Basic concept of thermodynamics:** Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2<sup>nd</sup> and 3<sup>rd</sup> law of thermodynamics, Concept of internal energy, enthalpy and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, Use of steam tables, Measurement of dryness fraction by throttling calorimeter.

## Unit II

**Refrigeration & Air-conditioning:** Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychrometric charts and its use, Human comforts.

**Hydraulic Turbines & Pumps:** Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

## Unit III

**Power Transmission Methods and Devices:** Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches

**Stresses and Strains:** Introduction, Concept & types of Stresses and strains, Poisson's ratio, stresses and strains in simple and compound bars under axial, flexure & torsional loading, Stress- strain diagrams, Hooks law, Elastic constants & their relationships.

## Unit IV

**Introduction to Manufacturing Systems:** Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

### Text Books:

1. Elements of Mechanical Engineering – R.K.Rajput Lakmi Pub., Delhi
2. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
4. Refrigeration & Air-conditioning – Arora & Domkundwar, Dhanpat rai & co.pvt ltd
5. Workshop Technology Vol.I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

### Reference Books:

1. Strength of Materials – Popov, Pub. PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials - G.H. Ryder, Pub. ELBS.

<b>OPEN ELECTIVE - I</b>	<b>C</b>
	<b>6</b>

There are three open electives offered by other departments / schools in first semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

<b>S. No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	IIT101	Harnessing the Power of the Web as a Knowledge Device
2	IIT107	Art of Logic & Programming
3	ETCE101	Fundamentals of Civil Engineering

<b>ETEL 101A</b>	<b>COMMUNICATION SKILLS</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

The world is shrinking into a global village and therefore, communication skills in English have emerged as a major means of empowerment and human resource development. Many professionals fail to make an impact on the global market as they lack the required communicative competence. The course will augment comprehension skills, enhance vocabulary, and enable to acquire impressive writing skills, assist correspondence with others effectively, aid in understanding the non-verbal cues and enrich skills in spoken English through a variety of teaching techniques. The course will be instrumental in acquiring proficiency both in spoken and oral language.

### **Objectives and Expected Outcomes**

The course will help the learners to focus on communication activities in functional and situational contexts as well as enhance the four language skills of reading, writing, listening and speaking through real-life and professional situations. It will build confidence among the students and encourage them to speak fluently. Through practical learning and delivery, the learners will be able to identify their areas of strengths and weaknesses and improvise their personality and soft skills. The learners will be able to strengthen and broaden their communication skills through various insightful ways.

This learning program with its practice-based learning tasks will facilitate the learners to enhance their communication skills in a modern and globalized context, enhance their linguistic and communicative competence and hone their interpersonal skills.

### **UNIT I**

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication; Literature: A Bird Came Down the Walk by Emily Dickinson

### **UNIT II**

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Types of sentences; Reported Speech; Punctuation; Literature: Stopping by Woods on A Snowy Evening by Robert Frost

### **UNIT III**

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms & Synonyms, Phrasal Verbs, Idioms & Proverbs ( 25 each); Commonly used foreign words(15 in number); Literature: The Gift of Magi by O'Henry

### **UNIT IV**

Personality Development: Etiquette & Manners; Leadership; Inter & intra personal skills; Attitude, Self-esteem & Self-reliance; Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques; Literature: My Prayer to Thee by Rabindranath Tagore;

**TEXT BOOK:**

Kumar, Sanjay and Pushplata. Communication Skills. Oxford University Press.

**REFERENCE BOOKS / SITES:**

1. Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. Intermediate Grammar, Usage and Composition. Orient Blackswan.
2. Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.
3. “Best Poems”, <http://100.best-poems.net/>. 20 July 2016.
4. “Classic English Short Stories”, <http://www.eastoftheweb.com/short-stories/Collections/ClasEngl.shtml>, 20 July 2016.

<b>ETCS103A</b>	<b>PROGRAMMING FOR PROBLEM SOLVING</b>	<b>C</b>
		<b>4</b>

### Course Overview:

Computer software plays an important role in our daily lives: Our mobile phones, laptop computers, online banking, Internet applications such as YouTube, video games and movies, cars, and almost all aspects of daily life are touched by software. In your personal and professional life you will utilize computer software. It is also likely that you will select, or even influence the design of, software that is used in your professional or personal life. This thematic sequence will give you a deep understanding of how software works and is created, its limitations, and its potential. You will be able to read software and therefore be able to make informed decisions when selecting or participating in the design of business, scientific, or information systems that utilize computer software. This is a course in which you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

### Objectives and Expected Outcomes:

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

## UNIT I

**Introduction to Programming:** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- Arithmetic expressions and precedence

## UNIT II

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Arrays: Arrays (1-D, 2-D), Character arrays and Strings

### **UNIT III**

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function, Quick sort or Merge sort.

### **UNIT IV**

Structure: Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

### **Suggested Text Books**

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

<b>ETCS521A</b>	<b>COMPUTER CENTRE PLANNING &amp; ESTABLISHMENT</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Computing and programming is essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. The course of Information Technology Fundamentals has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives.

### **Objectives and Expected Outcomes:**

The main objective is to introduce IT in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive media, Internet basics, etc. At the end of this course, students should be able to

- Understand basic concepts and terminology of information technology.
- Have a basic understanding of personal computers and their operations.
- Understand the process of algorithm development and documentation

## **UNIT – I**

### **Introduction to Computers:**

The evolution of computers: Computer Generation from First Generation to Fifth Generation. Classifications of Computers: Micro, Mini, Mainframe and super computers, Distributed Computer System, Parallel Computers. Computer Hardware: Major Components of a digital computer, Block Diagram of a computer Input devices, Output Device. Computer Memory: Memory Cell, Overview of Memory Organization, Primary Memory: RAM & ROM, Secondary memory: Magnetic tapes, Magnetic disk, CD-ROM, DVD.

## **UNIT – II**

### **Introduction to System Software and Operating System:**

Computer Software: Machine language, assembly language, high-level languages, fourth generation language, assemblers, compilers, interpreters, linkers, loaders.

Operating System concepts: different types of operating systems, functions of operating system, concept of multiprogramming, multitasking, multithreading, multiprocessing, time-sharing, real time, single-user & multi-user operating system.

## **UNIT – III**

### **Programming Concepts & Techniques:**

Algorithms, flow chart, decision tables, pseudo code, characteristics of a good programming language, Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming, Advantages and disadvantages of Structured programming.



## **UNIT – IV**

### **Computer Networks & The Internet:**

Basic elements of a communication system, Data transmission modes, Data transmission media, Network topologies, Network Types (LAN, WAN and MAN), Client and Servers, Intranet, Extranet.

**Internet:** Terminology related to Internet: Protocols, TCP/IP, HTTP, Internet addressing, Domain Names, DNS, URL, World Wide Web. Overview of various services on Internet: Webservers, E-mail, FTP, Telnet.

### **TEXT BOOKS**

1. P. K. Sinha & Priti Sinha , “Computer Fundamentals”, BPB Publications.
2. Anita Goel “Computer Fundamentals”, Pearson.

### **REFERENCE BOOKS**

1. B.Ram Computer fundamentals Architecture and Organization, New Age Intl.
2. Alex Leon & Mathews Leon, “Introduction to Computers”, Vikas Publishing .
3. Norton Peter, “Introduction to computers”, TMH.
4. Vikas Gupta, “Comdex Computer Kit”, Wiley Dreamtech, Delhi.

<b>ETME 151A</b>	<b>BASICS OF MECHANICAL ENGINEERING LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

This is one of the core lab subjects that introduces the student to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

### **Objectives and Expected Outcomes:**

- To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
- To study simple screw jack and compound screw jack and determine their efficiency.
- To verify the law of Moments using Parallel Force apparatus. (simply supported type)
- To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
- To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
- To Study the vapor compression Refrigeration System and Window Room Air Conditioner.
- To study the constructional features and working of Pelton wheel Turbine, Francis Turbine and Kaplan Turbine, etc.

Upon the completion of this course the students will be able to:

- Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.
- Understand concepts of screw jack, friction, law of moments.
- Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
- Get the knowledge of various Refrigeration and Air- Conditioning Systems.
- Know about the working of various turbines and pumps.

### **List of Experiments**

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To verify the law of moments using Bell crank lever.
8. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.
9. To Study Two-Stroke & Four-Stroke Diesel Engines.
10. To Study Two-Stroke & Four-Stroke Petrol Engines.
11. To Study the vapor compression Refrigeration System.

ETEL 171A	COMMUNICATION SKILLS LAB	C 1
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### Communication Skills Lab Activity

**Activity 1: Self- introduction:** Informal introduction & formal introduction; A detailed write up on formal ‘Self Introduction’; Formal Introduction of oneself in front of the group.

**Activity 2: News Reading:** Introduction to ‘online News papers’; Browsing and selecting the preferred Newspaper; Browsing through the News Headlines; Selecting interested News items; Comprehending the content, writing down the essence and reading the News in front of the Group. Discuss 5 to 8 new words or terms, 4 to 5 important personalities of that day’s news etc.

**Activity 3: JAM:** Introduction to ‘Just A Minute speech’ and the ‘Extempore speech’; Preparation of speech on given topic(different topic for each student); delivery of the speech; Feedback(on content, time management, body language etc. highlighting the positive aspects first.)

**Activity 4: News Discussions:** Selecting News of the day, Discussing among the group, prepare the news content and prepare the group opinion about the issue and present it in front of the class by the group involving each member; select 5 new words & new usages from the selected news item

**Activity 5: Conversation ability:** Characteristics of effective conversation; Listening to a few sample conversations; preparing conversation based on the given situation; enacting the situation through effective delivery of the script; feedback & suggestions for improvement.

**Activity 6: Role Play:** Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement.

**Activity 7: Public Speaking:** Characteristics of effective Public speaking; possible barriers; watching demo online; topic assignment, information gathering & recording; delivery in front of the class; feedback & suggestions for improvement. . (Different topic for each student)

**Activity 8: Group Discussion:** Importance and characteristics; Dos & Don’ts in GD; Demo display; assign topic for the group, Preparation & performance; feedback & suggestions for improvement.

**Activity 9: Debate:** Difference between Group Discussion & Debating; Watching demo of Debating; Topic for the group of 2 or 4; preparation and performance; feedback & suggestions for improvement.

