Course Description

1st Semester

Course Name: Mathematics-I **Course Code: 18B11MA111**

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:

Course Outcome	Description
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	
Total	**100 Marks**	

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. Lipshuts, S., Lipsom M.: Linear Algebra, 3rd 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, 9th Ed., Addison Wesley,1996.
6. Grewal, B.S. : Higher Engineering Mathematics, Khanna Publishers Delhi.

Title of Course: Physics-I **Course Code: 18B11PH111**

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 volving 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 &
1. Engineers, Pearson Education.
2. K Krane, Modern Physics, Wiley India
3. J Bernstein, P M Fishbane, S. Gasiorowicz, Modern Physics, Pearson
4. Education.
5. B. B. Laud, Laser and Non-Linear Optics, New Age International (P) Ltd.
6. R. Resnick, Relativity, New Age.

Title: English **Code: 18B11HS111**

L-T-P scheme: 2-1-0 **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	
Total	**100 Marks**	

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, 10thEdition)
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: Software Development Fundamentals **Code: 18B11CI111**
L-T-P scheme: 3-1-0 **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 B**ranching:** 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	
Total	**100 Marks**	

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
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: Physics Lab-I **Code: 18B17PH171**
L-T-P scheme: 0-0-2 **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, 8Vp-p(sine wave, square wave, triangular wave)
   ii. 4kHz, 6Vp-p(sine wave, square wave, triangular wave)
   iii. 10kHz, 8Vpeak(sine wave, square wave, triangular wave)
   iv. 4kHz, $6V_{peak}$(sine wave, square wave, triangular wave)
7. To verify the Kirchhoff's current law.
8. To verify the Kirchhoff's voltage law.

Title: Software Development Lab **Code: 18B17CI171**

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 form 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
   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 **Code: 18B17ME171**

L-T-P scheme: 0-0-3 **Credit: 1.5**

Prerequisite: Students must have the knowledge of fundamental principles of Physic and Chemistry upto class 12^{th} 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	**Description**
CO1	Identify the various processes of manufacturing.
CO2	Capable to explain the use of various holding, measuring, marking and cutting tools
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 Code: **18B11HS411**
L-T-P scheme: 2**-0-0** **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	
Total	**100 Marks**	

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: 18B11MA211**

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	
Total	**100 Marks**	

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: Physics-II **Course Code: 18B11PH211**

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:

Course Outcome	**Description**
CO1	Learn to apply the basic concepts of vector calculus and understanding of various co-dinate systems and related properties, Demonstrate basic understanding of formulation and duction 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: 18B11EC211**

L-T-P Scheme: 3-1-0 **Credit: 4**

Prerequisite: Students must have studied the core concepts of "*Physics-1*".

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
Total	**100**	

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. Kemerlay & 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 **Course Code: 18B11CI211**
L-T-P Scheme: 3-1-0 **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

Course Outcome	Description
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	
Total	**100 Marks**	

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. Stroustrap 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 Rambaugh, Ivar Jacobson,"Unified Modelling Language user's guide" , Addison Wesley Limited

Title of Course: Physics Lab-II **Course Code: 18B17PH271**
L-T-P Scheme: 0-0-2 **Course 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, 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, $FeCl_3$ 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: 18B17EC271

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. Kemerlay & 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 **Course Code: 18B17CI271**
L-T-P Scheme: 0-0-2 **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	
Total		**100 Marks**	

Text book

Text Book1: Robert Lafore, Object oriented programming in C++, Waite Group
Text Book2: E Balagurusamy, "Object-Oriented Programming with C++"

References

1. Stroustrap 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 Rambaugh, Ivar Jacobson,"Unified Modelling Language user's guide" , Addison Wesley Limited

Title: Engineering Drawing & Design Lab **Code: 18B17ME272**
L-T-P scheme: 0-0-3 **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:

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

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

3rd Semester:

Title: Techniques for Decision Making **Code**: **18B11HS312**
L-T-P scheme: 2-1-0 **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:

Course Outcome	Description
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 certainity, 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 **Course Code: 18B11CI311**
L-T-P Scheme: 3-1-0 **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**.**

18B11CI311: Data Structures	
Course Outcome	**Description**
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
Total		**100**

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

Title of Course: Digital Systems and Microprocessor **Course Code: 18B11EC311**

L-T-P Scheme: 3-1-0 **Credits:4**

Course Objective:

Digital Systems and Microprocessor Course is the Second year's course which is totally based on study and designing Digital components, digital circuits using basic components, types of signals on which these devices works and at last the study of the Microprocessor basics in a single course. This course aims to introduce students with a fundamental understanding of digital electronics and its application, Produce digital circuit, how signals are formed and further applications of microprocessor with all conditions.These undergraduate students will be equipped to play valuable roles in the Information Technology,Electronics and Communication industries.

