

# **Course Description-CSE (AI & ML)**

## **1<sup>st</sup> Semester**

**Course Name:** Engineering Mathematics

**Course Code:** MA101

**L-T-P scheme:** 3-1-0

**Credits:** 4

**Prerequisite:** Students should have basic knowledge of Algebra and calculus.

**Objective:** This course is aimed:

- To introduce the calculus of functions of two variables and applicability of derivatives and integrals of vector functions to Analytical geometry and physical problems.
- To make students aware of the basic mathematical concepts and methods which will help them in learning courses in engineering and Technology.

**Learning Outcomes:**

<b>Course Outcome</b>	<b>Description</b>
CO1	Understand the rank, eigen values, eigen vectors, diagonalization of matrix; compute inverse of matrix by Caley-Hamilton theorem.
CO2	Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, and solve it by Gauss elimination method.
CO3	Interpret derivatives and integrals of multivariable functions geometrically and physically; implement multivariable calculus tools in engineering, science, optimization, and understand the architecture of surfaces in plane and space etc.
CO4	Know about piecewise continuous functions, Laplace transforms and its properties; use of Laplace transform and inverse transform for solving initial value problems.
CO5	Realize importance of line, surface and volume integrals, Gauss and Stokes theorems and apply the concepts of vector calculus in real life problems.
CO6	Formulate mathematical models in the form of ordinary differential equations and learn various techniques of getting solutions of linear differential equations of second order.

**Course Contents:**

**Unit 1:** Algebra of matrices, Determinants, Rank, Gauss elimination method, Eigen values and vectors. Quadratic forms.

**Unit 2:** Partial differentiation. Taylor's series. Maxima and minima. Jacobians, Double integrals,

**Unit 3:** Differential Equations with constants coefficients.

**Unit 4:** Gradient, divergence and curl. Line and surface integrals, Normal and tangent to a surface. Gauss and Stokes theorems, Equations to a line, plane, curve and surfaces.

**Unit 5:** Laplace transforms.

**Methodology:**

The course will be covered through lectures supported by tutorials. There shall be 3 Lectures per week where the teacher will explain the theory, give some examples supporting the theory and its applications. About 12 Tutorial Sheets covering whole of the syllabus shall be given. Difficulties and doubts shall be cleared in tutorials. Apart from the discussions on the topics covered in the lectures, assignments/ quizzes in the form of questions will also be given.

**Evaluation Scheme:**

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

**Learning Resources:**

Tutorials, lecture slides and books on mathematics-1 will be available on the JUET server.

**Books**

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley Publishers.
2. Lipschutz, S., Lipschutz M.: Linear Algebra, 3<sup>rd</sup> Ed, Schaum series 2001.
3. B. V. Raman: Higher Engineering Mathematics, McGraw-Hill Publishers.
4. R.K. Jain, S.R.K. Iyenger: Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.
5. Thomas, G.B., Finney, R.L.: Calculus and Analytical Geometry, 9<sup>th</sup> Ed., Addison Wesley, 1996.
6. Grewal, B.S. : Higher Engineering Mathematics, Khanna Publishers Delhi.

**Title of Course: Engineering Physics-I**

**Course Code: PH101**

**L-T Scheme: 3-1-0**

**Course Credits: 4**

**Objective:** Broadly, the study of Physics improves one's ability to think logically about the problems of science and technology and obtain their solutions. The present course is aimed to offer a broad aspect of those areas of Physics which are specifically required as an essential background to all engineering students for their studies in higher semesters. The course intends to impart sufficient scientific understanding of different phenomena associated with Special relativity, Modern Physics, Statistical physics, atomic physics, and lasers.

**Course Outcomes:**

Course Outcome	Description
CO1	Describe the limitations of Newton's laws and explain when special relativity become evant, Learn to Apply the principles of Special Relativity to an extended range of problems olving particle kinematics
CO2	Demonstrate the ability to explain the concepts related to the consequences of Special Relativity, the nature of space-time and related dynamic observables
CO3	Acquired a profound understanding of inadequacy of classical mechanics regarding phenomena related to microscopic level, Become well versed with the experimental developments, historical account and importance of probabilistic interpretation
CO4	Understand the basic quantum mechanical ideas and relevant mathematical framework, approach the solution of one dimensional time independent Schrodinger equation
CO5	Appreciate the importance of applying statistical ideas to explore thermodynamic variables, Developed ability to identify and apply appropriate statistical method for describing the assembly of microscopic particles, comprehend basic properties and working of Laser systems

**Course Contents:**

**Unit-I (Theory of Special Relativity):** Frames of reference, Galilean transformation, Michelson Morley Experiment, Postulates of special theory of relativity, time dilation and length contraction, twin paradox, Lorentz transformations, addition of velocities, Relativistic Doppler effect, Mass variation with velocity, Mass-energy relation.

**Unit-II (Introduction to Modern Physics):**

Quantization of Radiation, Black body radiation, Rayleigh-Jeans law, Planck's law of radiation Wien's law, Stefan's law, Photoelectric effect Compton scattering, Atomic spectra, Bohr model of hydrogen atom, Frank hertz experiment, Matter waves, de Broglie hypothesis, Davisson Germer experiment

**Unit III Quantum Mechanics**

Wave packets, phase and group velocity, Heisenberg's uncertainty principle, Schrödinger wave equation and its applications to the free particle in a box, potential barrier and Harmonic oscillator

**Unit-IV (Statistical Mechanics):** Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions and their applications.

**Unit- V Laser Physics & Applications**

Fundamental ideas of stimulated and spontaneous emission, Einstein's coefficients, Principle and working of laser, Different types of lasers (He-Ne Laser, Ruby Laser, Semiconductor Laser), Applications of Lasers

**Text Books and References:**

1. A. Beiser, Perspectives of Modern Physics, Tata McGraw Hill.
2. J R Taylor, C D Zafiratos, M A Dubson, Modern Physics for Scientist & Engineers, Pearson Education.
2. K Krane, Modern Physics, Wiley India
3. J Bernstein, P M Fishbane, S. Gasiorowicz, Modern Physics, Pearson Education.
5. B. B. Laud, Laser and Non-Linear Optics, New Age International (P) Ltd.
6. R. Resnick, Relativity, New Age.

**Title: English**

**Code: HS101**

**L-T-P scheme: 2-0-2**

**Credit: 3**

**Prerequisite:** None

**Objective:**

1. To enable understanding of basics of communication in Business environment.
2. To provide insight into structural aspect of communication in business.
3. To impart knowledge about communication theory and develop skills in oral and non verbal communication.
4. To improve skills as critical readers, thinkers, listener and writer.

**Learning Outcomes:**

Course Outcome	Description
CO1	Outline the basic concept of verbal/ nonverbal skills to understand the role of effective communication in personal & professional success.
CO2	Describe drawbacks in listening patterns and apply listening techniques for specific needs.
CO3	Develop the understanding to analyze, interpret and effectively summarize a variety of textual content
CO4	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus.
CO5	Create effective presentations
CO6	Create professional and technical documents that are clear and adhering to all the necessary convention.

**Course Content:**

**Unit-1: Concept and Nature of Communication :** Definition of Communication, Process & Stages of Communication, Barriers to Communication, Channels of Communication.

**Unit-2: Listening Skills:** The listening process, Importance of listening, Purpose and types of listening, Hearing and listening, Listening with a purpose, Barriers to listening.

**Unit-3: Speaking/Oral Skills:** Importance of acquiring oral skills, Visual aids, Body Language, Delivery, Pronunciation, Use of connectives Organization of matter: Metadiscourse features, Textual organization, 7 C'S of effective communication , Improving vocabulary by learning Root words in English, Some foreign words, Reading comprehension, Some important synonyms and antonyms, commonly confused words, Etiquettes & grooming.

**Unit-4: Reading Skills:** Skimming and Scanning, Intensive and extensive reading, SQ3R Technique

**Unit-5: Writing Skills:** Business letters, Memo, Circulars, Notices, Report writing, resume writing, Agenda & Minutes writing, Tips on clear writing Translation- Hindi to English, Translation -English to Hindi.

**Unit-6: Introduction to Modern Communication Media:** Technology based communication tools, Committee types, Advantages, Conferences, Audio-video conferencing, Barriers and overcoming negative impact.

**Unit-7: Public Speaking and Interviewing Strategies:** Speech Preparation, Theory of group discussion, Participation in Group discussion, Oral presentation, Power point presentation ,Tips for successful job interview, Do's and don'ts while appearing for interview, Mock interview, Some interview questions, Telephonic interview tips, Resume writing

**Evaluation Scheme:**

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3,& Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-7 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

**Teaching Methodology:**

The course will be taught with the aid of lectures, handouts, case studies, Task-based language learning, and comprehensive language learning through language lab.

**Learning Resources:**

Lecture slides and e-books on ENGLISH (will be added from time to time): Digital copy will be available on the JUET server.

**Text Book:**

1. K.K. Sinha- Business Communication (Galgotia Publications)

**Reference Books:**

1. R.C. Bhatia- Business Communication (Ane Books Pvt. Ltd.)
2. P.D. Chaturvedi – Business Communication (Pearson Education, 1st Edition 2006).
3. Lesikar RV & Pettit Jr. JD – Basic Business Communication: Theory & Application (Tata Mc Graw Hill, 10<sup>th</sup> Edition)
4. Wren & Martin, High School English Grammar & Composition – S. Chand & Co. Delhi.
5. Raman Meenakshi & Sharma Sangeeta, Technical Communication-Principles & Practice –O.U.P. New Delhi. 2007.
6. Mitra Barum K., Effective Technical Communication – O.U.P. New Delhi. 2006.
7. Better Your English- a Workbook for 1st year Students- Macmillan India, New Delhi.
8. Raymond Murphy, ' Essential English Grammar', Cambridge University Press.

**Title: Computer Programming**  
**L-T-P scheme: 3-1-0**

**Code: CS101**  
**Credit: 4**

**Prerequisite:** There is no prerequisite in this course; however, students having any prior experience of programming are desirable.

**Objective:**

1. To provide exposure to problem-solving through programming.
2. To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

**Learning Outcomes:**

Course Outcome	Description
CO1	Makes students gain a broad perspective about the uses of computers in engineering industry.
CO2	Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO3	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO4	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
CO5	Introduces the more advanced features of the C language

**Course Content:**

**Unit-1: Introduction to Programming:** Basic computer organization, operating system, editor, compiler, interpreter, loader, linker, program development. Variable naming, basic function naming, indentation, usage and significance of comments for readability and program maintainability. Types of errors, debugging, tracing/stepwise execution of program, watching variables values in memory. Constants, Variables and data Types Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, assigning values to variables, typedef, and Defining symbolic constants. printf & scanf function.

**Unit-2: Operators and Expression:** Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Special Operators, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associativity.

**Management Input and Output Operators:** Introduction, reading a character, writing a character, formatted input, formatted output.

**Unit-3: Decision Making Branching:** Introduction, Decision making with IF statement, the IF-ELSE statement, nesting of IF-ELSE statement, ELSE-IF ladder, SWITCH statement, ternary operator, and the GOTO statement.

**Looping:** Introduction, the WHILE statement, the DO statement, The FOR statement, Break and Continue.

**Unit-4: Array:** Introduction, One-dimensional arrays, Two-dimensional arrays, arrays, Concept of Multidimensional arrays.

**Handling of Character strings:** Introduction, Declaring and initializing string variables, reading string from terminal, writing string to screen, String, Operations: String Copy, String Compare, String Concatenation and String Length (using predefined functions & without using them), Table of strings.

**Unit-5: User-Defined Functions (UDF):** Introduction, need for user-defined functions, the form of C function, elements of UDF, return values and their types, Calling a function, category of functions, Nesting of functions, Recursion, Functions with arrays, The scope and Lifetime of variables in functions, multi file program.

**Structures and Unions:** Introduction, Structure definition, declaring and initializing Structure variables, accessing Structure members, Copying & Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions.

**Unit-6: Pointers:** Introduction, understanding pointers, Accessing the address of variable, Declaring and initializing pointers, accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers & character strings, Pointers & Functions, Function returning multiple values, Pointers and structures.

**File Management in C and CONSOLE I/O:** Introduction, Defining files and its Operations, Error handling during I/O operations, Random access files, Command line arguments. Types of files, File vs. Console, File structure, File attributes, Standard i/o, Formatted i/o, Sample programs.

### Teaching Methodology:

This course is introduced to help students understand the discipline of programming. The programming language used to teach this course is C. Starting from the basic computer architecture, the student will slowly be exposed to program designing and later to programming fundamentals. The entire course is broken down into six separate units, from fundamentals of programming to some complex programming structures like pointers. This theory course is well complemented by a laboratory course under the name Software Development Fundamentals Lab in the same semester that helps a student learn with hand-on experience.

### Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 20-30% from coverage till Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage till Test-2
Assignment	10 Marks	
Tutorials	5 Marks	



Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### **Learning Resources:**

Tutorials and lecture slides on Software Development Fundamentals (will be added from time to time): Digital copy will be available on the JUET server.

### **Text Book:**

- [1] Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill.
- [2] Programming With C, Schaum Series.