**Activity 10: Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.

<b>ETCS 153A</b>	<b>PROGRAMMING FOR PROBLEM SOLVING LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

This course emphasizes solving problems using the language, and introduces standard programming techniques like alternation, iteration and recursion. It will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams. This course is enabled the students to formulate algorithms for arithmetic and logical problems, convert these algorithms to C language programs. It also aims on using arrays, pointers and structures to formulate algorithms and programs. In addition to that, apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

### **Objectives and Expected Outcomes:**

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

1. To understand the various steps in program development
2. To learn the syntax and semantics of C programming language
3. To use the structural programming approach in solving the problem.

## **LIST OF EXPERIMENTS**

**Lab1:** Familiarization with programming environment

**Lab 2:** Simple computational problems using arithmetic expressions

**Lab 3:** Problems involving if-then-else structures

**Lab 4:** Iterative problems e.g., sum of series

**Lab 5:** 1D Array manipulation

**Lab 6:** Matrix problems, String operations

**Lab 7:** Simple functions

**Lab 8 and 9:** Programming for solving Numerical methods problems

**Lab 10:** Recursive functions

**Lab 11:** Pointers and structures

**Lab 12:** File operations

<b>ETCS565A</b>	<b>COMPUTER CENTRE PLANNING &amp; ESTABLISHMENT LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

Computing and programming is essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. The course of Information Technology Fundamentals has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives.

### **Objectives and Expected Outcomes:**

The main objective is to introduce IT in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive media, Internet basics, etc. At the end of this course, students should be able to

- Understand basic concepts and terminology of information technology.
- Have a basic understanding of personal computers and their operations.

### **LIST OF EXPERIMENTS**

**1. MS-Windows:** Operating system-Definition & functions, basics of Windows. Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance. Using windows accessories.

**2. Documentation Using MS-Word** - Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advance Features of MS-Word-Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

**3. Electronic Spread Sheet using MS-Excel** - Introduction to MS-Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation, Database Management using Excel-Sorting, Filtering, Table, Validation, Goal Seek, Scenario.

**4. Presentation using MS-PowerPoint:** Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

## SEMESTER II

ETCS501A	LANGUAGES OF DATA MODELING	C
		4

### Course Overview:

Data modeling is the analysis of data objects and their relationships to other data objects. Data modeling is often the first step in database design and object-oriented programming as the designers first create a conceptual model of how data items relate to each other. Data modeling involves a progression from conceptual model to logical model to physical schema. It helps in the visual representation of data and enforces business rules, regulatory compliances, and government policies on the data. Data Models ensure consistency in naming conventions, default values, semantics, security while ensuring quality of the data.

### Course Objectives and Expected Outcomes:

The purpose of this course is to provide a comprehensive introduction to database modeling and design implementing the Database Systems Development Life Cycle. The course will define and use essential database terms and concepts. The emphasis of the course is on the design and use of a relational database. The student will analyze complex business scenarios, and design and create models to support said scenario. After the successful completion of the course the student is able to

1. Data modeling with an emphasis on entity-relationship models.
2. Relational database model for database systems, database schema and data integrity.
3. Design theory for relational databases.
4. System Design and programming using database systems.
5. Data storage, file organization and index structures.
6. Transactions, concurrency, and robustness against errors.

### UNIT 1:

**Introducing Data Modeling:** Introduction to data modeling, data modeling taxonomy: Entity expansion, Input Data Analysis-structuring, Output Data Analysis – structuring, Normalization, overview of model-driven database design, domain models and design patterns, benefits and pitfalls of model-driven design.

### UNIT 2:

**Designing Logical Data Models:** Entity-Relationship Model – Entity Types, Entity Sets, Attributes Relationship Types, Relationship Instances and ER Diagrams. Extended E-R features: Generalization, Specialization and Aggregations. Concepts of hierarchical, network and relational data models.

### UNIT 3:

**Designing Physical Data Models:** Concepts of hierarchical, network and relational data models. Function dependency, Dependency preservation, Lossless and lossy decomposition, Multivalued dependency, Normalization 1NF, 2NF, 3NF, BCNF, 4NF, 5NF

### UNIT 4:

**Unified Modeling Language:** Overview, Building Blocks, Architecture, Modeling Types, Basic Notations, Standard Diagrams, Class Diagram, Object Diagram, and Component Diagram.

<b>OPEN ELECTIVE - II</b>	<b>C</b>
	<b>6</b>

There are three open electives offered by other departments / schools in second semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

<b>S.No.</b>	<b>Course Code</b>	<b>Course Title</b>
1	IIT104	Understanding The Power of Data
2	IIT102	Fundamentals of Innovation and Entrepreneurship
3	ETCE12	URBAN Engineering

<b>ETEL236A</b>	<b>SOFT SKILLS AND PERSONALITY DEVELOPMENT</b>	<b>C</b>
		<b>3</b>

### **Course Overview:**

In the contemporary world, employability and worth of a person depends largely on the ability of a person to exhibit different skills. Despite having sound knowledge of one's specialized subject, one cannot compete with his peer groups unless one has the potential of performance. It contains four modules which aim at improvising the soft skill, career management, language competence and behavioral skills of the students. The students will be trained in employment related written correspondence which would improve their potential in the corporate and academic world.

### **Objectives and Expected Outcomes**

The course aims to spread basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. The objective is to make students learn the effective business, social and professional communication strategies. Students will be benefitted with pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

This course is designed to help the learners build their communication and personality skills in fostering skills are crucial to increase employment opportunities and to compete successfully in the business environment.

### **UNIT I**

Soft Skills: Inter & intra personal qualities; Leadership; Team spirit; Decision Making; Effective listening for effective communication; Speeches by Martin Luther King & Charlie Chaplin (Listen to the speech and its pronunciation, tone and intonation; content analysis to know the message and also discuss the personality of the speaker).

### **UNIT II**

Career Management: Resume and C V writing, Job applications, Interviews, Group Discussion Techniques, Negotiation and Meeting Skills, Presentation skills, Speeches by John F. Kennedy & G. Vivekananda (Listen to the speech and its pronunciation, tone and intonation; content analysis to know the message and also discuss the personality of the speaker).

### **UNIT III**

Written Communication: Employment related correspondence, Report Writing, Editing the given document; Phonetics: Importance, Speech articulation, Transcription, Speeches by APJ Abdul Kalam & Shashi Tharoor (Listen to the speech and its pronunciation, tone and intonation; content analysis to know the message and also discuss the personality of the speaker).

### **UNIT IV**

Etiquettes & Manners: Effective non-verbal communication; Hospitality Tips; Corporate behaviour; Etiquettes at Business Meetings; Transcultural Etiquettes; Speeches by Barack Obama & Narendra Modi (Listen to the speech and its pronunciation, tone and intonation; content analysis to know the message and also discuss the personality of the speaker).



**TEXT BOOK:**

Prasad, P. Functional Aspects of .Communication Skills.4th Ed. S.K. Kataria & Sons, New Delhi.2008

**REFERENCE BOOKS:**

1. Sinha, K.K. Business Communication. Galgotia Publishers.
2. Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.
3. Bansal, R.K. and Harrison J.B. Spoken English for India: A Manual of Speech and Phonetics, Hyderabad: Orient Longman.
4. “Best Poems”, <http://100.best-poems.net/>. 20 July 2016.
- 5.“Classic English Short Stories”, <http://www.eastoftheweb.com/short-stories/Collections/ClasEngl.shtml>, 20 July 2016

<b>ETCH 125A</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>C</b>
		<b>3</b>

### **Course Overview:**

Everything that surrounds and affects living organisms is environment. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living or biotic components like animals, plants or non-living or abiotic components like soil, air and water etc. It belongs to all, influences all and is important to all.

Environmental Protection Act (1986) defined “Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living organisms and materials.” Environmental studies are important since it deals with the most mundane problems of life like hygienic living conditions, safe and clean drinking water, fresh air, healthy food and sustainable development.

The syllabus for Environmental Studies includes conventional classroom teaching as well as field work. In this course the teacher simply acts as a catalyst to infer what the student observes or discovers in his/her own environment. Involvement of students in project work is one of the most effective learning tools for environmental issues. This syllabus is beyond the scope of textbook teaching and also the realm of real learning by observing the surroundings. The content of this course provides an overview of introduction to environment, concept of an ecosystem, various renewable and non-renewable resources, how various biodiversity occur and different means to conserve these. This course also includes various types of pollution and environmental policies & practices related with environs. Finally, it also highlights the relationship of human population with environment. The course further integrates to project work such as visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds, and study of simple ecosystems. These studies are as imperative as it forms a unique synergistic tool for comprehensive learning process. This will help students to recognize and appreciate how the technological advancement at global level, exponential growth of human population and their unlimited demands has put the environment at stake and has contaminated the environment worldwide.

### **Objective and Expected Outcome:**

The main objective of the course is to create consciousness among the students with the idea about healthy and safe environment. This course is aimed to explain students that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels. These changes need the discussion, concern and recognition at national and international level with respect to formulate protection acts and sustainable developments policies. It can be possible only if every citizen of the nation is environmentally educated and gets involved into this matter at the grass root level to mitigate pollution.

After studying the course, the learners will be able to comprehend and become responsive regarding environmental issues. They will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain. This is the only inheritance which every genera of specie passes to their future generation.

## UNIT I

**Introduction of Environmental Studies:** Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

**Natural Resources: Renewable and Non-renewable Resources**

**Land resources:** land use change; Land degradation, soil erosion and desertification.

**Deforestation:** Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

**Water:** Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

**Energy resources:** Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

## UNIT II

**Ecosystems:** Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

- a) Forest ecosystem
- b) Grassland ecosystem
- c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biological Diversity:** Levels of biological diversity; genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

## UNIT III

**Environmental Pollution:** Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

**Environmental Policies and practices:** Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. International agreements: Montreal & Kyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wild life conflicts in Indian context.

## UNIT IV

**Human Communities and the Environment:** Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

### Field work:

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

Study of common plants, insects, birds and basic principles of identification.

Study of simple ecosystems-pond, river, Delhi Ridge, etc.

### TEXT BOOKS:

1. Erach Bharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India.
2. Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

### REFERENCE BOOKS:

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.

ETCS 316A	WEB TECHNOLOGIES	C
		4

### Course Overview:

This course is an introduction to Web site development and the technologies behind it. Students will learn how to design and develop Web pages using current technologies and tools. Topics covered will include the World Wide Web, HTML, Cascading Style Sheets (CSS) and XML.

Once the student has gained a basic knowledge of HTML coding and CSS, the goal of this course is to create large-scale, interactive, professional Web sites that are in accordance with current standards. The focus of this course is on dynamic HTML, a collection of web technologies such as HTML and scripting languages used together to create interactive and animated Web pages. Students will learn to program client-side scripts using JavaScript and the Document Object Model to transform static Web pages created with HTML and CSS into dynamic Web pages. Other Web design topics include information architecture, scalability, multimedia integration, browser compatibility, standardization, and maintenance.