Learning Outcomes:

Digital Systems and Microprocessor	
Course Outcome	**Description**
CO1	Outline various number systems of Digital Electronics with respect to the requirements of the computer systems used in technical industries fulfilling the user requirement.
CO2	Solving various problems based on the number systems, complements techniques, compute simple arithmetic operations addition, subtraction, multiplication & division including ability to prove implication problems using truth table method, Boolean method etc. considering the real world examples.
CO3	Design Karnaugh map and Quine McCluskey method to get simplified form of a Boolean function.
CO4	Design combinational and sequential digital functions.
CO5	Understanding the various types of signals used for the various explained devices and getting knowledge of trans-receiving the signals using explained devices.
CO6	Introduction of Microprocessor with its interfaces and basic coding understanding utilized in it. Understand the features and architecture of 16 bit Microprocessor.
CO7	Understand the data types and addressing modes of 8086 Microprocessor. Demonstrate deployment and basic maintenance skills.

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. Tutorials will have conceptual and numerical questions that would aid in strengthening the Digital electronics, signals and Microprocessors principles.Keeping in view the student's background, starting from number system to Basic pulse circuits design, the student will cover the study of basic signal types and application of microprocessors. In this course a student will learn about various digital components and designing digital circuits and moreover he will study about the various

sequential and combinational circuits using basic gates and K-Map designing using the same gates. After this he will be taught combinational and sequential circuits which will make him proficient in designing any digital circuit. After this the basic knowledge of types of signals will be taught which will make them to learn how to implement these digital circuits over different types of signals and at last they will be taught about the Microprocessor basics which will guide them how Microprocessor world is more emphasizing on basics of Digital Electronics. And at the end of the course, successful students should have knowledge of and ability to apply the Mathematics and scientific concepts required by Digital Electronic engineers, basic level of knowledge of and ability to apply the concepts, principles and theories of Computing and IT, as likely to be required by a Digital Electronic engineer, detailed knowledge of and ability to apply the essential facts, concepts, principles and theories needed by Digital Electronic engineers.

Course Outline:

Unit I:
Conversion of bases, Representation of negative numbers, 9's and 1's complement, 10's and 2's complement, Binary arithmetic, BCD code, Excess-3 code, Gray Code and Alphanumeric code. Logic gates and Boolean algebra, Standard and canonical representation and minimization of Boolean expressions using Karnaugh Map and Quine – McClausky methods.

Unit II:
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. Binary multiplier.

Unit III:
Flip Flops: SR, JK, Master slave JK, T and D. Shift Registers and their Applications. Synchronous and Asynchronous counters, ROM, PROM, EPROM, EEPROM.

Unit IV:
Basics of Signals and Systems, Elements of a communication system, Continuous-time and discrete-time signals, signal energy and power, Periodic signals, even-odd signals, Exponential and Sinusoidal Signals.

Unit V:
Evolution of Microprocessor, Cache Memory, 8085 Architecture and its pin descriptions.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2 (30%)
Test-2	25 Marks	Based on Unit-2 (70%), Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 & 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:

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

Text Books :

1. Morris Mano, Digital Logic and Computer Design, PHI
2. Taub and Schilling, Digital Integrated Electronics, McGraw Hill, Int. Ed.
3. Signal and Systems, 2nd Edition, PHI Publications, India 1997 by Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab.
4. Fundamentals of Microprocessors and Microcontrollers, 7th edition, Dhanpat Rai Publication, India, 2010 by B. Ram.
5. Introduction to Microprocessors, Wiley Eastern (Latest Edition) R.S. Gaonkar.