### **Reference Books/Material:**

- [1] The 'C' programming language by Kernighan and Ritchie, Prentice Hall
- [2] Computer Programming in 'C' by V. Rajaraman, Prentice Hall
- [3] Programming and Problem Solving by M. Sprankle, Pearson Education
- [4] How to solve it by Computer by R.G. Dromey, Pearson Education

### **Web References:**

- [1] <http://www2.its.strath.ac.uk/courses/c/>  
Notes on C programming by University of Strathclyde Computer Centre. This tutorial was awarded the NetGuide Gold Award during the 1990s.
- [2] [http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C\\_%28programming\\_language%29.html](http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html)  
This site contains notes on C programming from Princeton University, USA. These are very useful for students who are learning C as their first programming Language.
- [3] <http://www.stat.cmu.edu/~hseltman/Computer.html>  
Online reference material on Computers and Programming from Carnegie Mellon University, Pittsburgh, USA
- [4] <http://projecteuler.net/>  
Collection of mathematical problems which make you use your programming skills

**Title: Engineering Physics Lab-I**

**L-T-P scheme: 0-0-2**

**Code: PH201**

**Credit: 1**

**Learning Outcomes**

Course Outcome	Description
CO1	Demonstrate ability to collect experimental data and understanding the working procedures within the precautionary limits
CO2	Acquired the ability to analyze the experimental data and related errors in a reflective, iterative and responsive way
CO3	Developed understanding of the basic concepts related to Modern Physics, Basic Solid State Physics and Optics
CO4	Acquired a first hand and independent experience of verifying Kirchoff's circuit laws and related concepts e.g. resistivity, measurement of resistance
CO5	Appreciate the importance of the laboratory work culture and ethics that is intended to impart features like regularity, continuity of self evaluation and honesty of reporting the data

**List of Experiments**

1. To study the variation of magnetic field along the axis of Helmholtz Galvanometer and to determine its reduction factor.
2. To determine the resistance per unit length of a Carey Foster's bridge and to obtain the specific resistance of a given wire.
3. To determine the wavelengths of spectral lines Red, Green and Violet of mercury using plane transmission grating.
4. To determine the specific rotation of cane sugar solution using Bi-quartz polarimeter.
5. To observe Newton's rings and to determine the wavelength of sodium light.
6. To study the CRO and function generator by producing the following waveforms.
  - i. 10kHz, 8V<sub>p-p</sub>(sine wave, square wave, triangular wave)
  - ii. 4kHz, 6V<sub>p-p</sub>(sine wave, square wave, triangular wave)
  - iii. 10kHz, 8V<sub>peak</sub>(sine wave, square wave, triangular wave)
  - iv. 4kHz, 6V<sub>peak</sub>(sine wave, square wave, triangular wave)
7. To verify the Kirchhoff's current law.
8. To verify the Kirchhoff's voltage law.

**Title: Computer Programming Lab**

**Code: CS201**

**L-T-P scheme: 0-0-4**

**Credit: 2**

**Prerequisite:** Experience in programming is desirable.

Objective:

1. To provide exposure to problem-solving through programming.
2. To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
3. To give the student hands-on experience with the concepts.

**Learning Outcomes:**

Course Outcome	Description
CO1	Makes students gain a broad perspective about the uses of computers in engineering industry.
CO2	Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO3	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO4	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
CO5	Introduces the more advanced features of the C language

**Course Content:**

The following assignments will be carried out in synchronization with the theory classes.

**Unit-1:** Introduction to programming Environment (Linux commands, editing tools such as vi editor, sample program entry, compilation and execution). Development of programs using multiple arithmetic and logical operators. Programs for Roots of quadratic equation, conversion of units etc.

**Unit-II:** Programs using simple control statements such as if else, while, do while etc. Making a program for a calculator for example. Extracting the digits of an integer, reversing digits, finding sum of digits etc.

**Unit-III:** Programs using For loop, switch statement etc. For example, Finding average of numbers, printing multiplication tables etc. Checking for primes, generation of Armstrong numbers. Generation of the Fibonacci sequence, Finding the square root of a number, calculation of factorials, printing various patterns using for loop. The greatest common divisor of two integers, Raising a number to large power.

**Unit-IV:** Programs using Arrays: declaring and initializing arrays. Program to do simple operations with arrays. Strings – inputting and outputting strings. Using string functions such as strcat, strlen etc. Writing simple programs for strings without using string functions. Finding the maximum number in a set, Array order reversal, Finding maximum number from an array of numbers Removal of duplicates from an ordered array,

**Unit-V:** Selection/ Bubble/ Insertion sort, create a linked list, traverse a linked list, insert a node and delete a node from the list. Recursion and related examples such as Tower of Hanoi, computing factorial etc. Practice sessions and sessions for missed labs

### Units to Lab Mapping:

Unit	Labs
I	1, 2, 3
II	4, 5
III	6, 7, 8
IV	9, 10, 11
V	12, 13, 14

### Teaching Methodology:

This course is introduced to help students understand the discipline of programming. The programming language used to teach this course is C. Starting from the programming environment setup, the student will slowly be exposed to program designing and later to programming fundamentals. The entire course is broken down into six separate units, from fundamentals of programming to some complex programming structures like pointers. This theory course is well complemented by a laboratory course under the name Software Development Fundamentals Lab in the same semester that helps a student learn with hand-on experience.

### Evaluation Scheme:

Exams		Marks	Coverage
P-1		15 Marks	Based on Lab Exercises: 1-6
P-2		15 Marks	Based on Lab Exercises: 7-13
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

### Learning Resources:

Study material of Software Development Fundamentals Lab (will be added time to time):  
Digital copy will be available on the JUET server.

**Text Book:**

1. Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill.
2. Programming With C, Schaum Series.

**Reference Books/Material:**

1. The 'C' programming language by Kernighan and Ritchie, Prentice Hall
2. Computer Programming in 'C' by V. Rajaraman, Prentice Hall
3. Programming and Problem Solving by M. Sprankle, Pearson Education
4. How to solve it by Computer by R.G. Dromey, Pearson Education

**Web References:**

1. <http://www2.its.strath.ac.uk/courses/c/>
  - a. Notes on C programming by University of Strathclyde Computer Centre. This tutorial was awarded the NetGuide Gold Award during the 1990s.
2. [http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C\\_%28programming\\_language%29.html](http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html)
  - a. This site contains notes on C programming from Princeton University, USA. These are very useful for students who are learning C as their first programming Language.
3. <http://www.stat.cmu.edu/~hseltman/Computer.html>
  - a. Online reference material on Computers and Programming from Carnegie Mellon University, Pittsburgh, USA
4. <http://projecteuler.net/>
  - a. Collection of mathematical problems which make you use your programming skills

**Title: Workshop Practices**  
**L-T-P scheme: 0-0-3**

**Code: ME201**  
**Credit: 1.5**

**Prerequisite:** Students must have the knowledge of fundamental principles of Physics and Chemistry upto class 12<sup>th</sup> which helps them to understand the various process of Workshop Lab.

**Objective:**

1. To demonstrate students, the basic manufacturing processes of Workshop lab: Carpentry, Fitting, Welding, Machining and Casting Processes.
2. To develop effective skills in students to identify the manufacturing process with its applications
3. To be able to perform basic manufacturing processes safely.

**Learning Outcomes:**

Course Outcome	Description
CO1	Identify the various processes of manufacturing.
CO2	Capable to explain the use of various holding, measuring, marking and cutting tools of workshop
CO3	Prepare a useful job by performing the various processes in proper sequence safely
CO4	Apply Bernoulli's theorem to analyze the liquid metal velocity in casting process.
CO5	Develop the skills to join two metallic specimen using welding process
CO6	Work as a team on a project

**Course Content:**

**Carpentry Shop**

1. To study about various tools/equipments used in carpentry shop
2. To make Cross lap /T joint as per given specification
3. To make Cross lap /T joint as per given specification

**Foundry Shop**

1. To study about various tools used in foundry shop.
2. To prepare a green sand mould with the help of a given pattern.
3. To perform permeability test on moulding sand

**Machine Shop**

1. To study various machine tools such as lathe, milling, shaper, drilling, grinding, EDM drill and cutting tools used by them.
2. To perform turning, step turning and taper turning operations on lathe machine
3. To perform threading operation on the lathe machine

**Fitting Shop**

1. To study about various tools used in fitting shop.

2. To make a fitting job as per given drawing.

### **Welding Shop**

1. To study various types of welding processes available in the workshop such as Electric arc welding, TIG and MIG welding, gas welding and spot resistance welding,
2. To prepare welding joint by using Electric arc welding/gas welding
3. To prepare welding joint by using Spot Resistance welding

### **Teaching Methodology:**

This Lab course has been introduced to help a student to learn with hand-on experience on machines. The entire course is broken down into fourteen experiments. Experiments are performed different shop wise by taking the proper safety precautions. Workshop lab includes five shops namely: Carpentry, Foundry, Machining, Fitting and Welding. Basic principles of manufacturing processes are applied to prepare a job. Students learn here how to handle the real world problems by using technical skills. The way of experimentation here realizes the students that they are now moving on an Engineering path. This Lab course will enable a student to learn with hand-on experience.

### **Evaluation Scheme:**

Exams		Marks	Coverage
P-1		15 Marks	Based on Lab Experiments: 1-7
P-2		15 Marks	Based on Lab Experiments: 8-14
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

### **Learning Resources:**

Laboratory Manual available in Lab. Study material of Workshop Lab (will be added time to time): Digital copy will be available on the JUET server.

### **Text Books:**

- [1] “Workshop Technology Volume- I & II”, B.S. Raghuvanshi, Dhanpat Rai & Co.
- [2] “Workshop Technology Volume-I & II”, Khanna Publisher.

### **Reference Books:**

- [1] “Workshop Technology Vol.- 1, 2, 3 & 4”, Butterworth-Heinemann.
- [2] “Material Science & Engineering”, W. D. Callister, John Wiley

### **Web References:**

- [1] <https://nptel.ac.in/courses/112/107/112107219/>
- [2] <https://nptel.ac.in/courses/112/107/112107144/>

# **Course Description**

## **IInd Semester**

**Title: Life Skills and Effective Communication**  
**L-T-P scheme: 1-0-2**

**Code: HS104**  
**Credit: 2**

***Prerequisites: None***

***Objective:***

1. To employ positive behavior management techniques and to develop skills to manage their own behavior effectively
2. To develop one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete.
3. To enhance the employability and maximize the potential of the students by introducing them to the principles that underlying personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

**Learning Outcomes:**

CO1	Outline different life skills required in personal and professional life.
CO2	Describe the application of different theoretical perspectives within the field of motivation and applying these motivation theories to everyday settings (e.g., business, social interactions, education)
CO3	Develop the understanding of personality and shaping behavior through personality
CO4	Identify the basic mechanics of perception by demonstrating these through presentations.
CO5	Apply well-defined techniques to cope with emotions and stress and develop an awareness of the self.
CO6	Understand the basics of leadership and Learning

**Course Content:**

**Unit-1:** Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

**Unit-2:** Motivation: Morale and Morale Building, Need and Importance of motivation, Process and types of motivation, Theories of motivation, Essentials of Good Motivation system

**Unit-3:** Overview of Personality concept and types, Personality traits, Factors that help in shaping personality, Theories of personality, Measurement of personality

**Unit-4:** Perception: - Factors affecting perception, Perceptual mechanisms Perceptual errors and distortions, Behavioral applications of perceptions

**Unit-5:** Self Awareness, Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, Stress Management: Stress, reasons and effects, identifying stress, Managing Stress

**Unit-6:** Conflict Management –sources, process and resolution of conflict



**Unit-7:** Leadership: Need for Leadership, Models of leadership development, and Characteristics of a good leader.

**Unit-8:** Learning: Concepts and Theories, classical conditioning, operant conditioning, Biological influences, Cognitive influences, Social learning theory, Behavioral modification theory

### Teaching Methodology:

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. This course will equip students with the social and interpersonal skills that enable them to cope with the demands of everyday life. There will be a particular focus on social-cognitive processes and how situational factors trigger various emotions and corresponding motives that can then drive behavior. The main objectives of this course is to build self-confidence, encourage critical thinking, foster independence and help students to communicate more effectively

### Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1, Unit-2 & Unit-3
Test-2	25 Marks	Based on Unit-4 & Unit-5 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-6, Unit-7 & Unit-8 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### Learning Resources:

Case studies, video lectures and lecture slides on Life Skills (will be added from time to time):  
Digital copy will be available on the JUET server.

### Text Book:

1. "Effective Communication and Soft Skills"; Nitin Bhatnagar, Pearson Education India, 1e, 2011
2. "Personality Development and Soft Skills"; Barun Mitra, Oxford Higher Education, 2016
3. "Sizzling Soft Skills for Spectacular Success"; P. Ameer Ali, Notion Press, 2017
4. "Organizational Behavior"; Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Pearson Education India, 16e, 2016
5. "Managing Organisations"; Rachna Chaturvedi, Vikas Publications, 2013

### Reference Books/Material:

1. "The Power of Your Subconscious Mind"; Joseph Murphy, General press, 2015
2. "The Life-Changing Magic of Tidying Up: The Japanese Art of De cluttering and Organizing"; Marie Kondō, 1e, Ten speed Press, 2011
3. "The Power of Habit: Why We Do What We Do in Life and Business"; Charles Duhigg, Random House, 2012

**Course Title: Discrete Mathematics**

**Course Code: MA105**

**L-T-P scheme: 3-1-0**

**Credits: 4**

**Objectives:**

The aim of the course is to cover the basic principles sets relations functions partially ordered set, lattice, Boolean algebra and its applications. The main objective of the course is to develop in student, an intuitive understanding of graphs by emphasizing on the real world problems.

**Course Outcomes:**

At the end of the course, the student is able to:

CO1	Employ De Moivre's theorem in a number of applications to solve numerical problems.
CO2	Appreciate the definition and basics of graphs along with types and their examples.
CO3	Visualize the applications of graph theory to network flows. Understand the notion of planarity and coloring of a graph. Relate the graph theory to the real-world problems.
CO4	Understand the definition of a tree and learn its applications to fundamental circuits.
CO5	Solve real-life problems using finite-state and Turing machines
CO6	Learn about partially ordered sets, lattices and their types, Boolean algebra and Boolean functions, logic gates, switching circuits and their applications.