### Objectives and Expected Outcomes:

Upon completion of the course the participant will be able to:

1. Create a well-designed and well-formed, professional Web site utilizing the most current standards and practices
2. Demonstrate knowledge in web technologies including HTML, XHTML, CSS, image-editing software, web authoring software, and client-side scripting
3. Create client-side scripts to add interactivity to Web pages
4. Select appropriate Web tools for a Web development project
5. Identify Web authoring obstacles created by the availability of various web browsers and markup language versions

### UNIT I

Overview of the Internet and World Wide Web and Search Engines, Common terminology: IP Addressing, URLs, Domain names. Website Creation and maintenance, Web Hosting and Publishing Concepts.

**Static Webpages:** HTML - Introduction to HTML, HTML Document structure tags, HTML comments, Text formatting, inserting special characters, anchor tag, adding images and sound, lists: types of lists, tables, frames and floating frames, Developing Forms, Image maps.

### UNIT II

**Client-side scripting:** JavaScript - Data Types, Control Statements, operators, Built in and User Defined Functions, Objects in JavaScript, Handling Events. HTML Document Object Model.

**Page Styling:** Separation of content and presentation in HTML, Cascading Style Sheets - Types of Style Sheets – Internal, inline and External style sheets, customizing common HTML elements, types of CSS selectors.

### UNIT III

XML: Introduction to XML-Mark up languages, Features of Markup languages, XML Naming rules, Building block of XML, Document, Difference between HTML & XML, Components of XML, XML Parser, DTD's Using XML with HTML and CSS.

## **UNIT IV**

Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. AJAX –Introduction AJAX programming, Improving web page performance using AJAX.

### **Textbooks:**

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson

### **Reference Books:**

1. Web Technologies, Uttam K. Roy, Oxford University Press
2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.
3. Web Technology, Rajkamal, Tata McGraw-Hill.
4. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, Pearson.
5. XML: How to Program, Deitel&Deitel Nieto.

ETCS112A	OBJECT ORIENTED PROGRAMMING	C
		4

### Course Overview:

This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, event-driven programming, memory management and an introduction to software engineering issues.

### Objectives and Expected Outcomes:

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

On successful completion of this course students will be able to:

1. Explain the steps in creating an executable program for a computer, including the intermediate representations and their purpose
2. Manipulate binary patterns and understand the use of binary to represent numbers.
3. Apply good programming style and understand the impact of style on developing and maintaining programs
4. Effectively use a version control system and the Linux command line tools for incremental development.
5. Explain the benefits of object-oriented design and understand when it is an appropriate methodology to use.
6. Design object-oriented solutions for small systems involving multiple objects.
7. Identify the relative merits of different algorithmic designs.

### UNIT I

**Introduction:** Introducing Object-Oriented Approach related to other paradigms (functional, data decomposition), Characteristics of Object-Oriented Languages.

**Basic terms and ideas:** Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference between C and C++, Cin, Cout, new, delete operators.

### UNIT II

**Classes and Objects:** Abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, Copy Constructor, Static Class Data, Constant Classes, C++ garbage collection, dynamic memory allocation.

### UNIT III

**Inheritance and Polymorphism:** Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Agrégations, composition vs classification hiérarchies, Polymorphism, Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric polymorphism, Generic function – template function, function name overloading, Overriding inheritance methods

## **UNIT IV**

**Files and Exception Handling:** Persistent objects, Streams and files, Namespaces, Exception handling, Generic Classes

**Standard Template Library:** Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

### **TEXT BOOKS:**

1. A.R. Venugopal, Rajj Kumar, T. Ravishanker “Mastering C++”, TMH
2. R. Lafore, “Object Oriented Programming using C++”, BPB Publications
3. Schildt Herbert, “C++ Programming”, 2<sup>nd</sup> Edition, Wiley DreamTech.

### **REFERENCE BOOKS:**

1. D. Parsons, “Object Oriented Programming with C++”, BPB Publication
2. Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication
3. Yashwant Kanethkar, “Object Oriented Programming using C++”, BPB



ETCA 164A	WEB TECHNOLOGIES LAB	C 1
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### Course Overview:

This course is an introduction to Web site development and the technologies behind it. Students will learn how to design and develop Web pages using current technologies and tools. Topics covered will include the World Wide Web, HTML, Cascading Style Sheets (CSS) and XML.

### Objectives and Expected Outcomes:

The following experiments are expected to be performed in the lab.

1. Write HTML/Java scripts to display your CV in Web Browser.
2. Creation and annotation of static web pages using any HTML editor.
3. Write a program to use XML and JavaScript for creation of your homepage.
4. Write a program in XML for creation of DTD which specifies a particular set of rules.
5. Create a Stylesheet in CSS/XSL and display the document in Web Browser.
6. Create a Registration Form with Table.
7. CSS : Inline Style , Internal Style ,and External Style Sheets
8. JavaScript & HTML:
  - Use user defined function to get array of values and sort them in ascending order
  - Demonstrate String and Math Object's predefined methods
  - Demonstrate Array Objects and Date Object's predefined methods
  - Exception Handling
  - Calendar Creation : Display all month
  - Event Handling
    - Validation of registration form
    - Open a Window from the current window
    - Change color of background at each click of button or refresh of a page
    - Display calendar for the month and year selected from combo box
    - OnMouseover event
9. XML
  - Create any catalog
  - Display the catalog created using CSS or XS

ETCS166A	OBJECT ORIENTED PROGRAMMING LAB	C
		1

### Course Overview:

This course will give the learner an insight into how everything can be considered an object and how simply we can write code to implement it. It helps us in making programming relatable to real world, as everything around us can be an object (having properties and functionality)

Object-oriented programming aims to implement real world entities like inheritance, hiding, polymorphism etc in programming. The main aim of OOP is to bind together the data and the functions that operates on them so that no other part of code can access this data except that function.

### Objective and Expected Outcome:

Students who have already studied Structural programming like C, would understand how Object-oriented programming would help them in coding in a simpler and better way. For instance, a user of the program should only know what the input is and what is the output, he should not be concerned about the process. The programmer implements the concept through abstraction and information hiding, which are important features of object-oriented programming. The course would help students achieve the following goals:

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development.
- Develop the ability to write a computer program to solve specified problems.

### LIST OF EXPERIENTS

Q1. Raising a number  $n$  to a power  $p$  is the same as multiplying  $n$  by itself  $p$  times. Write a function called `power ( )` that takes a double value for  $n$  and an int value for  $p$ , and returns the result as double value. Use a default argument of 2 for  $p$ , so that if this argument is omitted, the number will be squared. Write a `main ( )` function that gets values from the user to test this function.

Q2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates.

Write a program that uses a structure called `point` to model a point. Define three points, and have the user input values to two of them. Than set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4

Enter coordinates for P2: 5 7

Coordinates of  $P1 + P2$  are : 8, 11

Q 3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation).

Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, second number: 10/ 3

Answer = 3.333333

Do another (Y/ N)? Y

Enter first number, operator, second number 12 + 100

Answer = 112

Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

Enter your area code, exchange, and number: 415 555 1212

My number is (212) 767-8900

Your number is (415) 555-1212

Q 5. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB.

Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB object, depending on the units in which the results are required.

The display should be in the format of feet and inches or metres and centimetres depending on the object on display.

Q 6. Create a class rational which represents a numerical value by two double values- NUMERATOR & DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