Web References:

1. https://nptel.ac.in/courses/117106086/
2. http://web.iitd.ac.in/~shouri/eel201/lectures.php
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials
4. https://www.electrical4u.com/digital-electronics

Journals References:

1. IEEE Transactions on Circuits and Systems
2. International Journal of Electronics by Taylor and Francis
3. AEÜ - International Journal of Electronics and Communications by Elsevier

Title of Course: Database Systems **Course Code: 18B11CI312**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

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 Contents:

Introduction to Databases, Database Environment, Relational Model, Relational Algebra, SQL: Data Manipulation, Data Definition, And Commercial RDMS: MS-Access/MySQL, PL/SQL,

18B11CI312: Database Systems	
Course Outcome	**Description**
CO1	Introduction various types of database systems with respect to their features and charterstics 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 deployed the database systems basis of the real life database problems.

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, 4th 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: Environmental Science **Code: 18B19GE399**

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

Prerequisite: The students must be aware of basic Environmental Science upto class 12^{th}. 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 filed 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,	2

	hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.	
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. • Carbon foot-print. • Resettlement and rehabilitation of project affected persons; case studies. • Disaster management: floods, earthquakes, cyclones and landslides. • Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. • Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. • Environmental communication and public awareness, case studies (e.g.,	4

	CNG vehicles in Delhi).	
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	
Total	**100 Marks**	

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 **Course Code: 18B17CI371**
L-T-P Scheme: 0-0-2 **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

18B11CI371: Data Structures Lab	
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:

Component & Nature	**Marks**
Lab work	40
Lab record	15
Mid sem lab –Viva/Test	15
End sem lab – Viva/Test	15
Attendance & discipline in lab	15
Total	**100**

Title: Digital System & Microprocessors Lab **Code: 18B17EC371**
L-T-P scheme: 0-0-1 **Credit: 1**
Prerequisite: Students must have already studied the courses, "Digital Electronics and Microprocessor

Objective:

1. To learn and be able to implement the front-end and back-end digital electronics
2. To develop the abilities to call oneself full-stack microprocessor

Course Outcome	Description
CO1	Get familiar with basic of Digital Electronics
CO2	Understanding of logic gates and flip flops
CO3	Demonstration of combinational and sequential circuits
CO4	To understand the operation of ALU
CO5	Analyze the basic operations of 8085 microprocessor

Experiment No 1: Familiarization and Verification of logic functions of the TTL ICs.
Activity 1: Verification of AND gate using 7408 IC.
Activity 2: Verification of OR gate using 7432 IC.
Activity 3: Verification of NOT gate using 7404 IC.
Activity 4: Verification of NAND gate using 7400 IC.
Activity 5: Verification of NOR gate using 7402 IC.
Activity 6: Verification of XOR gate using 7486 IC.

Experiment No 2: Implementation of Combinational digital circuits using MSI Logic.
Activity 1: Combinational circuit-1
Activity 2: Combinational circuit-2

Experiment No 3: Implementation of Binary Adders and Subtractors.
Activity 1: Implementation of the Half-Adder.
Activity 2: Implementation of the Full-Adder using two Half-Adders.
Activity 3: Implementation of the Half-Subtractor.
Activity 4: Implementation of the Full-Subtractor using two Half-Subtractors.
Activity 5: Implementation of the 4-Bit Parallel Adder using ICs 7483.
Activity 6: Implementation of the 4-Bit Parallel Subtractor using IC 7483.

Experiment No 4: K-map and Boolean function simplification
Activity 1: Simplify the given digital circuit using K-map and verify the simplified function by implementing the given circuit and its simplified one.
Activity 2: Simplify the given functions whose minterm canonical formula is given. Implement the two functions with identical inputs and only use NAND gate ICs. Verify your result from the truth table.
Activity 3: Simplify the given Boolean function using minterms and maxterms. Implement both the simplified functions and verify that the functions are complement to each other. Construct the truth table as per your input/output behavior of the circuit.

Experiment No 5: Implementation of Multiplexer
Activity 1: Implementation of 2-to-1 Multiplexer using gates.
Activity 2: Implementation of 2-to-1 Multiplexer with enable/disable control signal.

Activity 3: Implementation of 2-to-1 Multiplexer using IC 74157.
Activity 4: Implementation of 4-to-1 Multiplexer using IC 74153.
Activity 5: Implementation of 8-to-1 Multiplexer using 4-to-1 MUX (IC 74153)

Experiment No 6: Use of Flip-Flop TTL IC in digital system.
Activity 1: Design and Implement NAND gated SR Latch
Activity 2: Design and Implement clocked RS Flip-Flop
Activity 3: Design and Implement D Flip-Flop using IC 7474.
Activity 4: Design and Implement JK Flip-Flop using IC 7476.
Activity 5: Design and Implement Master-Slave JK Flip-Flop.