**Course Contents:**

**Unit 1:** Basics of set theory, Mathematical induction. Relations, Equivalence relation, partial- ordered relation algorithms and functions.

**Unit 2:** Big O notation, Proposition, Basic logical operators, Propositional functions and Quantifiers.

**Unit 3:** Graphs and related definitions, Eulerian and Hamiltonian graphs, Graph colorings. Trees, Algebraic expressions and Polish notation, shortest path.

**Unit 4:** Algebraic Systems. Lattice and Boolean Algebra.

**Unit 5:** Language, Finite State Automata and Machines. Grammars.

**Methodology:**

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

### Evaluation plan:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### References:

1. B. A. Davey & H. A. Priestley (2002). "Introduction to Lattices and Order" (2nd edition) Cambridge University, Press.
2. Edgar, G. Goodaire & Michael M. Parmenter (2018). "Discrete Mathematics with Graph Theory" (3rd edition). Pearson Education.
3. Rudolf Lidl & Günter Pilz (1998). "Applied Abstract Algebra" (2nd edition).Springer.
4. Kenneth H. Rosen (2012). "Discrete Mathematics and its Applications: With Combinatorics and Graph Theory" (7th edition), McGraw-Hill.
5. C. L. Liu (1985). "Elements of Discrete Mathematics" (2nd edition). McGraw- Hill.

**Title of Course: Engineering Physics-II**

**Course Code: PH102**

**L-T Scheme: 3-1-0**

**Course Credits: 4**

**Objective:**

Broadly, the study of Physics improves one's ability to think logically about the problems of science and technology and obtain their solutions. The present course is aimed to offer a broad aspect of those areas of Physics which are specifically required as an essential background to all engineering students for their studies in higher semesters. At the end of the course, the students will have sufficient scientific understanding of basic vector calculus, electrostatics, magnetostatics, electromagnetic fields and waves, basic understanding of physics of semiconducting materials

**Course Outcomes:**

<b>Course Outcome</b>	<b>Description</b>
CO1	Learn to apply the basic concepts of vector calculus and understanding of various co-ordinate systems and related properties, Demonstrate basic understanding of formulation and induction of electric field produced by static charge distributions
CO2	Evaluate the electrostatic field due to symmetric charge distributions, Understand the utility of formulation of electric potential and solve related problems using special techniques and boundary conditions
CO3	Acquired understanding of electrostatic fields inside matter, Explain the magnetic field due to moving charge distribution, evaluate the magnetic field due to current distribution in space,
CO4	appreciate the importance of Maxwell's equations and understand the electromagnetic wave propagation in free space Categorisation of materials on the basis of band structure
CO5	Developed understanding of quantum mechanical origin of band formation in solids, describing the energy state of electrons in crystalline materials, comprehend basic carrier properties

**Course Content:**

**Unit I (*Electrostatics*)**

Review of vector calculus, Cartesian, spherical polar and cylindrical co-ordinate systems, concept of gradient, divergence and curl, Coulomb's law, Gauss law and its applications, Boundary condition on electrostatic field, electric potential, Laplace equation, Poisson equation and related boundary value problems, capacitance, electrostatic fields in matter [10]

**Unit II (*Magnetostatics*)**

Lorentz force, cyclotron formula, line, surface and volume currents, , Biot-Savart law and its applications, Ampere's law and its applications, equation of continuity, Faraday's law of electromagnetic induction, boundary conditions on magnetic field, Magnetic field in matter [08]

### **Unit III (Electromagnetic field)**

Maxwell's equations in free space and matter, Maxwell correction to Ampere's law, Electromagnetic waves in free space and matter, Transverse nature of em waves and Polarization, Propagation of electromagnetic field in free space and Poynting vector, Poynting theorem, Normal incidence of em waves [10]

### **Unit IV (*Elements of Solid State Physics*)**

Basic ideas of bonding in solids, Crystal structure, X-ray diffraction, Band theory of solids, Distinction between metals, semiconductors and insulators [04]

### **Unit V (*Physics of Semiconductors*)**

Band theory of solids, Kronig Penney model, effective mass, Direct and indirect bandgap semiconductors, optical and thermal properties, Fermi-Dirac Distribution in semi-conductors, Equilibrium carrier concentrations in intrinsic and extrinsic semiconductors, Fermi energy variation with temperature and impurity concentration, Hall Effect in semiconductors, P-N junction characteristics [10]

### **Text/ Reference Books:**

1. D.J. Griffiths, *Introduction to electrodynamics*, Prentice Hall of India Ltd.
2. B.G. Streetman, S. Banerjee, *Solid State Electronic Devices*
3. *Semiconductor Physics and Devices*, Donald A. Neamen
4. Boylstad and Nashelsky, *Electronic Devices and Circuits*, PHI, 6e, 2001.
5. J. Reitz, F. Milford and R. Christy, *Foundation of Electromagnetic Theory*, Narosa Publishing.
6. J. Millman and C.C. Halkias, *Electronic Devices and Circuits*, Millman, McGra-Hill

**Title: Electrical Science**

**Code: EC101**

**L-T-P Scheme: 3-1-0**

**Credit: 4**

**Prerequisite:** Students must have studied the core concepts of “*Physics-I*”.

**Course Objectives:**

1. This course is designed for developing the understanding about basics of electrical and electronics concepts.
2. In this course students will have an enough idea about the working of systems and enable them to analyze a circuit.

**Learning Outcomes:**

1. The students shall acquire the generic skills to study & analyze the electrical and electronic systems.
2. This course will enable them to think and design various applications of the electrical and electronics at basic level.

The student will be able to:

Course Outcome	Description
CO1	Understand the basic electrical and electronics component and their importance determine the current, voltage and power.
CO2	Apply networks laws and theorems to solve electric circuits and may understand circuit reduction techniques with their advantages.
CO3	Understand charging discharging Steady state and transient
CO4	Demonstrate the use of semiconductor diodes in various applications.
CO5	Discuss and explain the working of transistors Amplifiers, their configurations and applications.
CO6	Analysis concept and two port networks simplification technique.

**Course Content:**

**Unit I: Basic Electrical Circuit:** Electromotive Force (EMF), Terminal Voltage; Resistance ( $R$ ), Inductance ( $L$ ) and Capacitance ( $C$ ) from (i) Circuit, (ii) Energy, and (iii) Geometrical Points of View; Voltage Divider, Current Divider; Star-Delta Transformation; Voltage Source and Current Source, Source Transformation, Combination of Sources; Controlled (Dependent) Sources. **Unit 2:** **Methods of Analysis:** Kichhoff’s Circuit Laws; Loop-Current Analysis, Mesh Analysis; Node-Voltage Analysis; Choices of Method of Analysis.

**Unit 3: Network Theorems (DC Circuits):** Superposition Theorem; Thevenin's Theorem; Norton's Theorem; Maximum Power Transfer Theorem.

**Unit 4: DC Transients:** Simple  $RL$  Circuit, Time Constant, Decay and Growth of Current; Simple  $RC$  Circuit, Discharging of a Capacitor, Charging of a Capacitor.

**Unit 5: Two-Port Networks:** Impedance, Admittance, Hybrid, Transmission Parameters; Equivalent Networks.

**Unit 6: Diodes and its Applications:** Unidirectional property,  $PN$ -junction with no bias, with forward bias and with reverse bias,  $V$ - $I$  characteristics, Comparison of Si and Ge diodes, Temperature effects, Diode resistance (static and dynamic), Diode equation, Ideal diode, Circuit model of a diode. Half-wave and full-wave (centre tap and bridge) rectifiers, PIV rating of diode, Performance of half-wave and full-wave rectifiers, Shunt capacitor filter. Clippers: Series and Parallel, Limiters, Clampers. Zener diode, Analysis of Zener voltage regulator. LED, varactor diode .

**Unit 7: Transistor:** BJT Structure, Working of a transistor, Transistor current equation, Collector reverse saturation current, DC alpha of a transistor. The three configurations, CB and CE input and output characteristics.

### Teaching Methodology:

Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

### Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15	Based on Unit-1 & Unit-2
Test-2	25	Based on Unit-3, Unit-4 & Unit-5 and around 30% from coverage of Test-1
Test-3	35	Based on Unit-6 to Unit-7 and around 30% from coverage of Test-2
Assignment	10	Based on Unit-1, Unit-2 & Unit-3
Tutorials	5	Based on Unit-4 & Unit-5
Quiz	5	Based on Unit-6 & Unit-7
Attendance	5	Based on attendance in the theory classes
<b>Total</b>	<b>100</b>	

**Learning Resources:**

Tutorials sheets, lecture slides and handwritten notes on Electrical circuit, Electrical Science and Basic Electronics (will be added from time to time): Digital copy will be available on the JUET server.

**Text-Books:**

1. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill Education, 2009.
2. W.H. Hayt, J. E. Kemerly & S.M. Durbin, “Engineering Circuit Analysis (Sixth Edition)”, McGraw Hill, 2006.
3. R.C. Dorf & J.A. Svoboda, “Introduction to Electric Circuits”, John Wiley, 2004.
4. D.S. Chauhan & D.C. Kulshreshtha, ‘Electronics Engineering’, New Age, 2e, 2009.
5. D.C. Kulshreshtha, ‘Electronic Devices and Circuits’, New Age, 2e, 2006.

**References:**

1. Van Valkenburg, “Network Analysis”, Prentice-Hall India Ltd., 2001.
2. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, “Basic Electrical Engineering”, Tata McGraw Hill Publishing Co, 2008.
3. Vincent Del Toro, “Principles of Electrical Engineering”, Prentice Hall of India.
4. Kumar and Jain, ‘Electronic Devices and Circuits’, PHI, 2007.
5. Boylstad and Nashelsky, ‘Electronic Devices and Circuits’, PHI, 6e, 2001.

**Web References:**

1. <https://www.electrical4u.com/electrical-engineering-objective-questions-mcq/>
2. <https://www.pdfdrive.com/basic-electric-circuit-analysis-books.html>
3. <https://lecturenotes.in/subject/842>

**Journals References:**

1. Circuits, Systems, and Signal Processing (CSSP), Springer
2. Journal of Electrical & Electronic Systems
3. International Journal of Circuit Theory and Applications, Wiley



**Title of Course: Object Oriented Programming**  
**L-T-P Scheme: 3-1-0**

**Course Code: CS102**  
**Course Credit: 4**

**Prerequisites:**

Students must have already registered for the course, “Software Development Fundamentals”

**Objectives:**

To strengthen their problem solving ability by applying the characteristics of an object-oriented approach and to introduce object oriented concepts in C++.

**Learning Outcomes**

<b>Course Outcome</b>	<b>Description</b>
CO1	List various principles of Object-Oriented Programming (OOP).
CO2	Describe the real world problems using object-oriented programming concepts.
CO3	Develop the programs using the fundamental concepts of OOP.
CO4	Identify and use various techniques used in OOP.
CO5	Apply techniques used in OOP to solve the software design problems on a given software project.
CO6	Demonstrate the learning on the course to solve the real life programming problems.

**Course Content**

**Unit-1:** Review of Structured programming in C, Structured versus Object-Oriented Programming, Principles of Object-Oriented Programming, Beginning with C++, Control Structures, Functions in C++, Reference Variables, Default Parameters, Function Overloading, Inline Function, Const Variables.

**Unit-2:** Classes, Member Functions, Objects, Static Data Members, Static Member Functions, Friend Functions, Pointer to Members, Local classes, Constructors and Destructors of objects in C++,

**Unit-3:** Operator overloading and Type Conversions, Inheritance and its form, Multiple Inheritance in C++, Function Overriding, Virtual Inheritance, Virtual Base Class .

**Unit-4:** Pointers, Early binding, late binding, Type of polymorphism, Virtual Functions, Abstract Class, Virtual Destructor

**Unit-5:** Managing Console I/O Operations, File handling and Exception handling.

**Unit-6:** Templates, Function templates, Class templates, introduction to Standard Template Library (STL), Sequence, Containers, Iterators

**Teaching Methodology**

The course will use the mixed technique of interactive lectures, tutorials, guided case studies, literature survey, regular assignments and project work. Teaching in this course is designed to engage the students in active and experiential learning by taking a problem solving and design-oriented approach with special emphasis on real world applications.

In the lectures the fundamental theoretical concepts will be introduced and demonstrated through examples and case studies. Discussion in lecture will be done using design problems which will be implemented in laboratory individually in C++.