Q 7. Consider the following class definition

```
class father {
protected : int age;
public;
father (int x) { age = x;}
virtual void iam ( )
{ cout << "I AM THE FATHER, my age is : "<< age<< endl;}
};
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes.

Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

Q 8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name ( a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

- a) Name of the patient
- b) Date of admission
- c) Disease
- d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q 10. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **toString** that prints the manager's name, department and salary. Make a class **Executive** inherit from **Manager**. Supply a method to **String** that prints the string "**Executive**" followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit ( ) that reverses a string (an array of char). Use for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

Q13. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

Q 14. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get\_data ( ) to initialize base class data Members and another member function display\_area ( ) to compute and display the area of figures. Make display\_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements.

Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

$$\begin{aligned}\text{Area of rectangle} &= x * y \\ \text{Area of triangle} &= \frac{1}{2} * x * y\end{aligned}$$

<b>ETCS551A</b>	<b>LANGUAGES OF DATA MODELING LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

A student will achieve two important skills required for a Business Analyst - Data Modelling and Database Design. After completing this course, a student will be able to analyse business cases, develop Entity Relationship Diagram (ERD) and design Relational Database. However, this course is NOT about database development on any specific DBMS. A database design can be implemented using any available tool or DBMS (e.g. Oracle, SQL). Data Modelling and Database Design are independent of any specific tool.

### **Course Objectives and Expected Outcomes:**

Data modelling is a process used to define and analyze the data requirements in an IT project with the end result being a data model that can accurately describe the structure, manipulation and integrity aspects of the data stored within relational databases. By completion of this course, successful students will be able to:

- Understand basics of the DAMA DM-BOK guidelines for Data Modelling
- Create three distinct levels of data models
- Apply data modelling skills to practical situations
- Understand metadata and its purpose

### **List of Experiments**

1. Represent the following concepts of OOSE using suitable UML symbols: Association, Composition, Activity, Classes, Interface etc.
2. Create a Usecase diagram of Airline Reservation System.
3. Create a class diagram of Airline Reservation System or any suitable case study.
4. Create an Activity Diagram for the above problem.
5. Design JUnit test cases to test a given Java code. Test cases should cover checking of boundary value analysis, complete path coverage etc.

### SEMESTER III

ETCS502A	STATISTICAL DATA ANALYSIS	C
		4

#### Course Overview:

Statistics is the science that turns data into information and information into knowledge. This class covers applied statistical methodology from an analysis-of-data viewpoint. Topics covered include frequency distributions; measures of location; mean, median, mode; measures of dispersion; variance; graphic presentation; elementary probability; populations and samples; sampling distributions; one sample univariate inference problems, and two sample problems; categorical data; regression and correlation; and analysis of variance. Use of computers in data analysis is also explored.

This is an introductory course in statistics designed to provide students with the basic concepts of data analysis and statistical computing. Topics covered include basic descriptive measures, measures of association, probability theory, confidence intervals, and hypothesis testing. The main objective is to provide students with pragmatic tools for assessing statistical claims and conducting their own statistical analyses.

**Objective and Expected Outcome:** At the end of this course, students should be able to:

1. Demonstrate their understanding of descriptive statistics by practical application of quantitative reasoning and data visualization
2. Demonstrate their knowledge of the basics of inferential statistics by making valid generalizations from sample data
3. Use R and Excel to conduct statistical analysis
4. Recognize pitfalls in using statistical methodology
5. Critical attitudes, which are necessary for “life-long learning”
6. Greater appreciation for the importance of statistical literacy in today’s data rich world

#### UNIT I

Introduction to the course: Descriptive Statistics, Probability Distributions, Inferential Statistics, Inferential Statistics through hypothesis tests, Permutation & Randomization Test, Regression, ANOVA (Analysis of Variance).

#### UNIT II

Machine Learning: Introduction and Concepts, Differentiating algorithmic and model based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K-Nearest Neighbours Regression & Classification.

### **UNIT III**

Supervised Learning with Regression and Classification techniques -1: Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines.

### **UNIT IV**

Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining, Challenges for big data analytics. Prescriptive analytics: Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.

<b>ETCS217A</b>	<b>DATA STRUCTURES</b>	<b>C</b>
		<b>4</b>

### Course Overview:

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

### Objectives and Expected Outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

## UNIT I

**Introduction to Data Structures:** Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; **Arrays:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

**Running time:** Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

## UNIT II

**The Stacks:** ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

**Queues and Lists:** ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

## UNIT III

**Trees:** Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.



**Graphs:** Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

#### **UNIT IV**

**Sorting Algorithms:** Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

**Searching Algorithms:** Straight Sequential Search, Binary Search (recursive & non–recursive Algorithms)

#### **TEXT BOOKS:**

1. E. Horowitz and S. Sahani, “Fundamentals of Data Structures”, GalgotiaBooksource Pvt. Ltd.
2. R. L. Kruse, B. P. Leung, C. L. Tondo, “Data Structures and program design in C”, PHI.

#### **REFERENCES BOOKS:**

1. Schaum’s outline series, “Data Structure”, TMH.
2. Y. Langsamet. al., “Data Structures using C and C++”, PHI.
3. Yashwant Kanetkar, “Data Structure through C”, BPB.

ETMA208A	NUMERICAL ANALYSIS	C
		4

### Course Overview:

The purpose of this course is to sharpen the skills of students to solve problems related to engineering, social and medical science by using computer programming. We build mathematical models to describe real-life problems but the methods we studied in calculus, algebra and other areas of mathematics not necessarily provide solutions to these problems. For instance, if we have an equation involving transcendental functions such as  $e^x$ ,  $\sin \sin x$  then the methods we studied so far fail to find a root of this equation. In order to overcome this difficulty, we start with an initial estimate and improve this estimated value in an iterative manner. This is an example of how we solve a problem numerically.

Mathematical models and their numerical solutions are crucial in many problems of our life. This course introduces various methods to numerically solve the problems in different areas. In addition, the students will learn how effective a method is in solving a problem at hand.

### Objective and Expected Outcome:

Differential and integral calculus is introduced to the students at intermediate level and they have an instinct of its importance in our life. Finding roots of equations arise in problems in optimization and problems in the stock market require least-squares solutions. Models in economics require a detailed analysis of system linear of equations. These problems are mathematically complex and require plenty of computational skills. During the course, students will learn numerical techniques to solve problems in differentiation, integration and differential equations. Further, students would be able to solve linear and non-linear equations iteratively.

This course aims to develop computational thinking in students and enable them to examine the algorithmic techniques to learn how computational tools can find the answer. In this way, students would even have a better understanding of some theoretical concepts in mathematics such as limits, sequence and their convergence. They will also become more efficient in detecting and controlling the errors, and can determine the accuracy of the results. Students are free to choose their own programming language so that the programming language is not a barrier.

**After completing the course, students will have a good bird's-eye view of numerical analysis, and consequently, they will be better prepared for a more intense study of the subject.**

### UNIT I

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation.

Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

### UNIT II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

### UNIT III

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

## UNIT IV

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule, Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.

Ordinary Differential Equations: Euler's method, Runge-Kutta methods of orders two and four.

### TEXT BOOK:

B. S. Grewal, *Numerical Methods in Engineering and Science*, Khanna Publishers.

### REFERENCE BOOKS:

1. M. K. Jain, S.R.K. Iyengar and R.K. Jain; *Numerical Methods for Scientific and Engineering Computation*; New age International Publisher.
2. Brian Bradie; *A Friendly Introduction to Numerical Analysis*; Pearson Education.
3. C.F. Gerald and P.O. Wheatley; *Applied Numerical Analysis*; Pearson Education.
4. Uri M. Ascher and Chen Greif; *A First Course in Numerical Methods*; PHI Learning Private Limited.
5. John H. Mathews and Kurtis D. Fink; *Numerical Methods using Matlab*; PHI Learning Private Limited.

<b>BSMA217A</b>	<b>REAL ANALYSIS</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Much of mathematics relies on our ability to be able to solve equations, if not in explicit exact forms, then at least in being able to establish the existence of solutions. To do this requires knowledge of so-called "analysis", which in many respects is just Calculus in very general settings. The foundations for this work are commenced in Real Analysis, a course that develops this basic material in a systematic and rigorous manner in the context of real-valued functions of a real variable. Topics covered are: Basic set theory. The real numbers and their basic properties. Sequences: convergence, subsequences, Cauchy sequences. Open, closed, and compact sets of real numbers. Continuous functions and uniform continuity. The Riemann integral. Differentiation and Mean Value theorems. The Fundamental Theorem of Calculus. Series. Power series and Taylor series. Convergence of sequences and series of functions.

### **Objective and Expected Outcome:**

A lot of mathematics is about real-valued continuous or differentiable functions and this generally falls under the heading of "real-analysis". Everything from ODEs and PDEs, Taylor series, Fourier transforms, and other functional decompositions. In addition, real-analysis is necessary for probability theory, which is the foundation for all of statistics, operations research, queuing theory, and the mathematical finance (e.g. Black Scholes Theory). Real Analysis enables the necessary background for Measure Theory. Measure theory is further used in the study of Stochastic Differential Equations (Finance, Signal Processing), Stochastic Geometry (Wireless Communications), Topology (Topological Data Analysis) and many more.

### **UNIT I**

Review of Algebraic and Order Properties of  $\mathbb{R}$ ,  $\epsilon$ -neighborhood of a point in  $\mathbb{R}$ , Idea of countable sets, uncountable sets and uncountability of  $\mathbb{R}$ . Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets.

### **UNIT II**

Suprema and Infima, The Completeness Property of  $\mathbb{R}$ , The Archimedean Property, Density of Rational (and Irrational) numbers in  $\mathbb{R}$ , Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.

### **UNIT III**

Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

## UNIT IV

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's  $n$ th root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

### TEXT BOOK:

S.C. Malik and Savita Arora; *Mathematical Analysis*; New Age Science.

### REFERENCE BOOKS:

1. R.G. Bartle and D. R. Sherbert; *Introduction to Real Analysis*; John Wiley and Sons Pvt. Ltd.
2. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough; *An Introduction to Analysis*; Jones & Bartlett.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner; *Elementary Real Analysis*, Prentice Hall.

<b>ETCS219A</b>	<b>FOUNDATION OF COMPUTER SYSTEMS</b>	<b>C</b>
		<b>4</b>

### Course Overview:

Throughout the course, students will be expected to demonstrate their understanding of

Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

### Objectives and Expected Outcomes:

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.

### UNIT I

**Set Theory:** Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

### UNIT II

**Graphs And Trees:** Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eulerian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

### UNIT III

**Propositional logic:** Basic operations: AND( $\wedge$ ), OR( $\vee$ ), NOT( $\sim$ ), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

**Group theory:** Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

#### **UNIT IV**

**Recursion and Recurrence Relation:** linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

**Techniques Of Counting:** Permutations with and without repetition, Combination.

#### **TEXT BOOKS:**

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