Experiment No 7: Implementation of 4-Bit Binary Counter.
Activity 1: Implementation of 4-Bit Binary counter using 7493 IC .The clock signal to be giventhrough the pulsar and 1 Hz clock generator, and observe the output through LED.
Activity 2: Draw the waveform of the counter outputs Q_A, Q_B, Q_C and Q_D
Activity 3: Implementation of BCD counter using 7493 IC. Observe the output through sevensegment display.
Activity 4: Implementation of Mod-5 counter using 7493 IC.
Activity 5: Implementation of Mod-7 counter using 7493 IC.

Experiment No 8: Implementation of Shift Registers
Activity 1: Implementation of 4.bit Serial load parallel out (SIPO) shift register using 7474 IC.
Activity 2: Implementation of 4.bit parallel load serial out (PISO) shift register using 7474 IC.
Activity 3: Use of universal shift register IC 74194

Experiment No.9: Familiarization with 8085 microprocessor Kit
Activity 1: Draw and describe the each block of 8085 microprocessor kit
Activity 2: Practice the different command for Assembly Language Programming (ALP) of 8085 microprocessor

Experiment No.10: To perform loading and movement related instructions
Activity 1: Move the given data from accumulator to register
Activity 2: Load the content of memory location directly to the accumulator
Activity 3: Place the content of the memory location in register

Experiment No.11: **Aim: To carry out addition & subtraction operation.**
Activity 1: Perform the addition of given numbers
Activity 2: Addition of two 8- bit hexadecimal numbers
Activity 3: Addition of two 16- bit hexadecimal numbers
Activity 4: Perform the subtraction of given numbers
Activity 5: Subtraction of 16-bit hexadecimal numbers

Experiment No.12: To observe larger and smaller from given numbers
Activity 1: Find the larger and smaller number
Activity 2: Locate the largest number among the ten numbers
Activity 3: Locate the smallest number among the five numbers

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**	

Learning Resources:

Study material of Digital System & Microprocessors Lab (will be added time to time): Digital copy will be available on the JUET server

Text Book:

1. Fundamental of Digital Electronics And Microprocessors
2. Digital Electronics and Microprocessors

Web References:

1. http://www.becbapatla.ac.in/uploads/BCE1555920601838.pdf
2. https://et.charlotte.edu/about-us/facilities-equipment-and-infrastructure/eet-laboratories-and-associated-equipment/digital

Journals References:

1. Microprocessors and Microsystems - Journal - Elsevier
2. Microprocessors and digital ICs for motion control - IEEE Xplore
3. Journal of Microprocessor Engineering(STM Journals)

Title of Course: Database Systems Lab **Course Code: 18B11CI372**
L-T-P Scheme: 0-0-2 **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.

18B11CI373: Database Systems Lab	
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, 3rd edition.

Title of Course: UI /UX Lab **Course Code: 18B17CI307**

L-T-P Scheme: 0-0-2 **Course Credit: 1**

Objectives & Learning Outcomes:

Objective is to make students aware of the concepts underlying Multimedia Technology. Students will learn behind the design thinking process with practical implementation. Ultimately, the course will use design thinking to take students through the design of the User Experience (UX) and User-Interface (UI) of a product or service of their creation.

Learning Outcomes:

Course Outcome	Description
CO1	**Understand** the definition and principles of UI/UX Design in order to design with intention.
CO2	**Achieve** a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
CO3	**Learn** the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
CO4	**Discover** the industry-standard tools and specific project deliverables in UI/UX.
CO5	**Explain** why you made design decisions, through presentations of assignments and your personal portfolio.

Course Contents:

Unit 1: Adobe Photoshop CS, Adobe Illustrator CS, Windows Live Movie Maker,
Unit 2: Macromedia Flash MX 2004, Flimora video editing
Unit 3:- Microsoft Front Page – Designing of Web Page, Hosting of Website created in Lab exercise on intranet.
Unit 4:- UI/ UX approaches, ideas, principles
Unit 5:- Understanding and implementation of AR/ VR projects

Text Book

1. The Design of Everyday Things – by Don Norman.
2. The Elements of User Experience: User-Centered Design for the Web- by Jesse James Garrett

Evaluation scheme:

Exams		Marks	Coverage
P-1		15 Marks	**Based on Lab Exercises: up to P1**
P-2		15 Marks	**Based on Lab Exercises: up to P2**
Day-to-Day Work	Viva	20 Marks	**70 Marks**
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		**100 Marks**	

Title of Course: Advance Programming Lab-I **Course Code: 18B17CI373**

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

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

1. 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

4th Semester:

Title of Course: Computer Networks **Course Code: 18B11CI411**

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

Objective:

The objective of this course is to build basic concepts of Computer network established for the data communication. This course also aims to provide the fundamental concepts in the design and implementation of networks, their protocols and its applications.