### Evaluation Scheme

Evaluations	Marks	Remarks
T1	15 Marks (1 Hour)	
T2	25 Marks (1.5 Hours)	
T3	35 Marks(2 Hours)	
Assignments	10 Marks	2 or 3 Assignments to given
Quiz	5 Marks	2 or 3 quizzes
Tutorials	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### Text books

**Text book1:** Robert Lafore, Object oriented programming in C++, Waite Group.

**Text book2:** E Balagurusamy, “Object-Oriented Programming with C++”

### References

1. Deitel and Deitel, “C++ How to program”, - Pearson Education.
2. Stroustrup B., the C++ Programming Language, Addison Wesley.
3. Lippman F. B., C++ Primer, Addison Wesley.
4. Prata S., C++ Primer Plus, Waite Group.
5. Parimala N., Object Orientation through C++, Macmillan India Ltd. 1999.
6. Pohl I., Object oriented Programming Using C++, Addison Wesley.
7. Grady Booch, James Rumbaugh, Ivar Jacobson, “Unified Modelling Language user’s guide” , Addison Wesley Limited

**Title of Course: Engineering Physics Lab-II**  
**L-T-P Scheme: 0-0-2**

**Course Code: PH202**  
**Course Credit: 1**

### **Learning Outcomes**

<b>Course Outcome</b>	<b>Description</b>
CO1	Demonstrate ability to collect experimental data and understanding the working procedures within the precautionary limits
CO2	Acquired the ability to analyze the experimental data and related errors in a reflective, iterative and responsive way
CO3	Developed understanding of the basic concepts related to Modern Physics, Basic Solid State Physics, Optics,
CO4	Acquired a first hand and independent experience of verifying the working principle of solar cell
CO5	Appreciate the importance of the laboratory work culture and ethics that is intended to impart features like regularity, continuity of self evaluation and honesty of reporting the data

### **Experiments List**

1. To determine the magnetic susceptibility of a paramagnetic,  $\text{FeCl}_3$  solution by Quinck's tube method.
2. To determine dispersive power of a prism using spectrometer.
3. To study the magnetostriction in metallic rod using Michelson-Interferometer.
4. To determine the Planck's constant using Photo electric effect.
5. To study the Hall effect in P type semi conductor and to determine
  - (i) Hall voltage and Hall coefficient
  - (ii) Number of charge carriers per unit volume
  - (iii) Hall angle and mobility
6. To study the variation of resistivity of a semiconductor with temperature and to determine the band gap using Four-Probe method.
7. To study the presence of discrete energy levels in an atom by Franck Hertz experiment.
8. Using solar cell Trainer (a) study voltage and current of a solar cell  
(b) Voltage and current in series and parallel combinations (c) Draw power curve to find maximum power point (MPP) and to obtain efficiency of a solar cell.

**Title: Electrical Science Lab**

**Code: EC203**

**L-T-P Scheme: 0-0-2**

**Credit: 1**

**Prerequisite:** Student must have already registered for the course, “*Physics Lab-I*”

**Objective:**

1. The main aim of the lab is to familiarize with different types of electrical and electronic circuits
2. Identify their applications to the different electrical and electronic systems.

**Learning Outcomes:**

1. Completion of lab students will be able to understand the different techniques to simplify circuit
2. Two port networks and basic principles of different electronic devices and their characteristics.

Course Outcome	Description
CO1	Simplify complex network using Thevenin theorem and verify it.State Superposition Theorem and verify.Perform and verify Maximum Power Transfer Theorem.
CO2	To determine the Z parameters of the given two port network. Calculate the Y parameters for the given two port network.
CO3	V-I characteristic of p-n junction diode
CO4	Design Clipper and Clamper Circuit.
CO5	Rectifier circuits
CO6	Transistor and their v-I characteristics

**Course Content:**

1. Simplify complex network using Thevenin theorem and verify it.
2. State Superposition Theorem and verify.
3. Perform and verify Maximum Power Transfer Theorem.
4. To determine the Z parameters of the given two port network.
5. Calculate the Y parameters for the given two port network.
6. Perform Clipper Circuit.
7. Design Clamper Circuit.
8. Half wave rectifier with and without filter circuit.
9. Full wave rectifier with and without filter circuit.
10. Transistor as an Amplifier.
11. Common Emitter  $v-i$  characteristic of n-p-n transistor.
12. Common base  $v-i$  characteristic of n-p-n transistor.

**Unit I: Basic Electrical Circuit**

Voltage Divider, Current Divider; Kichhoff’s Circuit Laws; Loop-Current Analysis, Mesh Analysis; Node-Voltage Analysis; Choices of Method of Analysis. Source Transformation, Combination of Sources; series and parallel combination of resistors.

## Unit 2: Network Theorems (DC Circuits)

Superposition Theorem; Thevenin's Theorem; Norton's Theorem; Maximum Power Transfer Theorem.

## Unit 3: Two-Port Networks

Impedance, Admittance, Hybrid, Transmission Parameters; Equivalent Networks.

## UNIT 4: Diodes and its Applications

Unidirectional property, *PN*-junction with no bias, with forward bias and with reverse bias, *V-I* characteristics, Diode resistance (static and dynamic), Diode equation, Ideal diode, Circuit model of a diode. Half-wave and full-wave (centre tap and bridge) rectifiers, PIV rating of diode, Performance of half-wave and full-wave rectifiers, Shunt capacitor filter.

Clippers: Series and Parallel, Limiters, Clampers. Zener diode, Analysis of Zener voltage regulator. LED, varactor diode .

## UNIT 5: Transistor

BJT as an amplifier, CB and CE input and output characteristics.

### Teaching Methodology:

In each experiment the practical is designed and analyzed on bread board with the help of physical devices by each student and further checked and validated by faculty and lab staff.

### Evaluation Scheme:

Exams	Marks		Coverage
P-1	15 Marks		Based on Lab Exercises: 1-6
P-2	15 Marks		Based on Lab Exercises: 6-12
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

### Learning Resources:

Tutorials sheets, lecture slides and handwritten notes on Electrical circuit, Electrical Science and Basic Electronics (will be added from time to time): Digital copy will be available on the JUET server.

### Text-Books:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education, 2009.

2. W.H. Hayt, J. E. Kemerly & S.M. Durbin, "Engineering Circuit Analysis (Sixth Edition)", McGraw Hill, 2006.
3. R.C. Dorf & J.A. Svoboda, "Introduction to Electric Circuits", John Wiley, 2004.
4. D.S. Chauhan & D.C. Kulshreshtha, 'Electronics Engineering', New Age, 2e, 2009.
5. D.C. Kulshreshtha, 'Electronic Devices and Circuits', New Age, 2e, 2006.

#### **References:**

1. Van Valkenburg, "Network Analysis", Prentice-Hall India Ltd., 2001.
2. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "Basic Electrical Engineering", Tata McGraw Hill Publishing Co, 2008.
3. Vincent Del Toro, "Principles of Electrical Engineering", Prentice Hall of India.
4. Kumar and Jain, 'Electronic Devices and Circuits', PHI, 2007.
5. Boylstad and Nashelsky, 'Electronic Devices and Circuits', PHI, 6e, 2001.

#### **Web References:**

1. <https://www.electrical4u.com/electrical-engineering-objective-questions-mcq/>
2. <https://www.pdfdrive.com/basic-electric-circuit-analysis-books.html>
3. <https://lecturenotes.in/subject/842>

#### **Journals References:**

1. Circuits, Systems, and Signal Processing (CSSP), Springer
2. Journal of Electrical & Electronic Systems
3. International Journal of Circuit Theory and Applications, Wiley

**Title of Course: Object Oriented Programming Lab**  
**L-T-P Scheme: 0-0-2**

**Course Code: CS202**  
**Course Credit: 1**

### **Pre-requisites**

Students must have already registered for the course, “Software Development Fundamentals Lab”.

### **Objectives**

To strengthen their problem solving ability by applying the characteristics of an object-oriented approach and to introduce object oriented concepts in C++.

### **Learning Outcomes**

CO1	Define basic concepts of Object-Oriented Programming (OOP).
CO2	Illustrate the key features available in OOP using C++.
CO3	Apply the concepts of OOP to solve different common problems.
CO4	Utilize the knowledge of OOP in solving programming problems.
CO5	Analyze the various concepts of OOP for their suitability on a given problem.
CO6	Design the systems, from concept to executable artefact, using object oriented techniques.

### **Course Content**

**Unit-1:** Structured versus Object-Oriented Programming, Principles of Object-Oriented Programming, Beginning with C++, Control Structures, Functions in C++, Reference Variables, Default Parameters, Function Overloading, Inline Function, Const Variables.

**Unit-2:** Classes, Member Functions, Objects, Static Data Members, Static Member Functions, Friend Functions, Pointer to Members, Local classes, Constructors and Destructors of objects in C++,

**Unit-3:** Operator overloading and Type Conversions, Inheritance and its form, Multiple Inheritance in C++, Function Overriding, Virtual Inheritance, Virtual Base Class .

**Unit-4:** Pointers, Early binding, late binding, Type of polymorphism, Virtual Functions, Abstract Class, Virtual Destructor

**Unit-5:** Managing Console I/O Operations, File handling and Exception handling.

**Unit-6:** Templates, Function templates, Class templates, introduction to Standard Template Library (STL), Sequence, Containers, Iterators

### **Laboratory work and project**

The students shall be given regular lab assignments, which will allow them to practically apply the concepts studied in the lecture Session. The lab assignments will be designed with focus on applying the concepts learnt in object-oriented programming, Data structures in an integrated manner.

## Evaluation Scheme

Evaluations		Marks	Remarks
P-1		15 Marks	
P-2		15 Marks	
Continuous Evaluations	Viva	20 Marks	
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Discipline and Punctuality and Attendance	15 Marks	
<b>Total</b>		<b>100 Marks</b>	

## Text book

**Text Book1:** Robert Lafore, Object oriented programming in C++, Waite Group

**Text Book2:** E Balagurusamy, “Object-Oriented Programming with C++”

## References

1. Stroustrup B., the C++ Programming Language, Addison Wesley.
2. Lippman F. B., C++ Primer, Addison Wesley.
3. Prata S., C++ Primer Plus, Waite Group.
4. Parimala N., Object Orientation through C++, Macmillan India Ltd. 1999.
5. Pohl I., Object oriented Programming Using C++, Addison Wesley.
6. Grady Booch, James Rumbaugh, Ivar Jacobson, “Unified Modelling Language user’s guide” , Addison Wesley Limited



**Title: Engineering Drawing & Design Lab**  
**L-T-P scheme: 0-0-3**

**Code: ME203**  
**Credits: 1.5**

## **OBJECTIVE**

- [1] Enables students to learn the concepts of graphic communication, their role in sanitary construction.
- [2] Make familiar with different drawing equipment, technical standards and procedures for construction of geometric figures.
- [3] Equipped with the skill that enables them to convert pictorial to orthogonal representations.

## **Learning Outcomes:**

<b>Course Outcome</b>	<b>Description</b>
CO1	<b>Outline</b> the objectives of scale and develop the imagination and mental visualization capabilities for correlating the geometrical details of objects.
CO2	To <b>develop</b> the constructional ability for a different curve.
CO3	To <b>Describe</b> BIS rules for orthogonal projection and understand the fundamental concept of orthogonal projection for point, line, plane and solids.
CO4	Understand and <b>apply</b> orthogonal projection for solids, section and intersection of solid objects/structures
CO5	To <b>apply</b> the skill of development of surfaces of three dimensional objects for evaluation of black size of the components.
CO6	<b>Demonstrate</b> computer aided drafting tools and techniques using CAD software's

## **Course Content:**

**Unit-1:** Study and construction of lines, lettering, dimensioning, plane scales, diagonal scales, construction of different methods used for the construction of conic curves.

**Unit-2:** Study and construction of geometrical construction, cycloidal curves, involutes and helix etc.

**Unit-3:** Orthogonal projection of point in all possible positions, Study and construction of projection of line and its applications (inclined to both planes), and projection of planes (inclined to both planes).

**Unit-4:** Study and construction of projection of solids (right circular cone, prism, pyramid and cylinders), and true shape of sections,

**Unit-5:** Study and construction of oblique projection and development of surface, isometric view using orthogonal projection on isometric scales.

**Unit-6:** Introduction to basic and editing command of CAD software, 2-D drafting, surface modeling, and 3-D geometrical model.

## **Teaching Methodology:**

This course is introduced to build the imagination and established the correlation between the real object and engineering drawing and CAD developed by the design engineers and the requirement of the production engineers of the different units.

**Evaluation Scheme:**

Exams		Marks	Coverage
P-1		15 Marks	<b>Based on Lab Exercises: 1-7</b>
P-2		15 Marks	<b>Based on Lab Exercises: 8-14</b>
Day-to-Day Work	Viva	20 Marks	<b>70 Marks</b>
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		<b>100 Marks</b>	

**Learning Resources:**

The study material of engineering drawing & design lab (will be added time to time): Digital copy will be available on the JUET server.

**Text Book:**

1. Bhatt, N.D., Engineering Drawing,

**Reference Books:**

1. Gill, PS, A Text Book of Engineering Drawing (Geometrical Drawing)
2. Dhananjay A J, Engineering Drawing with an introduction to Auto CAD, Mc Graw Hill

# **Course Description**

## **3<sup>rd</sup> Semester:**

**Title: Techniques for Decision Making**

**L-T-P scheme: 2-1-0**

**Code: HS103**

**Credit: 3**

**Prerequisite:** None

### **Objectives:**

1. To use basic techniques of inferential data analysis, quality control, and regression modeling;
2. To analyze a set of data, to reach a conclusion based on these analyses, and to make and defend a recommended course of action;
3. To be well-equipped to take courses in Marketing, Investments, Accounting, Finance, and Operations Management that require proficiency in statistical methods.

### **Learning Outcomes:**

<b>Course Outcome</b>	<b>Description</b>
CO1	Outline various concepts of techniques for decision making with respect to the needs of modern business management.
CO2	Describe the real world problems using basic techniques of descriptive and inferential data analysis and business forecasting.
CO3	Identify and use various index numbers used in business decision making.
CO4	Apply decision making techniques to reach a conclusion based on the data analysis, and to make and defend a recommended course of action.
CO5	Deployment and proficiency in statistical methods.
CO6	Develop the understanding to analyze a set of data using correlation analysis and regression analysis.

### **Course Content:**

**Unit-1:** Collection of data and Presentation of data: Classification of data, Secondary data, Primary data, Designing of questionnaire, Unstructured and structured questionnaire, Tabulation of data, Charting of data.

**Unit-2:** Business Forecasting: Introduction, steps in forecasting, good forecasting, Time series forecasting, secular trend, seasonal variations, cyclical variations.