#### **REFERENCES BOOKS:**

1. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI.
2. NarsinghDeo, "Graph Theory with Application to Engineering and Computer Science", PHI.
3. J. P. Trembly & P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill.
4. Vinay Kumar, "Discrete Mathematics", BPB Publications.

<b>ETCS552A</b>	<b>STATISTICAL DATA ANALYSIS LAB</b>	<b>C</b>
		<b>1</b>

Based on theory subject **ETCS 502A** following experiments are to be performed:

1. Setting Up of Modeling Frameworks (Weka, Orange and R), I/O Formats, Basic Introduction to Interfaces.
2. Linear models in R, Writing Basic Interface for a Learner.
3. Models Using Weka or Orange on UCI Benchmark Data Sets. Writing Interfaces for a Classifier as Derived from a Learner.
4. K-Means Clustering, Writing Interface for a Cluster.
5. Coding any of the learning algorithms and testing them on suitable UCI Data Sets. Suggestions for algorithms: Decision trees, Naïve Bayesian, q-learning etc.



<b>BSMA351A</b>	<b>NUMERICAL ANALYSIS LAB</b>	<b>C</b>
		<b>1</b>

Hands-on experiments related to the course contents **ETMA208A** by performing experiments as given below:

### **PRACTICAL/LAB WORK**

(Modeling of the following problems Using MATLAB/ Mathematica/ Maple Etc.)

#### **List of Practical's**

- (i) Calculate the sum  $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$ .
- (ii) To find the absolute value of an integer.
- (iii) Enter 100 integers into an array and sort them in an ascending order.
- (iv) Bisection Method.
- (v) Newton Raphson Method.
- (vi) Secant Method.
- (vii) Regula Falsi Method.
- (viii) LU decomposition Method.
- (ix) Gauss-Jacobi Method.
- (x) SOR Method or Gauss-Siedel Method.
- (xi) Lagrange Interpolation or Newton Interpolation.
- (xii) Simpson's rule.

**Note:** For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

<b>ETCS257A</b>	<b>DATA STRUCTURES LAB</b>	<b>C</b>
		<b>1</b>

Based on theory subject **EETEC217A** following experiments are to be performed:

### **LIST OF EXPERIMENTS**

1. Write a program for multiplication and transpose of array.
2. Write a program to compute the transpose of a sparse matrix
3. Write a program to implement push and pop operation in Stack.
4. Write a program to convert a Infix notation to post fix notation using stacks
5. Write a program to evaluate postfix notation using stacks
6. Write a program to implement a linear queue
7. Write a program for swapping two numbers using call by value and call by reference strategies.
8. Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.
9. Write a program to implement a linear search arrays and linked list.
10. Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.
11. Write the programs to implement bubble sort.
12. Write a program using iteration and recursion concepts for quick sort.
13. Write a program to implement merge sort.
14. Write a program to simulate various tree traversal techniques.
15. Write a program to simulate various BFS and DFS.

## SEMESTER IV

ETCS503A	DATA MINING AND PREDICTIVE MODELING	C
		4

### Course Overview:

This course will introduce you to the tools and techniques of predictive models as used by researchers in the fields of learning analytics and educational data mining. It covers the concepts and techniques that underlie current educational “student success” and “early warning” systems, giving insight into how learners are categorized as at-risk through automated processes. Student will gain hands-on experience building these kinds of predictive models using the popular software packages. Also, included in this course is a discussion of feature selection, model fit, and evaluation of data based on student attributes.

### Objectives and Expected Outcomes:

Data Mining and Predictive Analytics is a graduate-level course designed to introduce students to various data mining concepts and algorithms.

It emphasizes on classifiers, clustering, and association analysis applicable to the distinct nature of healthcare data. The terms data mining and predictive analytics refer to the computational process of discovering patterns in large datasets using interdisciplinary methods such as artificial intelligence, machine learning, and statistics. Ultimate goal of data mining is to extract previously unknown information from data residing in a preferably electronic dataset. After the completion of student is able to

1. Identify appropriate data mining algorithms to solve real world problems
2. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
3. Describe complex data types with respect to spatial and web mining.

### UNIT I

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

### UNIT II

**Classification and Prediction:** Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

### UNIT III

**Cluster Analysis:** Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

**Mining Association Rules:** Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

## **UNIT IV**

Predictive modeling and Analysis - Regression Analysis, Multicollinearity, Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

### **TEXT BOOKS:**

Kamber and Han, “Data Mining Concepts and Techniques”, Hartcourt India P. Ltd.

<b>BSMA137A</b>	<b>ALGEBRA</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Algebra is designed to give students a foundation for all future mathematics courses. The fundamentals of algebraic problem-solving are explained. Students will explore the basic concepts of matrices, relation between the roots and coefficients of general polynomial equation in one variable, Nature of roots by inspection of change of sign of equations. Throughout the course the student learns how to apply the concepts in real-life situations.

### **Objective and Expected Outcome:**

During this course the student will be able to find the rank, Eigen values of matrices and solve the homogeneous and non-homogeneous systems, solution of cubic and biquadratic equations.

Upon completion of this course, you should be able to students understand mathematical concepts, symbols and procedures and are able to apply them to real world situations. Use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts. Select and apply appropriate inquiry and mathematical problem solving techniques in recognize patterns.

The main objective of this program is to cultivate a mathematical aptitude and nurture the interests of the students towards problem solving aptitude. Further, it aims at motivating the young minds for research in mathematical sciences and to train computational scientists who can work on real life challenging problems. It further aims at motivating the students to join teaching profession.

### **UNIT I**

Symmetric; Skew-symmetric; Hermitian and skew Hermitian matrices; Elementary Operations on matrices; Rank of a matrices; Inverse of a matrix; Linear dependence and independence of rows and columns of matrices; Row rank and column rank of a matrix; Eigenvalues, eigenvectors and the characteristic equation of a matrix; Minimal polynomial of a matrix; Cayley Hamilton theorem and its use in finding the inverse of a matrix.

### **UNIT II**

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations; Theorems on consistency of a system of linear equations; unitary and Orthogonal Matrices; Bilinear and Quadratic forms

### **UNIT III**

Relations between the roots and coefficients of general polynomial equation in one variable; Solutions of polynomial equations having conditions on roots; Common roots and multiple roots; Transformation of equations

### **UNIT IV**

Nature of the roots of an equation; Descarte's rule of signs; Solutions of cubic equations (Cardon's method); Biquadratic equations and their solutions.

### **TEXT BOOK:**

Chandrika Prasad; *Text Book on Algebra and Theory of Equations*; Pothishala Private Ltd., Allahabad

**REFERENCE BOOKS:**

1. David C. Lay; *Linear Algebra and its Applications*; Pearson Education.
2. H.S. Hall and S.R. Knight; *Higher Algebra*, *H.M. Publications*; New Delhi.
3. Shanti Narayan; *A Text Books of Matrices*; S.Chand, New Delhi.

<b>ETCS307A</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terabytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

### **Objectives and Expected Outcomes:**

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expressions.
7. For a given specification of the requirement design the databases using E-R method and normalization.
8. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.
9. For a given query optimize its execution using Query optimization algorithms
10. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
11. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

### **UNIT I**

**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

## UNIT II

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

**Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

## UNIT III

**Storage strategies:** Indices, B-trees, hashing.

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

## UNIT IV

**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

## SUGGESTED BOOKS:

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.
3. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education



<b>ETMC 226A</b>	<b>FUNDAMENTALS OF MANAGEMENT</b>	<b>C</b>
		<b>3</b>

### **Course Overview:**

Technical skills alone do not meet the real-world work and the business requirements; they have to be supplemented by management training. In fact, most of the people find that their success depends as much on general management skills and understanding operational systems as on their technical expertise. To become complete professional, students need a firm foundation in these basic managerial skills.

Fundamentals of Management are a basic introductory and foundational management course for under graduates. This course is designed for students to equip themselves with key knowledge, skills and competencies in various aspects of management. This course enables the students to develop an understanding of management and organization and focuses on important management functions such as planning, organizing, leading and controlling for successful managerial activities. The students will learn how successful managers use organizational resources through organizational functions in order to effectively and efficiently achieve organizational objectives.

Specific techniques related to managerial functions are explored as well as the broad issues and trends influence the practice of contemporary management, globalization, technology, diversity, and competitive advantage. Special emphasis is on basics of all the departments in the organization like Human Resource Management, Marketing Management, Productions and Operations Management and Financial Management.

### **Objectives and Expected Outcomes:**

The objective of this course is for each student to be able to know, comprehend, apply, analyze, synthesize and evaluate the basic fundamentals of managing organizations. Through the learning of this course on fundamentals of management, students will gain fundamental knowledge and skills for management in contemporary organizations. These include the “How to” and “Why”. Students will also develop analytical and critical thinking skills in the context of contemporary organizations. This focuses on the entire organisation from both a short term and long-term perspective for strategic vision, objectives, crafting a strategy and implementing it. Specifically, the learning objectives for the students are:

- Demonstrate basic knowledge of management and organization.
- Demonstrate a basic understanding of management functions such as planning, organizing, leading and controlling; and how successful managers effectively and efficiently use these functions and their business resources to achieve organizational objectives.
- Develop knowledge of fundamental management concepts and skills.
- Identify the key competencies needed to be an effective manager.
- Identify the most important components of human resource planning; outline a model of organizational staffing; recruitment; selection; orientation; human resource planning and training.

<b>ETMA326A</b>	<b>OPERATIONAL RESEARCH</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Operations research is a mathematical science concerned with optimal decision making and the modeling of deterministic and probabilistic systems. Its focus and field of application are interdisciplinary, embracing a broad range of quantitative techniques. Industrial engineering is concerned with the design, improvement, and installation of integrated systems of personnel, material, and equipment. Together, operations research and industrial engineering provide a rational approach to engineering and managerial problem solving through deliberate application of scientific methods. Operations research helps in solving problems in different environments that needs decisions. The module covers topics that include: linear programming, Transportation, Assignment, and CPM/ MSPT techniques. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments. Course Objectives: This module aims to introduce students to use quantitate methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

### **Objective and Expected Outcome:**

The purpose of the course is to provide students with the concepts and tools to help them understand the operations research and mathematical modeling methods. These methods will help the students to solve economic issues, which help to make a decision. The main goal is to find the lowest cost or the greatest profit in many linear programming in the economic field issues. The model was used to resolve the issue of transport. There are many of the problems regarding the transfer of goods within a minimum of expenses or the distribution of goods to obtain the maximum profit. It was used as a matter of allocation of activating the role of the distribution functions optimally to get the desired goal as costs or profits

Introduction to Operations Research (OR) • Introduction to Foundation mathematics and statistics • Linear Programming (LP), LP and allocation of resources, LP definition, Linearity requirement• Maximization Then Minimization problems. • Graphical LP Minimization solution, Introduction, Simplex method definition, formulating the Simplex model. • Linear Programming – Simplex Method for Maximizing. • Simplex maximizing example for similar limitations, Mixed limitations • Example containing mixed constraints, Minimization example for similar limitations. • Sensitivity Analysis: Changes in Objective Function, Changes in RHS, The Transportation Model •