Learning Outcomes:

Computer Networks	
Course Outcome	**Description**
CO1	Outline basics to advanced concepts and techniques of Computer networks.
CO2	Describe problem solving approaches as applied in Data communication networking areas.
CO3	Analyse performance of basic communication networks using both analytical and simulation techniques.
CO4	Develop the Computer network design techniques and practical implementation issues.
CO5	Understand the basic properties of internet and data traffic properties.
CO6	Apply verification and validation techniques on a given software project.
CO7	Demonstrate deployment and basic maintenance skills.

Course Content:

Unit I: Introduction: Introduction to computer network, classification of networks WAN, MAN, LAN), distributed systems, digital signals and data rates, bit stream, symbols and band rate, transmission media, modems, structure of computer network, circuit, packet, message switching, Network topological, Network model, ISO-OSI model, TCP/IP model, primitives and services.

Unit II: Physical Layer: Physical Layer Design Issues (Service provided to data link Layer) Introduction Transmission media, RS-232-C and RS-449, Line coding, Switching Techniques.

Unit III: Data Link Layer: Data Link Layer Design Issues (Service Provided to N/w Layer), Framing, error control, flow control, Link Management, Error Detection and Error Correction Coding, Data Link Protocols (Elementary and sliding Window), local and metropolitan area networks. The Medium Access sub layer, Static and Dynamic Channel Allocation in LANs and MANs, ALOHA Protocols (Pure and Slotted), Different Protocols of LAN, IEEE Standard 802 for LAN (802.2, 802.4, 802.5).

Unit IV: Network Layer: Network Layer Design Issues (Service Provided to Transport Layer). Routing, Congestion, Internetworking. Routing Algorithms, Congestion Control Algorithm Internetworking, congestion control. Design issues, buffer management, synchronization. Session and presentation layer synchronization issues, formatting, data compression, data security.

Unit V: Transport Layer: Transport Layer Design Issue .Connection Management, Buffer Management, Quality of Service. Session Layer Design Issues Synchronization issues. Introduction to Presentation Layer. Encryption and decryption. RSA algorithm.

Teaching Methodology

This course will help the students to facilitate interaction and information transfer over large distances. With internet, computer and telephone networks, buisenesses can allocate their resources efficiently. The Students will be able to learn basic concepts of computer network, its working principle & operation of Internet and Intranet. They will also learn the working principle of operation of LAN, WAN, MAN, congestion in the network and network management.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-2, 3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 and 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:

Tutorials and lecture slides on Telecommunication networks (will be added from time to time):

Text Books:

1. A.S. Tennenbaum, Computer Networks, PHI
2. W. Stallings, Data & Computer Communication, PHI
3. Forouzen, Behrouz A.Fegan, Sophia Chung Data Communications and Networking,

TMH

Reference Books:

1. Carne, E. Bryan Professional's Guide to Data Communication in a TCP/IP World Artech House, London, 2004
2. Young, Margret Levine Internet: The Complete Reference, Tata McGraw Hill, New Delhi, 2002

Web References:

1. **www.britannica.com**
2. **www.vssut.ac.in**

Journals References:

1. International Journal on Advances in Telecommunications
2. Journal of Network and Computer applications- Elsevier
3. IEEE transactions on networking
4. ACM Journals on networking

Title of Course: Algorithms and Problem Solving **Course Code: 18B11CI412**

L-T-P Scheme: 3-1-0 **Credit: 4**

Objective:

Analysis of common algorithms for processing strings, trees, graphs and networks. Comparison of sorting and searching algorithms. Algorithm design strategies: divide and conquer, dynamic programming, greedy, back tracking, branch and bound. Introduction to NP-completeness.