**Unit-3:** Index numbers: Uses, classification, problems, Methods of constructing index numbers, unweighted index numbers, Consumer Price index numbers.

**Unit-4:** Statistical Decision making : Decision making under certainty, Risk , uncertainty and conflict, Zero sum game, Prisoner's dilemma , Payoff Table, Maximin and minimax strategy.

**Unit-5:** Correlation Analysis and Regression analysis: Significance of the study of correlation, Correlation and causation, Karl Pearson's coefficient of correlation, Rank correlation, Method of

least squares, Difference between correlation and regression, Regression lines and regression equation, Regression equation of Y on X and regression equation of X on Y.

### **Teaching Methodology:**

The course “Techniques for Decision Making” is introduced to explain the basic concepts in statistics that have wide applicability in business decision making. As such, the focus will be more practical than theoretical. Because statistical analysis informs the judgment of the ultimate decision-maker—rather than replaces it—we will cover some key conceptual underpinnings of statistical analysis to insure that the students understand its proper usage. Statistics is about improved decision-making, which can be achieved through a thorough understanding of the data. We want to leave our pre-conceived notions at the door, and let the data tell us what is going on in a situation. The analytical techniques should provide valuable information to decision-makers. As such, it plays an important role in management decision processes. The course will be taught with the aid of lectures, tutorials, handouts, case studies, and problem-based learning.

### **Evaluation Scheme:**

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	100 Marks	

### **Learning Resources:**

Lectures, tutorials and e-books on Techniques for Decision Making (will be added from time to time): Digital copy will be available on the JUET server.

### **Text Book:**

1. “Business Statistics”; S.P. Gupta & M.P. Gupta, S. Chand Publishing, New Delhi, 2013.

### **Reference Books/Material:**

1. “Statistics for Business & Economics”; Anderson, Thomson Learning, Bombay.
2. “Quantitative Methods in Business”; Anderson, Thomson Learning, Bombay.
3. “Business Statistics”; R.S. Bhardwaj, Excel Books.
4. “Statistics for Management”; Levin & Rubin, Prentice Hall of India, New Delhi.
5. “Two Person Game Theory”; A. Rapport & Anne Arbric, The University of Michigan Press, 1966.

**Title of Course: Data Structures**  
**L-T-P Scheme: 3-1-0**

**Course Code: CS103**  
**Credits: 4**

### **Scope and Objectives:**

This course develop problem solving ability using programming, develop ability to express solutions to problems clearly and precisely, develop ability to design and analyze algorithms, introduce with fundamental data structures, develop ability to design and evaluate abstract data types and data structures.

### **Learning Outcome:**

The students shall acquire the generic skills to design and implement data structures and related algorithms for a broad-based set of computing problems.

<b>Course Outcome</b>	<b>Description</b>
CO1	List various types of data structures with respect to their requirements in different fields.
CO2	Describe the various methods to evaluate the algorithms.
CO3	Develop algorithms based on linear data structures
CO4	Identify the suitability of the data structures as per the requirements.
CO5	Apply data structures to solve the software design problems.
CO6	Demonstrate the learning on the course to solve the real life programming problems.

This course is intended to provide a thorough introduction to the use of data structures in programming. This course will cover the necessary mathematical background, but will assume the required programming experience.

### **Course Contents:**

#### **UNIT 1: Introduction to Data Structures, Algorithm and Complexity**

Data structure overview, need of data structure and how to select relevant data structure for given problem, basic C data types and ADT. Algorithm overview and its properties, problem analysis and construction of algorithm, difference between algorithm, program and software, algorithm analysis and complexity, asymptotic notations to represent the time complexity, Software Development Life Cycle (SDLC) phase

#### **UNIT 2: Array**

Overview, memory representation of 1D and 2D array, sparse matrix, operation supported by an array

##### **Part 1: Searching**

Linear search with illustration, analysis of linear search, binary search (iterative) and its analysis, binary search (recursive) and its analysis using recurrence relation, recurrence relation

##### **Part 2: Sorting**

Types of sorting algorithms, bubble sort, selection sort, insertion sort, quick sort, merge sort

#### **UNIT 3: Linked List**

Overview, types of linked list, linear linked list – overview, traversing, insertion, deletion, searching and reverse, doubly linked list – overview, traversing, insertion, deletion, circular linked list – overview, header linked list, applications of linked list

#### **UNIT 4: Stack**

Overview, stack implementation using stack and linked list, basic operations on stack using array and linked list – push, pop, dispose applications of stack – evaluation of mathematical expression, conversion of expression from one form to another (Polish Notation), Tower of Hanoi problem

### **UNIT 5: Queue**

Overview, basic operations on queue – enqueue, dequeue, implementation of queue using array and linked list, types of queue - linear queue, circular queue, deque, priority queue, applications

### **UNIT 6: Tree**

Tree definition and its terminology, representation of graph using array and linked list, tree traversals – preorder, inorder and postorder, binary search tree (BST) with insertion, deletion and searching operations, extended binary tree and its application in Huffman tree, threaded binary tree

### **UNIT 7: Graph**

Introduction to graph, types of graph, traversal algorithms in graph – breadth first search, depth first search, spanning tree, minimum cost spanning tree - Kruskal's, Prim's.

### **Evaluation Scheme:**

Component & Nature	Duration	Marks / Weightage
T1	1 hr	15
T2	1&1/2 hrs	25
T3	2hrs	35
Tutorials		05
Attendance		05
Quiz		05
Assignments		10
<b>Total</b>		<b>100</b>

### **Text Book::**

T1: Sartaj Sahni, “Fundamentals of Data Structures”, Tata Mc Graw Hill, New York

T2: [Seymour Lipschutz.](#), “Data Structures with C”, Schaum's Outline Series

T3: Narasimha Karumanchi, “Data Structures and Algorithms” Made Easy

### **Reference Books:**

R1: Corman et al: Introduction to Computer Algorithms

R2: Langsam, Augestein, Tenenbaum: Data Structures using C and C++

R3: Weiss: Data Structures and Algorithm Analysis in C/C++

R4: Samir K. Bandyopadhyay,” Data Structures using C”

**Title of Course:** Foundation of AI  
**L-T-P Scheme:** 3-0-0

**Course Code:** CSXXX  
**Credits:** 3

**Scope and Objectives:**

1. To understand the various characteristics of intelligent agents
2. To learn the different search strategies in AI
3. To understand the different ways of designing software agents
4. To know about the various applications of AI

**Learning Outcome:**

The students shall acquire the generic skills to design and implement data structures and related algorithms for a broad-based set of computing problems.

Course Outcome	Description
CO1	Describe the fundamental concepts, history, and goals of Artificial Intelligence (AI).
CO2	Explain the characteristics and structure of intelligent agents and their environments.
CO3	Apply various uninformed and informed search strategies to problem-solving scenarios.
CO4	Design basic AI agents using rule-based, goal-based, and utility-based approaches.
CO5	Analyze common knowledge representation techniques and reasoning methods used in AI.
CO6	Identify real-world applications of AI in areas such as robotics, natural language processing, and expert systems.

**Course Contents:**

**Unit 1: INTRODUCTION**

Definition –Agent based approach - Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems – AI Environments.

**Unit 2: PROBLEM SOLVING METHODS**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Backtracking Search –A\* Search – Mini-max search - Performance of search algorithms.

**Unit 3: KNOWLEDGE REPRESENTATION**

First Order Predicate Logic –Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation using First order Predicate logic - Reasoning Systems – Second Order Logic.

#### **Unit 4: SOFTWARE AGENTS**

Architecture for Intelligent Agents –Agent communication–Negotiation and Bargaining– Argumentation among Agents – Trust and Reputation in Multi-agent systems.

#### **Unit 5: APPLICATIONS AND CASE STUDY.**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving. Case study on Reinforcement Learning- Learning Decision Trees-Expert Systems

#### **Evaluation Scheme:**

Component & Nature	Duration	Marks / Weightage
T1	1 hr	15
T2	1&1/2 hrs	25
T3	2hrs	35
Tutorials		05
Attendance		05
Quiz		05
Assignments		10
<b>Total</b>		<b>100</b>

#### **Text Book::**

1. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Prentice Hall, 2009.
2. Bratko, *Prolog: Programming for Artificial Intelligence*, 4th Edition, Addison-Wesley, 2011.

#### **Reference Books:**

1. M. Tim Jones, *Artificial Intelligence: A Systems Approach (Computer Science)*, Jones and Bartlett Publishers, Inc., 1st Edition, 2008.
2. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press, 2009.



**Title of Course: Database Systems**  
**L-T-P Scheme: 3-1-0**

**Course Code: CS104**  
**Course Credits: 4**

**Objectives:** To develop the ability to design, implement and manipulate databases as well as to build Database management systems

**Learning Outcome:**

1. Ability to build normalized data bases.
2. Ability to design systems by using ER Modeling.
3. Ability to develop skills of writing applications by using SQL.
4. Ability to understand query optimization techniques.
5. Understanding of transaction processing.
6. Ability to handle recovery and concurrency issues

Course Outcome	Description
CO1	Introduction various types of database systems with respect to their features and characteristics and requirements in different fields.
CO2	Describe the various data definition, manipulation and various modifiers queries for database design.
CO3	Develop algorithms based on linear data structures
CO4	Develop the database using relational database query, Identify the suitable of the data structures as per the requirements.
CO5	Develop the normalized database with features of transaction, concurrency and recovery control
CO6	Demonstrate the learning on the course to deploy the database systems basis of the real life database problems.

**Course Contents:**

Introduction to Databases, Database Environment, Relational Model, Relational Algebra, SQL: Data Manipulation, Data Definition, And Commercial RDMS: MS-Access/MySQL, PL/SQL, ER Modeling: Entity type, Attributes, Relation types, Notations, Extended ER Features, Normalisation and building normalized databases & Data Dependencies, Case Study, Database Connectivity: Python MySQL Connectivity, Transactions, Concurrency, Recovery & Security, Query Processing & Optimization.

**Text Book**

1. “Database system concepts”, Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill, 4<sup>th</sup> Edition.

**References**

1. “An Introduction to Database Systems” Bipin. C. Desai. Revised Edition 2006.
2. "Fundamentals of Database Systems", Elmasri, Navathe, Pearson Education, IVth Edition.
3. “An Introduction to Database Systems”, C. J. Date, Pearson Education.
4. “Introduction to Data Base Management”, Naveen Prakash, Tata McGraw Hill.

5. "Database Management Systems", Ramakrishna, Gehrke; McGraw-Hill.
6. "Database Systems: A Practical Approach to design, Implementation and Management", Thomas Connolly, Carolyn Begg; Third Edition, Pearson Education.
7. "A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson Education
8. "Data Management: databases and organization", Richard T. Watson, Wiley Publication.
9. "Data Modeling Essentials", Graeme C. Simxion, Dreamtech Publications.
10. MS-ACCESS Projects "Oracle 8i manuals".

**Title: Environnemental Science**

**Code: GE101**

**L-T-P Scheme: 2-0-0**

**Credit: 0**

**Prerequisite:** The students must be aware of basic Environmental Science upto class 12<sup>th</sup>. Basic knowledge of Environmental Science helps them to correlate in various division of Engineering during this course.

**Objective:**

The purpose behind this course is to make the students familiar with Environment (surrounding) and to understand the significance/importance of natural resource, biodiversity, environment pollution and impact of intervention of human being in the Ecosystem. This course is mandatory for all branches of the Engineering and Sciences.

**Course Learning Outcomes:**

Course Outcome	Description
CO1	The outline, outcomes and attributes provide students with learning experiences that help in learning the significance and importance of environment in their life.
CO2	Describe the real world problems, challenges with the suitable case study based on conservation (natural resource and biodiversity), ecosystem, socio-economic development and remedial measure of the various pollutions (air, water, soil, noise and radiation).
CO3	Develop in students the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in their surrounding (the Environment).
CO4	Identify and use of various techniques for solving the Environmental Problems.
CO5	Apply field visit and justification by using various analytical techniques.
CO6	Demonstrate students with the knowledge and skill base that would enable them to undertake further studies in the Environmental Science and related multidisciplinary areas that involve Environmental Science and help to develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

Modules	Description	No. of lectures
Unit 1:	Introduction to Environmental Science: Multidisciplinary nature of environmental science; components of environment –atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.	2
Unit 2:	Ecosystems: What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web 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)	4
Unit 3:	Natural Resources: Renewable and Non-renewable Resources • Land Resources and 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). • Heating of earth and circulation of air; air mass formation and precipitation. • Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	5
Unit 4:	Biodiversity and its conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography 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.	4
Unit 5:	Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution. • Nuclear hazards and human health risks. • Solid waste management: Control measures of urban and industrial waste. • Pollution case studies.	5
Unit 6:	Environmental Policies & 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; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC). • Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context.	4

Unit 7:	Human Communities and the Environment Human population and growth: Impacts on environment, human health and welfares. <ul style="list-style-type: none"> <li>• Carbon foot-print.</li> <li>• Resettlement and rehabilitation of project affected persons; case studies.</li> <li>• Disaster management: floods, earthquakes, cyclones and landslides.</li> <li>• Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan.</li> <li>• Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.</li> <li>• Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).</li> </ul>	4
Unit 8:	Field Work: Visit to a local area to document assets-river / forest / grassland /hill / mountain. polluted sites(Urban, rural ,industrial, agriculture), plants, insects, bird, Ecosystem (pond, river, hill slopes etc)	4
	Total	32

### Teaching Methodology:

The core module Syllabus for Environment Science includes class room teaching and Field Work. The syllabus is divided into eight units covering lectures. The first seven units will cover 28 lectures, which are class room based to enhance knowledge skills and attitude to environment. Unit eight is based on field activities which will be covered in 4 lecture hours and would provide student firsthand knowledge on various local environmental aspects. Field experience is one of the most effective learning tools for environmental concerns. This moves out of the scope of the text book mode of teaching into the realm of real learning in the field, where the teacher merely acts as a catalyst to interpret what the student observes or discovers in his/her own environment. Field studies are as essential as class work and form an irreplaceable synergistic tool in the entire learning process. Course material provided by UGC for class room teaching and field activities is utilized.

### Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 Unit 2 and Unit-3
Test-2	25 Marks	Based on Unit-4 & Unit-5 (70 %) and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-6 to Unit-7 and around 30% from coverage of Test-1 and Text-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### Learning Resources:

Tutorials and lecture slides on Web Development (will be added from time to time): Digital copy will be available on the JUET server.

### **Text Book**

1. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahmadabad – 380013, India.
2. De Anil Kumar, Environmental Chemistry, Wiley Eastern Ltd, 2007.
3. Agarwal KC, 2001. Environmental Biology, Nidhi Publishers Ltd. Bikaner.

### **Reference Book**

1. Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
2. Clark R B, Marine Pollution, Clanderson Press, Oxford (TB).2001.
3. Cunningham WP, Cooper TH, Gorhani E & Hepworth MT, 2001. Environmental Encyclopedia, Jaico Publishing House, Mumbai, 1196 pgs.
4. Gleick HP, 1993. Water in Crisis, Pacific Institute for Studies in Development, Environment and Security. Stockholm Environmental Institute, Oxford University Press, 473pgs.
5. Heywood VH, and Watson RT, 1995. Global Biodiversity Assessment. Cambridge University Press 1140pgs.
6. Jadhav H and Bhosale VM, 1995. Environmental Protection and Laws. Himalaya Publishing House, Delhi 284pgs.
7. Mckinney ML and Schoch RM, 1996. Environmental Science Systems and Solutions. Web enhanced edition, 639pgs.

**Title of Course: Data Structures Lab**  
**L-T-P Scheme: 0-0-2**

**Course Code: CS203**  
**Credits: 1**

### **Scope and Objectives:**

This course develop problem solving ability using programming, develop ability to express solutions to problems clearly and precisely, develop ability to design and analyze algorithms, introduce with fundamental data structures, develop ability to design and evaluate abstract data types and data structures.

### **Learning Outcome:**

The students shall acquire the generic skills to design and implement data structures and related algorithms for a broad-based set of computing problems

CO1	Define basic operations on linear data structures
CO2	Illustrate the efficiency of a data structures in terms of time and space complexity.
CO3	Apply the data structures solve the searching and sorting problems.
CO4	Utilize the knowledge of non-linear data structures in solving programming problems.
CO5	Analyze the data structures for their suitability on a given problem.
CO6	Design the systems, from concept to executable artefact using data structures techniques.

### **Course Description:**

This course is intended to provide a thorough introduction to the use of data structures in programming. This course will cover the necessary mathematical background, but will assume the required programming experience.

### **Course Contents:**

#### **UNIT 1: Introduction to Data Structures, Algorithm and Complexity**

Data structure overview, need of data structure and how to select relevant data structure for given problem, basic C data types and ADT.

Algorithm overview and its properties, problem analysis and construction of algorithm, difference between algorithm, program and software, algorithm analysis and complexity, asymptotic notations to represent the time complexity, Software Development Life Cycle (SDLC) phase

#### **UNIT 2: Array**

Overview, memory representation of 1D and 2D array, sparse matrix, operation supported by an array

#### **Part 1: Searching**

Linear search with illustration, analysis of linear search, binary search (iterative) and its analysis, binary search (recursive) and its analysis using recurrence relation, recurrence relation

## **Part 2: Sorting**

Types of sorting algorithms, bubble sort, selection sort, insertion sort, quick sort, merge sort

## **UNIT 3: Linked List**

Overview, types of linked list, linear linked list – overview, traversing, insertion, deletion, searching and reverse, doubly linked list – overview, traversing, insertion, deletion, circular linked list – overview, header linked list, applications of linked list

## **UNIT 4: Stack**

Overview, stack implementation using stack and linked list, basic operations on stack using array and linked list – push, pop, dispose applications of stack – evaluation of mathematical expression, conversion of expression from one form to another (Polish Notation), Tower of Hanoi problem

## **UNIT 5: Queue**

Overview, basic operations on queue – enqueue, dequeue, implementation of queue using array and linked list, types of queue - linear queue, circular queue, deque, priority queue, applications

## **UNIT 6: Tree**

Tree definition and its terminology, representation of graph using array and linked list, tree traversals – preorder, inorder and postorder, binary search tree (BST) with insertion, deletion and searching operations, extended binary tree and its application in Huffman tree, threaded binary tree

## **UNIT 7: Graph**

Introduction to graph, types of graph, traversal algorithms in graph – breadth first search, depth first search, spanning tree, minimum cost spanning tree - Kruskal's, Prim's.

### **Text Book:**

- T1: Sartaj Sahni, "Fundamentals of Data Structures", Tata Mc Graw Hill, New York
- T2: Seymour Lipschutz., "Data Structures with C", Schaum's Outline Series
- T3: Narasimha Karumanchi, "Data Structures and Algorithms" Made Easy

### **Reference Books:**

- R1: Corman et al: Introduction to Computer Algorithms
- R2: Langsam, Augestein, Tenenbaum: Data Structures using C and C++
- R3: Weiss: Data Structures and Algorithm Analysis in C/C++
- R4: Samir K. Bandyopadhyay, "Data Structures using C"
- R5: Hopcraft, Ullman: Data Structures and Algorithms



**Evaluation Scheme:**

<b>Component &amp; Nature</b>	<b>Marks</b>
Lab work	40
Lab record	15
Mid sem lab –Viva/Test	15
End sem lab – Viva/Test	15
Attendance & discipline in lab	15
<b>Total</b>	<b>100</b>

**Course Name:** Foundation of AI LAB  
**L-T-P scheme:** 0-0-2

**Course Code:** CSXXX  
**Credits:** 1

### Prerequisite:

Students should have completed or be enrolled in a basic Artificial Intelligence theory course. Familiarity with data structures, logic, and programming in Python is expected.

### Objective:

- To provide hands-on experience with fundamental AI algorithms and problem-solving techniques.
- To enable implementation of key AI concepts including search strategies, intelligent agents, and reasoning.
- To strengthen understanding of theoretical AI concepts through programming-based exercises.

### Learning Outcomes:

Course Outcome	Description
CO1	Implement intelligent agents and simulate their interaction with environments.
CO2	Apply various search algorithms (uninformed and informed) to solve AI problems.
CO3	Design and develop simple rule-based systems for decision making.
CO4	Utilize knowledge representation techniques for solving logical inference problems.
CO5	Analyze AI solutions for efficiency and correctness using test cases.
CO6	Demonstrate the application of AI techniques in small real-world scenarios such as games or path finding.

### Course Contents:

Lab No.	Title
Lab 1	Introduction to AI development environment (Python, search libraries, Prolog intro)
Lab 2	Implementation of a simple intelligent agent and its environment simulation
Lab 3	Solving problems using uninformed search algorithms (BFS, DFS)
Lab 4	Solving problems using informed search algorithms (Greedy, A*)
Lab 5	Backtracking and local search for constraint satisfaction problems (e.g., N-Queens)
Lab 6	Implementation of Mini-max and Alpha-Beta pruning in a two-player game
Lab 7	Representing knowledge using First Order Logic; implementing forward & backward chaining
Lab 8	Unification and resolution in logical inference (Prolog or custom logic engine)
Lab 9	Simple agent communication and negotiation protocols (simulated)
Lab 10	Mini-project: AI application such as chatbot, pathfinding robot, or planning task (e.g., using NLP or robot simulator)

**Evaluation Scheme:**

Component & Nature	Marks
Lab work	40
Lab record	15
P1	15
P2	15
Attendance & discipline in lab	15
<b>Total</b>	<b>100</b>

**Learning Resources:****Textbooks:**

1. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Prentice Hall, 2009.
2. I. Bratko, *Prolog: Programming for Artificial Intelligence*, 4th Edition, Addison-Wesley, 2011.

**Reference Books:**

1. M. Tim Jones, *Artificial Intelligence: A Systems Approach*, Jones and Bartlett, 1st Edition, 2008.
2. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press, 2009.

**Tools & Platforms:**

- Python (with libraries: `networkx`, `numpy`, `scikit-learn`, etc.)
- Prolog (for logic programming labs)
- AI simulators like PyGame, OpenAI Gym (optional for projects)

**Title of Course: Database Systems Lab**  
**L-T-P Scheme: 0-0-2**

**Course Code: CI204**  
**Course Credit: 1**

**Objectives:** To develop the ability to design, implement and manipulate databases as well as to build Database management systems.

**Learning Outcome**

1. Ability to design systems by using ER Modeling.
2. Ability to develop skills of writing applications by using SQL.
3. Ability to understand query optimization techniques and transaction processing.

CO1	Define basic requirement and operations of file based and database systems.
CO2	Illustrate the relational database design using data definition, data manipulation queries.
CO3	Develop the database using relational database query, Identify the suitable of the data structures as per the requirements.
CO4	Utilize the knowledge of structured query language to develop and deploy the database for real life based problems.
CO5	Develop the normalize database for their suitability on a given problem.
CO6	Design the database systems, from concept to executable transaction, concurrency and recovery control using the real time based problems in group project based task .

**Course Contents:**

- SQL queries for the creation of tables and insertion of values into tables.
- SQL queries for viewing all data and specific data corresponding to a particular row or column in a table.
- SQL queries for the updation, deletion and dropping of tables.
- SQL queries for aggregation, range finding etc on the tables.
- SQL queries for renaming, truncating and destroying the tables.
- SQL queries for the use of not null, group by, having clause.
- SQL queries for the computation done on the table data.
- Exercise on nested SQL queries and sub queries.
- Use of cursors, triggers, functions and writing pl/sql block.
- A brief idea about oracle report builder.

**Evaluation scheme:**

Exams		Marks	Coverage
P-1		15 Marks	Based on Lab Exercises: 1-7
P-2		15 Marks	Based on Lab Exercises: 8-14
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

**Text Book**

1. SQL, PL/SQL the Programming Language of Oracle, Ivan Bayross, 3<sup>rd</sup> edition.

**Title of Course: UNIX Programming Lab**  
**L-T-P Scheme: 0-0-2**

**Course Code: CSXXX**  
**Course Credit: 1**

**Objectives:** This course introduces basic understanding of UNIX OS, UNIX commands and File system and to familiarize students with the Linux environment. To make student learn fundamentals of shell scripting and shell programming. Emphases are on making student familiar with UNIX environment and issues related to it.

### **Learning Outcome**

CO1	Understand various UNIX commands on a standard UNIX/LINUX Operating system
CO2	Illustrate C / C++ programs on UNIX.
CO3	Develop and do shell programming on UNIX OS.
CO4	Utilize the knowledge to handle UNIX system calls

### **Course Contents:**

- Introduction to Unix Operating System and comparing it with Windows OS. Overview to Open Source Software. Writing and studying about how to execute C program in UNIX environment using GCC compiler along with phases of compilation. Executing simple Hello World C program in UNIX environment using ed / nano / pico editor.
- Working with the vi editor: Creating and editing a text file with the vi text editor using the standard vi editor commands
- UNIX for Beginners: Getting hands-on on basic UNIX commands
- Some more UNIX commands: Working with directories, input-output redirection, Pipes, Processes
- The UNIX file system
- Using the Shell
- Working with filters: grep, sed and awk
- UNIX Shell Programming
- Programming with standard I/O
- UNIX Shell Call

### **Evaluation scheme:**

Exams		Marks	Coverage
P-1		15 Marks	Based on Lab Exercises: 1-7
P-2		15 Marks	Based on Lab Exercises: 8-14
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

### **Text Book**

1. Brian W. Kernighan and Rob Pike, “The UNIX Programming Environment” Prentice Hall India
2. Sumitabha Das, “UNIX: Concepts and Applications” Tata McGraw Hill (Latest Edition)
3. Yashwant Kanetkar, “UNIX Shell Programming” BPB Publications (First Edition)
4. Jerry Peek and others, “Unix Power Tools” O’Reilly Publishers

**Title of Course: Advance Programming Lab-I**

**Course Code: CS206**

**L-T-P scheme: 0-0-2**

**Course Credits: 1**

**Prerequisite:** No explicit prerequisite course work is required, but students are expected to have a fundamental understanding of basic computer principles and previous experience using a personal computer.

**Objective:** To emphasize object-oriented programming concepts and the design of algorithms and related data structures. Problem decomposition and principles of software engineering are stressed throughout the course. Advance aspects of programming may be taken care off through Python.

**Learning Outcomes:**

Course Outcome	Description
CO1	Installation and understanding features of Python.
CO2	Describe Python data types to handle programming problems
CO3	Develop understanding looping to handle new data types
CO4	Identify appropriate methods to solve challenging problems.
CO5	Apply programming knowledge to solve real world problems in the form of Project

**Course Contents:**

**An Introduction to Python:** Introductory Remarks about Python, Strengths and Weaknesses, A Brief History of Python, Python Versions, Installing Python, Environment Variables, Executing Python from the Command Line, IDLE, Editing Python Files, Getting Help, Dynamic Types, Python Reserved Words, Naming Conventions.

**Basic Python Syntax:** Introduction, Basic Syntax, Comments, String Values, String Operations, The format Method, String Slices, String Operators, Numeric Data Types, Conversions, Simple Input and Output, The print Function.