Basic Assumptions. • Solution Methods: Feasible Solution: The Northwest Method, The Lowest Cost Method; Optimal Solution: The Stepping Stone Method, Modified; Distribution (MODI) Method. • The Assignment Model:- Basic Assumptions • Solution Methods:-Different Combinations Method, Short-Cut Method (Hungarian Method) Knowledge and understanding - Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. The program in operations research is designed to allow students to develop the technical, analytic, and managerial skills necessary to perform these tasks successfully. The graduate program in Operations Research & Industrial Engineering offers M.Sc. and Ph.D. degrees.

**On completion of this course you should be able to:**

1. Define and formulate linear programming problems and appreciate their limitations.
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.
4. Develop mathematical skills to analyses and solve integer programming and network models arising from a wide range of applications.
5. Effectively communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.

**UNIT I**

Definition, scope, methodology and applications of OR. Types of OR models. Concept of optimization, Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP), Requirements for an LPP, Advantages and limitations of LP. Graphical solution: Multiple, unbounded and infeasible solutions.

**UNIT II**

Principle of simplex method: standard form, basic solution, basic feasible solution. Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, multiple solutions and unbounded solution and degeneracy. Two Phase and Big-M methods.

**UNIT III**

Duality in LPP, primal-dual relationship. Transportation Problem: Methods for finding basic feasible solution of a transportation problem, Modified distribution method for finding the optimum solution, Unbalanced and degenerate transportation problems, transshipment problem, maximization in a transportation problem.

**UNIT IV**

Assignment Problem: Solution by Hungarian method, Unbalanced assignment problem, maximization in an assignment problem, Crew assignment and Travelling salesman problem.

Game Theory: Two person zero sum game, Game with saddle points, the rule of dominance; Algebraic, graphical and linear programming methods for solving mixed strategy games.

**TEXT BOOKS:**

1. Kanti Swarup, P.K. Gupta and Manmohan; *Operations Research*; Sultan Chand & Sons.
2. H.A.Taha; *Operations Research – An Introduction*; Wiley.

**REFERENCE BOOKS:**

1. Gupta, P.K. and Hira, D.S.; *Operations Research*; S. Chand & Co.
2. S.I. Gass; *Linear Programming* (3rd Edition); McGraw Hill, NY.
3. G. Hadley; *Linear Programming*; Narosa Publishing.

ETCS553A	DATA MINING AND PREDICTIVE MODELING LAB	C
		1

### Course Overview:

Analytics is the process of transforming data into insight for making better decisions (INFORMS). There are three primary types of analytics: “Descriptive,” which examines historical data and identifies and reports historical patterns and trends; “Predictive,” which predicts outcomes and future trends from existing data to help discover new relationships; “Prescriptive,” which formulates and evaluates new ways for a business to operate. This course focuses on the second type, Predictive Analytics, which is of particular importance for business because it helps decision makers evaluate possible outcomes (e.g., revenues, profits, market share, probability of making a sale, probability of losing a client, etc.) based on other historical data predictors (e.g., marketing expenditures, quality assurance investments, sales force size, etc.). The process of analytics involves specifying a question, problem, or decision, and finding the right answers using data. The process begins with identifying the appropriate data sources (internal or external, data format), and the appropriate models, tools, and methods for analysis.

**Course Objective and Expected Outcomes:** In this course, students are introduced to predictive modeling methods, approaches and tools. Students develop skills in predictive analytics that will allow them to: (1) develop and use advanced predictive analytics methods; (2) develop expertise in the use of popular tools and software for predictive analytics; (3) learn how to develop predictive analytics questions, identify and select the most appropriate predictive analytics methods and tools, apply these methods to answer the respective questions and presenting data-driven solutions. After completing this class, the student will develop the following competencies:

1. The data mining process and important issues around data cleaning, pre-processing and integration.
2. The principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction.
3. Ability to apply specific statistical and regression analysis methods applicable to predictive analytics to identify new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses.
4. Ability to develop and use various quantitative and classification predictive models based on various regression and decision tree methods.

## **List of Experiments**

1. Demonstration of data preprocessing on datasets.
2. To list all the categorical (or nominal) attributes and the real valued attributes mining tool.
3. Create a data classification model using decision tree.
4. Create a data classification model using Naive Bayes.
5. Create a data classification model using rule based classifiers.
6. Create a data classification model using statistical classifiers.
7. Create a data classification model using neural networks.
8. Create a data classification model.
9. Demonstrate the working of k-means algorithm for clustering the data.
10. Create a clustering model using hierarchical clustering algorithm.

<b>ETCA365A</b>	<b>LINUX ENVIRONMENT LAB</b>	<b>C</b>
		<b>1</b>

### **Course Objective:**

This course will prepare students to develop software in and for Linux/UNIX environments. Topics to be covered include basic operating system concepts, effective command line usage, shell programming, the C language, programming development tools, system programming, network programming (client-server model and sockets), and GUI programming

### **Objectives and Expected Outcomes:**

At the end of the students should be able to:

1. Understanding the basic set of commands and utilities in Linux/UNIX systems.
2. To learn to develop software for Linux/UNIX systems.
3. To learn the C language and get experience programming in C.
4. To learn the important Linux/UNIX library functions and system calls. •To understand the inner workings of UNIX-like operating systems. •To obtain a foundation for an advanced course in operating systems.

### **LIST OF EXPERIMENTS**

1. **Installing Linux** :Installing the Operating System
2. **Exploring the System** :Starting Up and changing runlevels, Using the man utility, Using built-in help switches for commands, Using Auto completion
3. **Common System Utilities**: Using cd, Using pwd, Using mkdir, Using rmdir, Using Touch, Using ls, Using mv, Using cp, Using cat, Using Redirection, rm, Using VI, Searching for files: grep, frep and similar commands
4. **The XWindow System**: Preamble, Virtual terminals, Setting up a basic display, X clients, Window Managers, Display Manager, xinit and startx, system-config-display
5. **The Shell and Shell Scripting** : Different kind of shells (c shell, bash shell, korn shell and others), A simple Script, Using variables in scripts, Using Control Structures
6. **User Accounts** : Preamble. Manually creating a new user, Manually creating a new groups, automatically creating a new user, automatically creating new groups, using sticky bits, share the file between users and groups.
7. **Managing and Installing Software** :Installing, Querying and Uninstalling Packages Third party tools, Building Software from Source
8. **Understanding Devices**: Determining device type, Creating devices, mounting and umounting devices

<b>ETCS 355A</b>	<b>DATABASE MANAGEMENT SYSTEMS LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

A database management system (DBMS) is computer application software that provides a way to manage data. The requirement of modern days is to have an automated system that manages, modifies and updates data accurately. This is achieved by a DBMS in robust, correct and non-redundant way. DBMS lab aims at practicing and achieving this aim by using various software's such as SQL, ORACLE, and MS – Access etc. All these require a thorough practice of various DDL, DCL and DML queries.

### **LIST OF EXPERIMENTS**

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ()
6. Write the queries to implement the concept of Integrity constraints
7. Write the queries to create the views
8. Perform the queries for triggers
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints

## SEMESTER V

ETCS504A	BIG DATA ANALYTICS	C
		4

### Course Overview:

The explosion of social media and the computerization of every aspect of social and economic activity resulted in creation of large volumes of mostly unstructured data: web logs, videos, speech recordings, photographs, e-mails, Tweets, and similar. In a parallel development, computers keep getting ever more powerful and storage ever cheaper. Today, we have the ability to reliably and cheaply store huge volumes of data, efficiently analyze them, and extract business and socially relevant information. Big Data analytics is the process of collecting, organizing and analyzing large sets of data (*called* Big Data) to discover patterns and other useful information. Big Data analytics can help organizations to better understand the information contained within the data and will also help identify the data that is most important to the business and future business decisions. Analysts working with Big Data typically want the *knowledge* that comes from analyzing the data.

### Course Objectives and Expected Outcomes:

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches. The students learning outcomes are designed to specify what the students will be able to perform after completion of the course:

1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
4. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
5. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
6. Ability to integrate machine learning libraries and mathematical and statistical tools

### UNIT I

Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions. Overview of Hadoop: Core Hadoop Components, Hadoop Ecosystem, Physical Architecture, Hadoop limitations



## **UNIT II**

NoSQL: NoSQL business drivers; NoSQL case studies; NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns; Using NoSQL to manage big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer;

## **UNIT III**

MapReduce and the New Software Stack: Distributed File Systems -- Physical Organization of Compute Nodes, Large Scale File-System Organization, The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures.

## **UNIT IV**

Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step.

<b>ETCS211A</b>	<b>OPERATING SYSTEMS</b>	<b>C</b>
		<b>4</b>

### Course Overview:

To learn the fundamentals of Operating Systems.

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

### Objectives and Expected Outcomes:

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

## UNIT I

**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

## UNIT II

**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

**Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

**Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

**Scheduling algorithms:** Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor Scheduling: Real Time scheduling: RM and EDF.

### UNIT III

**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free- space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

### UNIT IV

**Process-Synchronization & Deadlocks: Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

**I/O Systems:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

#### TEXT BOOKS:

1. Silberschatz and Galvin, "Operating System Concepts", Pearson

#### REFERENCES BOOKS:

1. Tannenbaum, "Operating Systems", PHI, 4<sup>th</sup> Edition.
2. William Stallings, "Operating Systems Internals and Design Principles", PHI
3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5<sup>th</sup> Edition

<b>ETEL217</b>	<b>PERSONALITY DEVELOPMENT AND COMMUNICATION SKILLS</b>	<b>C</b>
		<b>3</b>

### **Course Overview:**

Personality means uniqueness, individuality and appearance of a person and his/her reflection of emotions, behaviours, communication skills and corporeal characteristics. It is not inherited but developed through activities. The development of one's personality is a challenging yet a rewarding task for every individual as it leads to the development of the traits, attitudes, behaviours, and perceptions to make an individual distinctive and pleasing. This programme will lead to the development of a holistic personality of students and promote integrated growth to bring out the best in one's persona.

### **Objective and Expected Outcome**

The course aims to develop self-awareness among students to improve their personality traits for their academic and social progress. It encourages self-development in the students through participation in a number of activities to imbibe leadership qualities and develop team culture. It enables the students to build their interpersonal skills, enhance language proficiency and apply the conceptual knowledge of communication into every day practice. The students will be motivated to improve their speaking and writing skills and learn active listening and responding skills. The course will benefit to gain the knowledge of corporate and social grooming to achieve success in the professional world.

**Personality Development and Communication Skills programme will help the students to face and overcome the challenges of the outside world more effectively and efficiently and also make it easier for them to ascend intricate academic and corporate ladder more smoothly.**

### **UNIT I**

Remedial Grammar: Errors of Accidence and syntax with reference to parts of speech; Confusion of adjectives and adverbs; Agreement of subject and verb; Simple, Complex and Compound Sentences; Sentence Errors; Indianism & Idiomatic expressionism; The Chimney Sweeper by William Blake

### **UNIT II**

Listening & Reading Skills: Listening & Hearing; Tips for effective listening; Role of listening in personality development; Types of reading: Comprehension of unseen passages; Summarizing; Of Death by Francis Bacon; The Diamond Necklace by Guy De Maupassant