Learning Outcomes:

Algorithms and Problem Solving	
Course Outcome	**Description**
CO1	Use critical thinking for problem solving and analyze time complexity of algorithms
CO2	Apply algorithms efficiently and correctly and argue algorithm correctness
CO3	Design efficient algorithms using well-known methods
CO4	Describe effectively, in writing and in an oral presentation, an algorithm and its implementation
CO5	Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline

Course Content:

Unit I: Introduction: Analysis of Algorithm: The efficient algorithm, Average, Best and worst case analysis, Amortized analysis , Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Shell sort Heap sort, Sorting in linear time : Bucket sort, Radix sort and Counting sort

Unit II: Divide and Conquer Algorithm:

Introduction, Recurrence and different methods to solve recurrence, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential**.**

Unit III: Dynamic Programming: Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, All Points Shortest path, Matrix chain multiplication, Longest Common Subsequence

Unit IV Greedy Algorithm: General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code

Unit V: Exploring Graphs and Backtracking and Branch and Bound: An introduction using graphs and games, Undirected Graph, Directed Graph, Traversing Graphs, Depth First Search, Breath First Search, Topological sort, Connected components, Introduction, The Eight queens problem , Knapsack problem, Travelling Salesman problem, Minimax principle

Unit VI: Exploring String Matching and NP-Completeness: Introduction, The naive string matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata, The Knuth-Morris-Pratt algorithm. The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem.

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 Unit-6 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:

Tutorials and lecture slides will be added from time to time on N-Drive.

Text Books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.

Reference Books:

1. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
2. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997
4. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.
5. Harsh Bhasin,”Algorithm Design and Analysis”,First Edition,Oxford University Press.
6. Gilles Brassard and Paul Bratley,Algorithmics:Theory and Practice,Prentice Hall,1995.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs53/preview
2. **https://nptel.ac.in/courses/106105171**

Title of Course: **Operating Systems** **Course Code: 18B11CI413**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Students must have knowledge of C programming and working of the computer systems.

Objective:

1. To familiarize with the basic functionality and the evolution of different types of operating systems.
2. To Learn and understand various algorithms related to CPU scheduling, deadlocks, memory management, and storage management.
3. To learn basic aspects of real time operating systems.

Learning Outcomes:

Course Outcome	Description
CO1	Gain knowledge of OS fundamentals along with process management concepts
CO2	Apply various process management concepts including scheduling, synchronization, dead-lock to solve given problem.
CO3	Explain various memory management techniques including virtual memory.
CO4	Analyse issues related to memory management.
CO5	Understand file system including disk structure by applying disk scheduling algorithm.
CO6	Work as a team on a project.

Course Content:

Unit-1: Introduction: Operating system structure, Operating system operations, Distributed systems, Special purpose systems, Computing environments, Open source operating systems.

Unit-2: CPU Scheduling: Process concepts: Process states, Process control block, Scheduling queues, Schedulers, Context switch, Multi-threaded programming: Overview, Multithreading models, Threading issues, Process scheduling: Basic concepts, Scheduling criteria, scheduling algorithms.

Unit-3: Synchronization: The Critical section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, monitors.

Unit-4: Deadlocks: Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

Unit-5: Memory management: Memory management strategies, Swapping, Contiguous memory allocation, Paging, Structure of the page table, Segmentation.

Unit-6: Virtual Memory: Demand paging, copy on write, page replacement, allocation of frames, thrashing.

Unit-7: Storage Management: File concept, Access methods, directory structure, file system structure, directory implementation, allocation methods, free space management, disk structure, and disk-scheduling.

Unit-8: Case study on UNIX based Operating system: Design principles, Kernel modules, Process management, Memory management.

Unit-9: Real time systems: Characteristics of Real time operating systems, classification of real time systems, Micro kernels and RTOS, scheduling in RTOS, Rate monotonic scheduling, EDF, Priority inversion

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 to Unit-9 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:

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

Text Book:

1. "Operating System Concepts"; A. Silberschatz , P. B. Galvin & G. Gagne , Wiley 10e 2018.
2. "Operating Systems: Internals and Design Principles"; W. Stallings, Pearson 9e, 2017.

Reference Books/Material:

1. "Real time systems design and analysis"; P. A. Laplante & S. J. Ovaska, Wiley, 2013.
2. "Real time systems: Theory and Practice"; Mall R., Pearson, 2e, 2009.

Title of Course: Artificial Intelligence and Applications **Course Code: 18B11CI415**
L-T Scheme: 3-1-0 **Course Credits: 4**

Objectives: In this course we will study the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence, various applications of AI in different fields, Aware of a variety of approaches to AI techniques.