**Language Components:** Introduction, Control Flow and Syntax, Indenting, The if Statement, Relational Operators, Logical Operators, True or False, Bit Wise Operators, The while Loop, break and continue, The for Loop.

**Collections:** Introduction, Lists, Tuples, Sets, Dictionaries, Sorting Dictionaries, Copying Collections, Summary.

**Functions:** Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope Functions- “First Class Citizens”, Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Closures.

**Exceptions:** Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple, Exceptions, raise, assert, Writing Your Own Exception Classes.

**Classes in Python:** Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Class Documentation-pydoc.

**GUI in Python:** Introduction, Base window, Widgets, Functions, Lambda Functions, Geometry manager, Sqlite3 Backend Connectivity, Handling images.

**Project:** Based on Learning in this course with database connectivity.

**Text Book**

5. Programming Python /Mark Lutz.

**Reference Books**

1. Think Python / Allen B Downey
2. Python 101 / Dave Kuhlman

**Evaluation scheme:**

Exams		Marks	Coverage
P-1		15 Marks	Based on Lab Exercises: 1-7
P-2		15 Marks	Based on Lab Exercises: 8-14
Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

# **Course Description**

## **4<sup>th</sup> Semester:**

**Title of Course: Software Engineering**  
**L-T-P Scheme: 3-0-0**

**Course Code CS105**  
**Credits: 3**

**Pre-requisite:** Good Knowledge of Computer Programming

**Post Course:**

Object Oriented Software Engineering, Software Quality Management Objective: To engineer good quality software from its specification

**Learning Outcomes**

<b>Software Engineering</b>	
<b>Course Outcome</b>	<b>Description</b>
CO1	Outline various software models with respect to their needs of the customer requirement and concepts of some modeling language.
CO2	Describe the real world problems using software engineering concepts and tools.
CO3	Develop the software design to meet customer expectations using modeling language.
CO4	Identify and use various cost estimation techniques used in software engineering project management.
CO5	Apply verification and validation techniques on a given software project.
CO6	Demonstrate deployment and basic maintenance skills.

**Course Outline:**

Interactive Systems, Usability, Introduction to software engineering, Software process models, PSP, TSP  
Requirement Engineering: Requirement Elicitation, Analysis, Specification, SRS, Formal system development techniques, Analysis and Modeling: Data modeling, Functional modeling, Software Architecture and Design: Data design, Architectural Design Process, SADT, OOAD, function-oriented design

UML: Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram, Design Patterns: Structural Patterns, Behavioral Patterns, Creational Patterns

Software Estimation- Estimating Size, Effort and Cost: Metric for Analysis, Metric for Design, COCOMO model, Putnam Model etc., Implementation and Integration: Coding standard and practices, Top-Down and Bottom-up Approach, Verification and Validation,

Software Testing: Structural testing, functional Testing, Testing Strategies, Test Case design.

Software Maintenance: Types, Cost of Software, maintenance, Software Maintenance Models  
CASE Tool Taxonomy: Business Process Engineering tool, Process modeling and management tool, project planning tool, requirement tracking tool, Metric and management tool, documentation tool, system software tool etc. Introduction to software engineering for web and mobile applications.



**Teaching Methodology:**

This course should be conducted in a highly interactive environment. Students will work on different software projects in small groups. Exercises shall almost exclusively consist of design work and the laboratory shall be a place to develop these designs using CASE tools. As part of lab work there shall be a project to build a specification and convert it into working software using Rational Unified Process. Also, there shall be a testing project. There is a self learning component that shall be announced.

**Evaluation Scheme:**

<b>Exams</b>	<b>Marks</b>	<b>Coverage</b>
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 to Unit-4 and around 20% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 40% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

**Text Book**

1. The Unified Modeling Language Users Guide: Grady Booch, James Rumbaugh, Ivar Jacobson, Addison Wesley.
2. Douglas Bell, "Software Engineering for students: a programming approach", 4th Ed Pearson Education, 2005.
3. Dines, Bjorna "Software Engineering: abstraction and Modelling" Vol.1, 2006, Springer Verlag Berlin Heidelberg (206).
4. Cooling Jin, "Software Engineering for real time systems, Addison Wesley.
5. Khoshgoftaar, Taghi M. "Software Engineering with Computational Intelligence".
6. Sommerville, Ian, "Software Engineering", 8<sup>th</sup> Edition, Pearson Education Ltd.
7. Pressman S. Roger, "Software Engineering: A practitioner's Approach", 7<sup>th</sup> Edition, McGraw Hill.

**Web References:**

1. [https://onlinecourses.nptel.ac.in/noc20\\_cs68/preview](https://onlinecourses.nptel.ac.in/noc20_cs68/preview)
2. <https://online.visual-paradigm.com/>
3. <https://www.coursera.org/learn/introduction-to-software-engineering>

**Title of Course: Algorithms and Problem Solving**  
**L-T Scheme: 3-1-0**

**Course Code: CS106**  
**Course Credit: 4**

**Prerequisites:**

Student must have already registered for “Introduction to Computer and programming” (07B11CI101), Data Structures (07B21CI102).

**Objectives:**

- Strengthen higher level cognitive Skills of analysis, creation and evaluation.
- Strengthen Ability of data abstraction and problem solving using computer
- Strengthen ability to express solution to problem clearly and precisely.
- Strengthen ability to design and evaluate ADTs, nonlinear temporary and persistent data structures and also related algorithms.
- Introduce students to some domain specific data structures and related algorithms in various domains.

**Learning Outcomes:**

Upon completion of the subject, students will be able to:

- 1 Get **familiar** with different basic concepts of algorithms and analyze the performance of algorithms.
- 2 Have a **good grounding** of advance data structures like R-B Tree, M – way tree, models and IDEs.
- 3 Get to **learn** about various algorithm design techniques for developing algorithms.
- 4 Possess **demonstrative skills** in solving optimization problems.
- 5 Be able to **design, develop algorithms**, and employ appropriate data structures for solving real world computing problems efficiently.

**Course Content:**

Analysis of algorithm: Asymptotic Notation, Sorting and merging Algorithm

Tree and related data Structure: Heap, Priority Queues, B+ Tree, AVL, Splay Tree, Red-Black Tree, Threaded Tree

Files: Classification, Record Organization, Retrieval System, External Sorting

Set, Dictionary: Design, Analysis, integration and applications

Fundamental techniques: Divide and Conquer method, Dynamic Programming, Introduction to Greedy Method

Hashing: technique, collision resolution and analysis

Text Processing: String operation, pattern matching algorithm, tries, text compression, text similarity testing.

**Teaching Methodology:**

The Course will use the mixed technique of interactive lectures, guided case studies, literature survey, regular assignments and project work. In addition to the material covered in the class, student will be required to explore study, evaluate present and implement domain specific data structure in different domain. Teaching in this course is designed to engage the student in active and experimental learning by

taking a problem solving and design oriented approach with special emphasis on real world applications. Lectures will be highly interactive and work oriented. Student will have to work individually as well as in groups inside as well as outside the class. Students are expected to carry out a lot of design and programming oriented project work. Each student is expected to write minimum 3000 lines of documented program code as part of this course. Students are encouraged to learned use toolkits like STL for project implementation. Each student is also expected to do literature survey making use of the library and web resources (including digital library) to identify ,understand ,summarize and present at least one research paper on science and application of non-linear data structure and algorithms.

### **Evaluation Scheme (Theory):**

Evaluation Scheme is designed to promote and test higher level thinking skills and de-emphasis rote learning through holistic and continuous evaluation. Written exam will be designed and conducted as open Book(s), open notes tests. One of the minor tests may me designed and conducted as a take home test. Evaluation scheme will have following components

Test-1	15 Marks
Test-2	25 Marks
Test-3	35 Marks
Home assignment /Quizzes	10 Marks
Tutorial/Problem solving session	10 Marks
Attendance	05 Marks
<b>Total</b>	<b>100 Marks</b>

### **Text book**

T1: Thomas H., Cormen: Introduction to algorithm, the Massachusetts institute of Technology, Cambridge, Massachusetts.

### **Reference Books:**

1. Aho, Hopcraft, Ullman: Data Structure and Algorithms
2. Kruse, Tonso, Leung: Data Structure and program Design in C
3. Sahni: Data structure and algorithm and application in C++
4. Weiss: Data Structure and Algorithm analysis in C/C++

**Course Name: Digital Systems and Computer Organization**  
**L-T-P scheme: 3-0-0**

**Code: CSXXX**  
**Credits: 3**

**Learning Outcomes:**

<b>Course Outcome</b>	<b>Description</b>
CO1	Develop the understanding of data representation and digital logic circuits used in the computer system.
CO2	Concepts of Register Transfer Language (RTL) to design data transfer bus, combinational and sequential logic circuits.
CO3	Understand the programming of basic computer system using machine language, assembly language and microinstructions.
CO4	Describe the various architectures of CPU and their designing concepts.
CO5	Memory hierarchy, cache memory, virtual memory and their working principle/performance.

**Course Contents:**

**Unit I:**

Review of number systems, Binary arithmetic, BCD code, Excess-3 code and Gray Codes. and Boolean algebra, Standard and canonical representation and minimization of Boolean expressions using Karnaugh Map and Quine–McCluskey methods, Data Representation Types, Complements, Fixed Point Representations, Floating Point Representations.

**Unit II:**

**Combinational Circuits:** Logic gates, Half & full adder and subtractor, Parallel adder, BCD adders, Lookahead carry generator. Decoders, Encoders, Multiplexers and De-multiplexers, Code convertor, Comparator, Parity generator and Checker. Seven Segment Display, Binary multiplier.  
**Sequential Circuits:** Flip Flops, Registers, Counters.

**Unit III:**

**Register Transfer and Micro operations:** Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design-Instruction Codes, Computer Registers, Computer Instructions, Design Of Basic Computer, Design Of Accumulator Logic, Basic Computer Programming in Assembly Language.

**Unit IV:**

**Central Processing Unit:** Introduction To CPU, General Register Organization, Stack Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer. Pipelining and Vector Processing - Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Multiprocessors-Characteristics of Multiprocessors. Introduction to Computer Arithmetic, Addition and Subtraction, Multiplication algorithms, Division algorithms, floating point arithmetic Operations.

**Unit V:**

Classification of Memory, Memory Organization, Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware. Page Replacement Algorithms,

**Evaluation Scheme:**

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 20-30% from coverage till Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage till Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

**Text Books**

1. “Digital Logic and Computer Design”, M. Morris Mano, PHI.
2. “Computer System Architecture”, M. Morris Mano, Third Edition.
3. “Computer Organization and Architecture”, William Stalling, Tenth Edition.

**Other References:****Resources**

Lecture presentations, assignments and practicals, will be posted on the student resource from time to time. In addition following additional online/downloadable resources will be useful.

- NPTEL Course: Computer architecture and organization, IIT Kharagpur by Prof. Indranil Sengupta, Prof. Kamalika Datta, <https://nptel.ac.in/courses/106105163>
- Official IA-32 Programmer Reference Manuals online at <http://developer.intel.com/design/Pentium4/documentation.htm>
- Professor Ralf Brown's Interrupt List online at <http://www.ctyme.com/rbrown.htm>
- Homepage for H. Peter Anvin's SYSLINUX Project online at <http://syslinux.zytor.com/>
- Online article: [The GNU GRUB Boot Loader](#) by Jaswinder Singh Kohli (Linux Gazette #64, 2001)

**Title of Course: Machine Learning**  
**L-T-P scheme: 3-0-0**

**Course Code: CS108**  
**Credit: 3**

**Prerequisite:** The mathematical tools needed for the course will be covered in some classes in the first week of the course.

Objective:

1. To learn and be able to implement the basic statistical techniques in the areas of interest.
2. To develop the abilities to apply the basic Machine Learning algorithms and interpret their results.

**Learning Outcomes:**

At the end of the course, students:

1. Get familiar with the fundamental methods at the core of modern machine learning.
2. Have a good grounding of the essential algorithms for supervised and unsupervised learning
3. Possess demonstrative skills in using and applying Machine Learning.
4. Work as a team on a project.

Course Outcome	Description
CO1	List various approaches of Machine Learning.
CO2	Describe machine learning algorithms to solve the real world problems
CO3	Develop Hypothesis and machine learning models
CO4	Identify appropriate models for solving machine learning problems.
CO5	Apply learning techniques to solve real world machine learning problems
CO6	Evaluate and interpret the results of the algorithms.

**Course Content:**

**Unit-I:** Introduction to machine learning, supervised and unsupervised machine learning, Applications of AI and machine learning , Linear Algebra, Matrices, Multi-Variable Calculus and Vectors, Mean, Median, mode, Dispersion.

**Unit-II:** Probability, Probability Distributions, and Central Limit Theorem.

**Hypothesis Testing:** The what, why and how of Hypothesis Testing are covered in this module. P-Value, different types of tests and implementation in Python.

**Exploratory Data Analysis:** EDA brings out the information from the Data. This module covers Data Cleaning, Univariate/ Bivariate analysis.

**Unit-III:** Linear Regression: Simple and Multiple, Issues in Regression like Collinearity. Project on Linear Regression. Logistic Regression Univariate and Multivariate Logistic Regression for

classification in ML, Implementation in R/Python, Naive Bayes Classification. Bias-Variance Tradeoff, Evaluation metrics: Confusion Matrix, F1 Score, Root Mean Squared Error.

**Unit-IV:** Decision Tree, Random Forest, SVM, Validation Techniques: Leave one out cross-validation, K-fold cross-validation, Stratified k-fold cross-validation.