### **UNIT III**

Personality Development: Nonverbal communication; Etiquette & Manners; Self-esteem & Self-confidence; Leadership traits; Effective Communication; Inter & Intra personal skills; Motivation & Appraisal; Mending Wall by Robert Frost

### **UNIT IV**

Verbal Communication: Formal speech; Role play; Effective public speaking; Interview; Etiquettes at formal gathering; Etiquettes in Official & Business correspondence; The Grief by Anton Chekhov

**TEXT BOOK:**

Raman Meenakshi & Sharma, Sangeetha. Technical Communication Principles and Practices, 2nd Ed. Oxford University Press, New Delhi, 2011

**REFERENCE BOOKS:**

1. Sinha, K.K. Business Communication. Galgotia Publishers.
2. Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. Intermediate Grammar, Usage and Composition. Orient Blackswan.
3. “Best Poems”, <http://100.best-poems.net/>. 20 July 2016.
4. “Classic English Short Stories”, <http://www.eastoftheweb.com/short-stories/Collections/ClasEngl.shtml>, 20 July 2016.
5. Mitra, Barun K. Personality Development and Soft Skills, OUP, Delhi, 2012.
6. Web Sources: [www.slideshare.com](http://www.slideshare.com)

<b>ETCS304A</b>	<b>COMPUTER NETWORKS</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

The subject of computer networking is enormously complex, involving many concepts, protocols, and technologies. To cope with the scope and complexity these protocols and technologies are woven together in an intricate manner in what is called the layered protocol stack (or suite). The layered organization allows breaking down complex functions required for computers networking into manageable tasks. This course is an introduction to computer networking using a top-down approach—that is, by beginning at the highest layer of the protocol stack (application layer) and proceeding down through different layers towards the lowest one (the physical layer). The course places emphasis on the application layer (a “high growth area” in networking). The course uses the Internet’s architecture and protocols as the primary vehicle for studying fundamental computer networking concepts. More than often, the course will also include concepts and protocols from other network architectures. But the main focus is on the Internet, a fact reflected in organizing the course around the Internet’s five-layer architecture.

### **Objectives and Expected Outcomes:**

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. Explain the functions of the different layer of the OSI Protocol.
5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

## **UNIT I**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

## **UNIT II**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

## **UNIT III**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

#### **UNIT IV**

**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

#### **Text Books**

Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.

1. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

<b>ETEC 210A</b>	<b>DIGITAL ELECTRONICS</b>	<b>C</b>
		<b>4</b>

### Course Overview:

Lectures and labs on digital logic, PALs, flip-flops, timing, counters, synchronization, and finite-state machines prepare students for the design and implementation of a final project of their choice, e.g., games, music, digital filters, wireless communications, graphics, etc. Extensive use of Verilog for describing and implementing digital logic designs. Students engage in extensive written and oral communication exercises.

### Objective and Expected Outcome:

- Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolean algebra, state elements and finite state machine (FSMs).
- Design simple digital systems based on these digital abstractions, using the "digital paradigm" including discrete sampled information.
- Use the "tools of the trade": basic instruments, devices and design tools.
- Work in a design team that can propose, design, successfully implement and report on a digital systems project.
- Communicate the purpose and results of a design project in written and oral presentations.

### COURSE OUTCOME:

- Create the appropriate truth table from a description of a combinational logic function.
- Create a gate-level implementation of a combinational logic function described by a truth table using and/or/inv gates, muxes or ROMs, and analyze its timing behavior.
- Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.
- Describe the operation and timing constraints for latches and registers.
- Draw a circuit diagram for a sequential logic circuit and analyze its timing properties (input setup and hold times, minimum clock period, output propagation delays).
- Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power
- Properly incorporate synchronous and asynchronous memories into a circuit design.
- Discuss how to interface digital circuits with analog components (ADC, DAC, sensors, etc.).

### UNIT – I

**Number Systems and Codes:** Review of number systems, BCD codes and arithmetic, Gray code, self-complementing codes, Error detection and correction.

**Digital Circuits:** Switching algebra & simplification of Boolean expressions, De Morgan's Theorem, Implementation of Boolean expressions (using logic gates)



## UNIT – II

**Combinational Logic Design:** Combinational circuit designing, Minimization Techniques of Boolean functions such as Karnaugh map and Quine-Mc Cluskey methods, Arithmetic circuits, code convertors, multiplexers, demultiplexers, encoders, decoders & comparators. Parity generators and checkers.

**Introduction to Sequential Logic:** Need for sequential circuits, Binary cell, Latches and different types of Flip-Flop and their Conversions.

## UNIT – III

**Synchronous Sequential Circuit :** Fundamentals of Synchronous sequential circuits, Analysis of Synchronous Sequential circuits, Design of Synchronous and Asynchronous Counters, Shift registers & Ring counters, Timing issues in synchronous circuits.

**Asynchronous Sequential Circuits:** Fundamentals of Asynchronous Sequential circuits. Analysis and design of Asynchronous Sequential circuits. Pulse mode and Fundamental-mode Circuits. Cycles, Races and Hazards in asynchronous circuits.

## UNIT – IV

**Synchronous Machines:** Classification of synchronous machines, Analysis and design of Finite State Machines.

**Logic Families:** Performance metrics of logic gates, Basic Transistor-Transistor Logic and CMOS logic.

**Converters:** A/D and D/A converters and their types.

## TEXT BOOKS:

1. G.K. Kharate -Digital Electronics, Oxford University Press
2. Aanand Kumar -Fundamentals of Digital Circuits, Prentice Hall of India

## REFERENCE BOOKS:

1. Morris Mano, —Digital design, Prentice Hall of India
2. R.P. Jain- Modern Digital Electronics, Tata Mc Graw Publishers
3. Floyd- Digital Fundamentals, Pearson Publication

<b>ETCS554A</b>	<b>BIG DATA ANALYTICS LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

Sophisticated software programs are used for big data analytics, but the unstructured data used in big data analytics may not be well suited to conventional data warehouses. Big data's high processing requirements also make traditional data warehousing a poor fit. As a result, newer, bigger data analytics environments and technologies have emerged, including Hadoop, MapReduce and NoSQL databases. These technologies make up an open-source software framework that's used to process huge data sets over clustered systems.

### **Course Objectives and Expected Outcomes:**

This course is recommended as an advancement to Processing BigData on Hadoop. While Processing BigData was geared more towards developers who wanted to understand how to use Hadoop to handle and arrange BigData. This course will go on to teach how to perform analytical operations to gain insights from data processed through Hadoop. BigData Analytics on Hadoop will teach you all you need to learn about BigData Analytics on Hadoop. Big Data is a popular term used to describe the exponential growth, availability and use of information, both structured and unstructured. It is imperative that organizations and IT leaders focus on the ever-increasing volume, variety and velocity of information that forms BigData. Hadoop is the core platform for structuring BigData, and solves the problem of making it useful

for Analytics. After the course students will be able to:

- 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

### **List of Experiments**

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using map reduce
5. Page Rank Computation
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries

<b>ETCS 255A</b>	<b>OPERATING SYSTEMS LAB</b>	<b>C</b>
		<b>1</b>

Hands-on experiments related to the course contents ETCS211A by performing All laboratory assignments

### **LIST OF EXPERIMENTS**

**Write down and execute the following programs using C/C++**

1. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
2. Write C programs to simulate UNIX commands like ls, grep, etc.
3. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions)
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions)
5. Developing Application using Inter Process Communication (using shared memory, pipes or message queues)
6. Implement the Producer –Consumer problem using semaphores (using UNIX system calls).
7. Implement some memory management schemes –I.
8. Implement any file allocation technique (Linked, Indexed or Contiguous).
9. Write programs based on shell programming

<b>ETCS365A</b>	<b>COMPUTER NETWORKS LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work.

### **Objectives and Expected Outcomes:**

After completing the course, the student should be able to:

1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.
2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios
3. Demonstrate the installation and configuration of network simulator.
4. Demonstrate and measure different network scenarios and their performance behavior.
5. Design and setup a organization network using packet tracer.

### **LIST OF EXPERIMENTS**

1. Study of Network devices in detail
2. Connect the computers in Local Area Network using packet tracer
3. Implementation of Data Link Framing method - Character Count.
4. Implementation of Data link framing method - Bit stuffing and Destuffing.
5. Implementation of Error detection method - even and odd parity.
6. Implementation of Error detection method - CRC Polynomials.
7. Implementation of Data Link protocols - Unrestricted simplex protocol
8. Implementation of data link protocols - Stop and Wait protocol
9. Implementation of routing algorithms - Dijkstra's algorithm
10. Study of Network IP Addressing using packet tracer
11. Design TCP client and server application to transfer file
12. Design UDP client and server application to transfer file
13. Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)
14. Working on NMAP Tool for Port scanning.

<b>ETCS507A</b>	<b>SEMINAR</b>	<b>C</b>
		<b>1</b>

Students are expected to conduct a self-study under the supervision of the respective teachers. The study may be related to the subjects or of related area and be useful for the students. Students will be expected to give presentations regarding the same.

ETCS401A	ARTIFICIAL INTELLIGENCE	C
		4

**Course Overview:**

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally.

Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines. Our ability to think and act accordingly to situations in the real world appears to be an amazing combination of different skills working in conjunction without us even realizing it. For instance, teaching a child to walk requires effort, but beyond a little help, children learn how to find their balance, walk without falling and avoid any obstacles along the way. However, it seems to take incredible amount of careful planning and execution to create a machine which can do the same on two legs, or for that matter, even four!

We attempt to unravel these special abilities that are crucial in making us appear ‘intelligent’. Our innate ability to perceive the environment and create internal representations for it, to be able to process colossal amounts of information systematically, to learn from the environment, and to plan a course of action for getting desired results is what inspires us to build machines capable of performing or surpassing human expertise.

**Objectives and expected outcomes:**

The course is oriented toward imparting a clear understanding of the problem-solving processes that we take for-granted. The course begins with an overview of the concept of intelligent agents and the various approaches for building them. The general ideas behind creating a machine that can learn are introduced here.

Next the core idea behind solving problems using search techniques is introduced. We learn how everyday problems can be represented as graph search or local search problems and how they can be tackled. Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed. We notice how exploiting knowledge of the problem & its domain allows us to avoid hunting naively through large search-spaces, thereby increasing efficiency. We develop the idea of deriving heuristic estimates from knowledge about problems and our experience in solving those.

Knowledge representation is another key aspect of dealing with information in the real-world. We study various ways in which facts and rules about the world can be encoded systematically and be used to derive meaningful inferences or answer queries. Logic is introduced as one such mechanism for expressing information. Propositional logic and predicate logic are both covered in detail with emphasis to problem-solving in AI. Reasoning systems based on logic are also discussed here. Logic-based proof techniques can be used to verify claims based on existing knowledge and also derive new inferences by combining incoming facts & rules with existing knowledge. Techniques discussed here are forward-chaining, backward-chaining & resolution. Rule-based Expert systems are a direct application and are covered in detail here.

Real world always entails uncertainty and the concept of uncertainty is introduced. The cause of uncertainty and the ways of incorporating it into our problem-solving techniques is studied in detail. Some of the topics covered here include, Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks.