Course Outcome	Description
CO1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
CO4	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning. playing.
CO5	Formulate and solve problems with uncertain information using Bayesian approaches.
CO6	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

Course Contents:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI.
Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)
Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience.
Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations.
Adversarial Search and Constraint Satisfaction Problems, Study of min-max algorithm Adversarial Search: Games, Optimal Decisions in Games, The mini-max algorithm, Optimal decisions in multiplayer games, Alpha--Beta Pruning, Move ordering , Imperfect Real-Time Decisions, Evaluation functions, Cutting off search, Forward pruning, Search versus lookup, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games
Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Variations on the CSP formalism, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs,

Local Search for CSPs, Alpha-beta pruning and CSP, Implementation aspects of mini-max algorithm and CSP.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)
Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)
Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees.
Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)
Introduction, Knowledge acquisition, Knowledge base, Working memory, Inference engine, Expert system shells, Explanation, Application of expert systems.
Fundamentals of Neural Networks: Introduction and research history, Model of artificial neuron, Characteristics of neural networks, learning methods in neural networks, Single-layer neural network system, Applications of neural networks.
Fundamentals of Genetic Algorithms: Introduction, Encoding, Operators of genetic algorithm, Basic genetic algorithm.

Evalution Scheme:

Evaluation	Marks	Remarks
T1	15 Marks(1 Hr.)	1^{st} -4^{th} Week
T2	25 Marks(1:30 Hr.)	5^{th} – 10^{th} Week
T3	35 Marks(2:00 Hr.)	11^{th} -16^{th} Week
Tutorial/Presentation	10	
Assignments	5	
Quiz	5	
Attendance	5	
Total	**100**	

Text Books

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References

1. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann, Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education.
2. Neural networks and Learning Machines, Simon Haykin, PHI Learning Pvt. Ltd.

Title: Algorithms Lab **Code: 18B17CI472**
L-T-P scheme: 0-0-2 **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	**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 Algorithms Lab (will be added time to time): Digital copy will be available on the JUET server.

Text Book:

1. Thomas H., Coremen: 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=huQojf2tevI
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: **Operating Systems Lab** **Course Code: 18B17CI473**

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

Prerequisite: Students must have knowledge of C programming and working of the computer systems.

Objective:

1. To execute shell scripts in UNIX based operating system.
2. To implement inter process communication using system calls.
3. To implement algorithms for CPU scheduling as well as process synchronization learn and be able to implement the front-end and back-end web-technologies.

Learning Outcomes:

Course Outcome	**Description**
CO1	Understand and execute basic commands of shell script.
CO2	Apply basic operations in shell scripts which are required for different applications.
CO3	Identify and understand concept of file systems in shell script.
CO4	Apply concept of creating new process from parent process.
CO5	Apply concept of virtual file and execute basic commands on it.
CO6	Design communication mechanisms ipc and pipe on linux.

Course Content:

Unit-1; Comparative Study of different operating systems

Unit-2: Demonstration of multitasking concept.

Unit-3: Implementing various process creation algorithms(FCFS,SJF and Round-Robin Scheduling)

Unit-4: Implementation of memory allocation policies.

Unit-5: Implementing Page replacement algorithms (FIFO,LIFO)

Unit-6: Implementing segmentation algorithms

Unit-7: Implementing file-handling algorithms

Unit-8: Demonstration of working of distributed OS environment.

Evaluation Scheme:

Exams		**Marks**	**Coverage**
P-1		15 Marks	**Based on Lab Exercises: 1-4**
P-2		15 Marks	**Based on Lab Exercises: 5-8**
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 Web Technology Lab (will be added time to time): Digital copy will be available on the JUET server.

Text Book:

1. "Operating System Concepts"; A. Silberschatz , P. B. Galvin & G. Gagne , Wiley 10e 2018.
2. "Operating Systems: Internals and Design Principles"; W. Stallings, Pearson 9e, 2017.

Reference Books/Material:

1. "Real time systems design and analysis"; P. A. Laplante & S. J. Ovaska, Wiley, 2013.
2. "Real time systems: Theory and Practice"; Mall R., Pearson, 2e, 2009.

Title of Course: AI and Application Lab **Course Code: 18B17CI475**
L-T-P Scheme: **0-0-2** **Credits:** 1

Objectives: In this course we will practical knowledge of the basic components of an intelligence system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes:

Course Outcome	Description
CO1	Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction,).
CO2	Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools.
CO3	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems

Course Content:

- Introduction to Python. [Quick Introduction of List, Tuple, Dictionary etc.]