**Unit-V:** K-Means clustering, Introduction to Neural Networks, Convolutional Neural Network.

### Teaching Methodology:

This course is introduced to help students understand the discipline of Machine Learning. The programming tool used to teach this course are R and Python. Starting from the basic mathematical tools, the student will slowly be exposed to inferential statistics, and later to Machine Learning Algorithms. This theory course is well complemented by a laboratory course under the name Machine Learning Lab in the same semester that helps a student learn with hand-on experience.

### Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 20-30% from coverage till Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage till Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
<b>Total</b>	<b>100 Marks</b>	

### Learning Resources:

Tutorials and lecture slides on Machine Learning (will be added from time to time):  
Digital copy will be available on the JUET server.

### Text Book:

- Hastie, Tibshirani and Friedman. [Elements of statistical learning.](#)

### Reference Material:

- L. Rosasco. [Introductory Machine Learning Notes.](#)
- Larry Wasserman. [Clustering chapter](#)

**Title: Algorithms Lab**  
**L-T-P scheme: 0-0-2**

**Code: CS207**  
**Credit: 1**

**Prerequisite:** Experience in programming is desirable. Student must have already registered for “Software Development Lab” (18B17CI171) and “Data Structures lab” (18B17CI371).

Objective:

1. To provide exposure to problem-solving through programming.
2. Strengthen higher level cognitive Skills of analysis of problem, creation of solution and evaluation of performance.
3. Strengthen Ability of data abstraction and problem solving using computer
4. Strengthen ability to express solution to problem clearly and precisely.
5. Strengthen ability to design and evaluate ADTs, nonlinear temporary and persistent data structures and also related algorithms.
6. Introduce students to some domain specific data structures and related algorithms in various domains.

**Learning Outcomes:**

Course Outcome	Description
CO1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.
CO2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).
CO3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.
CO4	Apply classical sorting, searching, optimization and graph algorithms.
CO5	Understand basic techniques for designing algorithms, including the techniques of Recursion, Divide-and-Conquer, Greedy Algorithms and Dynamic Programming

**Course Content:**

The following assignments will be carried out in synchronization with the theory classes.

**Unit-1:** Development of programs including analysis of algorithm Asymptotic Notation, Sorting and merging Algorithm.

**Unit-II:** Programs using Heap, Priority Queues, B-Tree, AVL, Splay Tree, Red-Black Tree, Threaded Tree.

**Unit-III:** Programs using Classification, Record Organization, and Retrieval System of files External Sorting. Design, Analysis, integration of set & dictionary, collision resolution and analysis



**Unit-IV:** Programs using Divide and Conquer method, Dynamic programming, Introduction to Greedy Method.

**Unit-V:** Program using String operation, pattern matching algorithm, tries, text compression, text similarity testing application.

**Units to Lab Mapping:**

Unit	Labs
I	1, 2, 3
II	4, 5
III	6, 7, 8
IV	9, 10, 11
V	12, 13, 14

**Teaching Methodology:**

This course is introduced to help students understand the designing and analysis of algorithm. Any ( C, C++, JAV etc) programming language used to implement algorithms. Starting from the programming environment setup, the student will slowly be exposed to program designing and later to complexity analysis fundamentals. The entire course is broken down into five separate units, from fundamentals of algorithms to some complex algorithms designing methodology like Dynamic Programming Greedy Techniques etc.

**Evaluation Scheme:**

Exams		Marks	Coverage
P-1		15 Marks	<b>Based on Lab Exercises: 1-6</b>
P-2		15 Marks	<b>Based on Lab Exercises: 7-13</b>
<b>Day-to-Day Work</b>	Viva	20 Marks	<b>70 Marks</b>
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
<b>Total</b>		<b>100 Marks</b>	

**Learning Resources:**

Study material of Algorithms Lab (will be added time to time): Digital copy will be available on the JUET server.

**Text Book:**

1. Thomas H., Cormen: Introduction to algorithm, the Massachusetts institute of Technology, Cambridge, Massachusetts.

### **Reference Books/Material:**

1. Aho, Hopcraft, Ullman: Data Structure and Algorithms
2. Kruse, Tonso, Leung: Data Structure and program Design in C
3. Sahani: Data structure and algorithm and application in C++
4. Weiss: Data Structure and Algorithm analysis in C/C++

### **Online Courses:**

NPTEL-Algorithms and Problem Solving: <https://nptel.ac.in/courses/106/105/106105164/>

### **Videos Available on YouTube:**

[https://www.youtube.com/watch?v=OQ5jsbhAv\\_M](https://www.youtube.com/watch?v=OQ5jsbhAv_M)

<https://www.youtube.com/watch?v=huQoif2tevI>

<https://www.youtube.com/watch?v=sSno9rV8Rhg>

### **Website**

- <https://www.geeksforgeeks.org>
- <https://www.indiabix.com>
- <https://www.includehelp.com>
- <https://www.tutorialspoint.com>
- <https://www.sanfoundry.com>
- <https://www.programiz.com>

### **Coding Platforms**

- <https://www.codechef.com>
- <https://www.hackerrank.com>
- <https://www.interviewbit.com>
- <https://www.spoj.com>
- <https://www.hackerearth.com>
- <https://leetcode.com>

### **Integrated Development Environment**

- Turbo C++
- Dev-c++
- Code::Block

**Title of Course:** Digital Systems and Computer Organization Lab  
**L-T-P scheme:** 0-0-2

**Course Code:** CSXXX  
**Credit:** 1

**Objective:**

1. To design and verify digital circuits and basic computer system using LogiSim simulator.
2. To acquire the hardware development skill through various stages of designing.

**Learning Outcomes:**

Course Outcome	Description
CO1	Implementation of combinational logic circuits.
CO2	Designing of basic building blocks of a computer system.
CO3	Learn to design the ALU of a computer system.
CO5	Designing of sequential logic circuits for a computer system
CO5	Memory (RAM/ROM) system designing.

**Course Content:**

**Unit-1;** Introduction to LogiSim simulator.

**Unit-2:** Design of basic digital circuits using logic gates.

**Unit-3:** Design of binary adders and subtractors.

**Unit-4:** Design of combinational logic circuits.

**Unit-5:** Design of logic circuits using mux, encoder and seven segment displays.

**Unit-6:** Design of common bus, logic unit and shift unit.

**Unit-7:** Design of Arithmetic Logic Shift Unit and Multiplier.

**Unit-8:** Design of sequential circuits and digital clock.

**Unit-9:** Design of accumulator and basic CPU.

**Unit-10:** Design of ROM and RAM.

**Evaluation Scheme:**

Exams		Marks	Coverage
P-1		15 Marks	<b>Based on Lab Exercises: 1-5</b>
P-2		15 Marks	<b>Based on Lab Exercises: 6-10</b>
<b>Day-to-Day Work</b>	Viva	20 Marks	<b>70 Marks</b>
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
<b>Total</b>		<b>100 Marks</b>	

**Learning Resources:**

Soft copies of study material and lab exercises of Digital Systems and Computer Organization Lab are made available on the JUET server.

**Text Book**

1. “Computer System Architecture” by M Morris Mano, Third Edition.

**Other References:**

1. Computer System Organization and Architecture: Designing for Performance” by W Stallings, Seventh Edition, Prentice Hall, 2006. ISBN: 0-13-185644-8.

**Resources**

Lecture presentations, assignments and practicals, will be posted on the student resource from time to time. In addition following additional online/downloadable resources will be useful.

- NPTEL Course: Computer architecture and organization, IIT Kharagpur by Prof. Indranil Sengupta, Prof. Kamalika Datta, <https://nptel.ac.in/courses/106105163>
- Virtual Lab: <http://vlabs.iitkgp.ac.in/coa>

**Title of Course: Machine Learning Lab**  
**L-T-P scheme: 0-0-2**

**Course Code: CS209**  
**Credit: 1**

**Prerequisite:** The mathematical tools needed for the course will be covered in some classes in the first week of the course.

Objective:

1. To learn and be able to implement the basic statistical techniques in the areas of interests.
2. To develop the abilities to apply the basic Machine Learning algorithms and interpret their results.

**Learning Outcomes:**

At the end of the course, students:

Course Outcome	Description
CO1	Get familiar with the fundamental methods at the core of modern machine learning.
CO2	Have a good grounding of the essential algorithms for supervised and unsupervised learning
CO3	Possess demonstrative skills in using and applying Machine Learning.
CO4	Work as a team on a project.

**Course Content:**

**Unit-I:** Introduction to machine learning, supervised and unsupervised machine learning, Applications of AI and machine learning , Linear Algebra, Matrices, Multi-Variable Calculus and Vectors, Mean, Median, mode, Dispersion.

**Unit-II:** Probability, Probability Distributions, and Central Limit Theorem.

**Hypothesis Testing:** The what, why and how of Hypothesis Testing are covered in this module. P-Value, different types of tests and implementation in Python.

**Exploratory Data Analysis:** EDA brings out the information from the Data. This module covers Data Cleaning, Univariate/ Bivariate analysis.

**Unit-III:** Linear Regression: Simple and Multiple, Issues in Regression like Collinearity. Project on Linear Regression. Logistic Regression Univariate and Multivariate Logistic Regression for classification in ML, Implementation in R/Python, Naive Bayes Classification. Bias-Variance Tradeoff, Evaluation metrics: Confusion Matrix, F1 Score, Root Mean Squared Error.

**Unit-IV:** Decision Tree, Random Forest, SVM, Validation Techniques: Leave one out cross-validation, K-fold cross-validation, Stratified k-fold cross-validation.

**Unit-V:** K-Means clustering, Introduction to Neural Networks, Convolutional Neural Network.

**Teaching Methodology:**

This course is introduced to help students understand the discipline of Machine Learning. The programming tool used to teach this course are R and Python. Starting from the basic mathematical tools, the student will slowly be exposed to inferential statistics, and later to Machine Learning Algorithms. This theory course is well complemented by a laboratory course under the name Machine Learning Lab in the same semester that helps a student learn with hand-on experience.

**Evaluation Scheme:**

Evaluations		Marks	Remarks
P-1		15 Marks	
P-2		15 Marks	
Continuous Evaluations	Viva	20 Marks	
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Discipline and Punctuality and Attendance	15 Marks	
Total		100 Marks	

**Learning Resources:**

Lab exercises and lecture slides on Machine Learning (will be added from time to time):  
Digital copy will be available on the JUET server.

**Text Book:**

- Hastie, Tibshirani and Friedman. [Elements of statistical learning.](#)

**Reference Material:**

- L. Rosasco. [Introductory Machine Learning Notes.](#)
- Larry Wasserman. [Clustering chapter](#)

**Course Code:** CS210  
**Credit:** 1

**Objective:**

- ### Learning Outcomes:

1. Get familiar with different approaches to mobile application development.
1. Get to learn about application marketing.
2. Have a good grounding of mobile application development requirements, models and IDEs.
3. Possess demonstrative skills in building native applications.
4. Be able to design and develop cross-platform applications.
5. Learn to work in a team on a project.

## Part-1: Orientation and Fundamentals of Development

## Part-2: Android Studio and Basic Development Skills

**Unit-3** Using animations, audio and video. Advanced android features like list views, Exception handling, Timers in androids, Advanced String manipulations.

**Unit-4** Maps and GeoLocation, Storing data permanently, Alert dialogs, SQLite databases, Advanced SQLite, Webviews.

## Part-4: Working in a team and Cross Platform Development

### Teaching Methodology:

This course is introduced to help students transition from a regular developer to a mobile app developer. Starting from the basics, the student will slowly progress to become to other aspects of development including database, version control and other essential technologies that are helpful for a developer. The entire course is broken down into four separate parts: Orientation and Fundamentals of Development, Android Studio and Basic Development Skills, Serious

Development, and Working in a team and Cross Platform Development. Each section includes multiple technologies to help a student gain more experience as a developer. This lab course is well complemented by a lecture in the same semester that helps a student learn and discuss the technical details of the underlying technologies.

#### **Evaluation Scheme:**

Exams		Marks	Coverage
P-1		15 Marks	<b>Based on Lab Exercises: 1-7</b>
P-2		15 Marks	<b>Based on Lab Exercises: 8-14</b>
<b>Day-to-Day Work</b>	Viva	20 Marks	<b>70 Marks</b>
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
<b>Total</b>		<b>100 Marks</b>	

#### **Learning Resources:**

Tutorials and lecture slides on Mobile Development (will be added from time to time): Digital copy will be available on the JUET server.

#### **Books:Text Book**

1. Hello, Android (3rd edition): Introducing Google's Mobile Development Platform by Ed Burnette ISBN: 978-1-93435-656-2
2. Android Programming for Beginners: Build in-depth, full-featured Android 9 Pie apps starting from zero programming experience, 2nd Edition by John Horton ISBN: 978-1789538502
3. Head First Android Development: A Brain-Friendly Guide 1st Edition by Dawn Griffiths, David Griffiths. ISBN: 978-1449362188

#### **Reference Books**

1. Android Programming: The Big Nerd Ranch Guide (3rd Edition) (Big Nerd Ranch Guides) 3rd Edition by Bill Phillips, Chris Stewart, Kristin Marsicano ISBN: 978-0134706054
2. The Busy Coder's Guide to Android Development Version 8.0 by Mark M Murphy (Online Book)

#### **Web References:**

1. <https://developer.android.com>
2. <https://www.androidauthority.com>
3. <https://www.vogella.com>

#### **Journals:**

1. International Journal of Interactive Mobile Technologies (IJIM)
2. ACM Transactions on the Information Systems (TOIC).
3. International Journal of Modern Computer Science (IJMCS)
4. ACM Transactions on Internet Technology (TOIT).