As always, we are fascinated by the idea of machines which can teach themselves or can be taught using examples from the environment. We study various learning paradigms here. The idea of supervised, unsupervised and reinforcement learning is covered. The course concludes with a discussion about the applications of AI across various domains. Specific examples of AI can be studied from domains like Robotics, Natural Language Processing, medicine, transport, security etc.

The course is expected to introduce the students to the challenges involved in designing intelligent systems and allow them to gain a thorough insight into the underlying components of such systems. The student will learn about the potential of this exciting field and explore various present-day applications of AI as it expands rapidly from specialized applications with limited scope to ubiquitous applications running our phones, homes, vehicles and so much more.

## UNIT I

**Scope of AI:** Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction.

**Problem Solving (Blind):** State space search; production systems, search space control; depth-first, breadth-first search.

**Heuristic Based Search:** Heuristic search, Hill climbing, best-first search, A\* Algorithm, Problem Reduction, Constraint Satisfaction.

## UNIT II

**Knowledge Representation:** Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems.

**Structured Knowledge Representation:** Semantic Nets: Slots, exceptions and default frames, conceptual dependency.

## UNIT III

**Handling Uncertainty:** Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors.

**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

## UNIT IV

**Learning:** Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

**Expert Systems:** Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

**TEXT BOOKS:**

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

**REFERENCES BOOKS:**

1. Artificial Intelligence, P. H. Winston, Pearson Education.
2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
3. Principles of AI, N. J. Nilsson, Narosa Publishing House.



<b>ETCS202A</b>	<b>SOFTWARE ENGINEERING</b>	<b>C</b>
		<b>4</b>

### Course Overview:

Software engineering is the branch of computer science that creates practical, cost-effective solutions to computing and information processing problems, preferentially by applying scientific knowledge, developing software systems in the service of mankind. This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools. The course will combine a strong technical focus with a capstone project providing the opportunity to practice engineering knowledge, skills, and practices in a realistic development setting with a real client. The program's goal is to provide a professionally guided education in software engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.

### Objectives and Expected Outcomes:

All Software Engineering students will have demonstrated:

1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2. An ability to work in one or more significant application domains
3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4. Demonstrate an understanding of and apply current theories, models and techniques that provide a basis for the software lifecycle.

## UNIT I

**Introduction:** Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

**Software Requirements analysis & specifications:** Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.

## UNIT II

**Software Metrics:** Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO, COCOMO-II.

**System Design:** Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

**Coding:** TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

### UNIT III

**Unified Approach and Unified Modeling Language:** The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

**Software Reliability:** Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

### UNIT IV

**Software Testing:** Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

**Software Maintenance:** Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

#### TEXT BOOKS:

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, McGraw Hill Int. Ed.
3. W.S. Jawadekar, “Software Engineering – Principles and Practices”, McGraw Hill

#### REFERENCE BOOKS:

1. Stephen R. Schach, “Classical & Object Oriented Software Engineering”, IRWIN, TMH.
2. James Peter, W. Pedrycz, “Software Engineering: An Engineering Approach”, John Wiley & Sons.
3. I. Sommerville, “Software Engineering”, Addison Wesley.
4. K. Chandrasekhkar, “Software Engineering & Quality Assurance”, BPB.

<b>ETCS505A</b>	<b>TECHNICAL WRITING</b>	<b>C</b>
		<b>3</b>

### **Course Overview:**

This course will explore the ways that writing supports work in scientific and technical fields. Through a variety of assignments incorporating both written and visual formats, students in this course will learn effective strategies for responding to communication challenges, with special emphasis on audience analysis, document design, communication ethics, collaboration, professional style, and editing. You can expect to develop your ability to organize and craft information for manuals, journal articles, and reports and to learn about document design, production principles, interactive documentation, and desktop publishing. Technical writers are crucial for fields in engineering, software, and the sciences. Successful technical writers are good at translating science and technology for various audiences, including non-experts such as the end users of a product or customers who are willing to pay for technical solutions for a problem. Experts who work in technical and scientific fields can also benefit from familiarity and practice in technical writing.

### **Objectives and Expected Outcomes**

In this course, students will become acquainted with the forms, functions, and rhetorical lives of technical documents. Students will examine and produce a variety of technical documents:

- Information reports and memos
- Usability reports
- Technical instructions
- Technical descriptions
- Technical reports
- Technical manuals

In the course of preparing these documents, candidates will consider concepts such as how audiences affect these texts, document design principles, and the role of visuals or graphics in both written and oral texts. Students will combine analysis, organization, and visual elements to pursue high standards in document design culminating in a major technical writing project. The main outcomes of the course are

1. To understand the genre and manipulate the structure of selected technical documents;
2. To convey clearly, cogently and correctly, through written media, the technical aspects of a practice to non-specialist audiences;
3. To recognize and use the rhetorical and stylistic elements necessary for the successful practice of scientific and technical communication;
4. To work collaboratively and individually to research, to analyze, and to write about, public debates regarding the conduct of science and technology;
5. To appreciate your obligations as prospective practitioners in your chosen field to the laypersons affected by your work.

**UNIT 1: LANGUAGE SKILLS:** An introduction to language skills & Communication; listening and hearing, verbal & Nonverbal communication; Technical vs General writing; Prewriting Techniques; Writing with a purpose

**UNIT II: TECHNICAL COMMUNICATION:** An introduction; Writing emails, letters, and memos. Differences between writing for neutral and hostile audiences; Writing a Proposal; Types of technical communication; Project: Minor & Major; Project Management; Writing resumes and cover letters

**UNIT III: TECHNICAL WRITING:** How to do a research? Sources for data; Documentation; functions of reports; types of reports; purpose and significance of technical reports; Structure and lay out; Presentation skills; Delivering a presentation

**UNIT IV: FORMAL INTERACTION:** Running a Meeting effectively; Writing Instructions; Negotiation discussions; Formal Speeches; Job interviewing techniques & Mock Interview

**TEXT BOOK:** Sharma, R.C & Mohan, **Krishna**, “Business Correspondence and Report Writing”, Tata McGraw Hill Education Private Limited, New Delhi, 4<sup>th</sup> Ed . 2010.

**REFERENCE BOOKS:**

- David F. Beer and David McMurrey, *Guide to Writing as an Engineer*, 2<sup>nd</sup> ed., Wiley, 2004,.
- Dale Jungk, *Applied Writing for Technicians*, McGraw-Hill, 2005, ISBN 0-07-828357
- Diane Hacker, *Pocket Style Manual*, Bedford/St. Martin's, 2003, ISBN: 0312406843.
- . Raman, Meenakshi and Sharma, Sangeeta, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2<sup>nd</sup> Ed. 2012.
- Kumar, Sanjay & Lata, Pushp, “Communication Skills”, Oxford University Press, New Delhi, 1st Ed. 2011.

<b>ETCS506A</b>	<b>PYTHON PROGRAMMING</b>	<b>C</b>
		<b>4</b>

### **Course Overview:**

Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming, and graphical user interface-driven applications. The examples and problems used in this course are drawn from diverse areas such as text processing, simple graphics creation and image manipulation, HTML and web programming, and genomics.

### **Objectives and Expected Outcomes:**

The learning objectives of this course are:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to design object-oriented programs with Python classes.
- To learn how to use class inheritance in Python for reusability.
- To learn how to use exception handling in Python applications for error handling.

### **Unit I**

**Introduction to Python:** The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration

### **Unit II**

Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

### **Unit III**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions

### **Unit IV**

Simple Algorithms and Data structures: Search Algorithms, Sorting

Algorithms, Hash Tables

#### **Text Books:**

John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

#### **Reference Books**

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech
2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley
4. Kenneth A. Lambert, “Fundamentals of Python, First Programs”, CENGAGE Publication

<b>ETCS555A</b>	<b>PYTHON PROGRAMMING LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

Programming and problem-solving using Python. Emphasize on principles of software development, style, and testing. Topics include procedures and functions, iteration, recursion, arrays and vectors, strings, an operational model of procedure and function calls, algorithms, exceptions, object-oriented programming, and GUIs (graphical user interfaces). Weekly labs provide guided practice on the computer, with staff present to help. Assignments use graphics and GUIs to help develop fluency and understanding.

### **Objectives and Expected Outcomes:**

Upon a successful completion of this course students should be able to:

1. Be fluent in the use of procedural statements — assignments, conditional statements, loops, function calls — and sequences. Be able to design, code, and test small Python programs.
2. Understand the concepts of object-oriented programming as used in Python: classes, subclasses, inheritance, and overriding. Understand the basics of OO design.
3. Implement the data structures and use the built-in libraries for efficient codes.

### **List of Experiments**

1. Develop programs to understand the control structures of python
2. Develop programs to implement list
3. Develop programs to implement Dictionary
4. Develop programs to implement tuples
5. Develop programs to implement function with stress on scoping
6. Develop programs to implement classes and objects
7. Develop programs to implement exception handling.
8. Develop programs to implement linear search and binary search.
9. Develop programs to implement insertion sort
10. Develop programs to implement bubble sort.
11. Develop programs to implement quick sort.
12. Develop programs to implement heap sort.

<b>ETCS451A</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>C</b>
		<b>1</b>

### **Course Overview:**

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

### **Objectives and Expected Outcomes:**

Upon a successful completion of this course students should be able to :

1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs
2. Understand different types of AI agents Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)
3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving
4. Know how to build simple knowledge-based systems
5. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

### **LIST OF EXPERIMENTS**

Write the following programs using PROLOG.

1. Write a program to solve 8-queens problem.
2. Solve any problem using depth first search.
3. Solve any problem using best first search.
4. Solve 8-puzzle problem using best first search
5. Solve Robot (traversal) problem using means End Analysis.
6. Solve traveling salesman problem.



<b>ETCS252A</b>	<b>SOFTWARE ENGINEERING LAB</b>	<b>C</b>
		<b>1</b>

Hands-on experiments related to the course contents ETCS202A by performing all laboratory assignments:

### **LIST OF EXPERIMENTS**

1. To identify the role of the software in today's world across a few significant domains related to day to day life Create SRS document of admission management for your university
2. To identify the problem related to software crisis for a given scenario
3. To identify the suitable software development model for the given scenario.
4. To identify the various requirement development activities viz. elicitation, analysis, specification and verification for the given scenario
5. To identify the various elicitation techniques and their usage for the Banking case study.
6. Identify the elements in Software Requirements Specification for a given document.
7. Draw E-R Diagram for Hockey League.
8. Draw a context diagram and a level-1 diagram that represent the selling system at the store.
9. Find out all software metrics for a Quadratic Equation program written in 'C'.
10. Identify the design principle that is being violated in relation to the given scenario.
11. To identify the usage of stubs or drivers in the context of an integration testing scenario.
12. Identify the different types of performance testing.
13. Identify the usage of regression testing.
14. Write various white box test cases to test the internal behavior of above program.
15. Write various Black box test cases to test the functionalities of above program.

<b>ETCA368A</b>	<b>MAJOR PROJECT</b>	<b>C</b>
		<b>3</b>

The major-project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a Dissertation in the standard format for being evaluated by the Department.
6. Final Seminar Presentation before a Departmental Committee.