1. Problem solving Agents using Python
    - Simple Reflex Agent
    - Table Driven Agent
    - Random Agent.
    - Goal-Based Agent
    - Utility Based Agent

2. Problem Spaces and blind search techniques by using Python.
    - Breadth First Search
    - Depth First Search
    - Uniform Cost Search
    - Depth Limit Search
    - Recursive Depth Limit Search
    - Iterative Deepening Search

3. Informed search techniques by using Python.
    - Greedy Best First Search
    - A* Search

4. Beyond Classical Search

    - Hill-Climbing Search Algorithm

5. Game playing by using Python.
6. Constraint satisfaction problems by using strawberry prolog.

7. Logic programming by using Python.

Teaching Methodology:

Project Application based lectures would be interactive, and it would cover the core concepts that are explained in the text and reference materials with adequate examples. Demo of tree graph search tutorials will have conceptual and numerical questions that would aid in strengthening the Artificial system principles.

Evaluation Scheme:

Component & Nature	**Duration**	**Marks / Weightage**
Practical Test – 1	2 hrs	15
Practical Test – 2	2 hrs	15
Lab Performance	---	10
Day to Day work	---	45
Attendance & Punctuality	----	15
Total		100

Text Books:

1. Allen B. Downey, Think Python, O'Reilly Media
2. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
3. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

Reference Books:

1. Russell, Stuart J. Norvig, Peter, Artificial Intelligence: A Modern Approach, Pearson Education

Title of Course: Computer Networks Lab **Course Code: 18B17CI471**
L-T-P Scheme: 0-0-2 **Credits:** 1

Course Objectives

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

Learning Outcomes:

Course Outcome	Description
CO1	Understand fundamental underlying principles of computer networking
CO2	Understand details and functionality of layered network architecture.
CO3	Apply mathematical foundations to solve computational problems in computer networking
CO4	Analyze performance of various communication protocols.
CO5	Compare routing algorithms
CO6	Practice packet /file transmission between nodes.

Course Content:

1. Identification of network hardware.
2. Fabrication of network cables and trouble shooting.
3. To study *stop &wait* and *sliding window* protocol.
4. To study MAC ALOHA protocol.
5. To study MAC CSMA and MAC CSMA/CD protocol.
6. To study TOKEN BUS and TOKEN RING.
7. To study ETHERNET.
8. To study TOKEN RING.
9. To study SWITCHED LAN.
10. To study Static routing.
11. To study dynamic routing.

Text Books:

1. Sybex CCNA Cisco Certified Network Associate Study Guide.5th Edition
2. Forouzen, Behrouz A.Fegan, Sophia Chung Data Communications and Networking TMH

Reference Books:

1. Carne, E. Bryan Professional's Guide to Data Communication in a CP/IP World Artech House, London, 2004

Title of Course: Mobile and Application Development Lab **Course Code:** 18B28CI408
L-T-P scheme: 1-0-2 **Credit: 3**

Prerequisite: Students must have already registered for the course, "***Introduction to Computers and Programming***" and "**Object Oriented Programming**".

Objective:

1. To learn and be able to implement different mobile-technologies.
2. To develop the abilities to call oneself mobile application developer.

Learning Outcomes:

At the end of the course, a student will:

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

Course Content:

Part-1: Orientation and Fundamentals of Development

Unit-1 Mobile applications and different approaches to mobile application development. Java features and review of Object Oriented Programming fundamentals.

Part-2: Android Studio and Basic Development Skills

Unit-2 Installing and getting accustomed to the android studio environment. Using activities and views. Working on different views like TextViews, ImageViews etc. Creating simple applications using basic view types.

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

Part-3: Serious Development

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

Unit-5 Submitting app to distribution channels, marketing mobile app, Mobile App development models.

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

Unit-6 Using Git, Common Git commands, Project Development, Cross Platform Development using Flutter, Coding using Dart, MVC design pattern, Networking, Data storage, Authentication, State Management.

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	**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**	

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

i. Hello, Android (3rd edition): Introducing Google's Mobile Development Platform by Ed Burnette ISBN: 978-1-93435-656-2
ii. 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
iii. 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 (O nline 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).

Course Description

5th Semester:

Title: Probability Theory and Random Processes **Code: 18B11MA511**

L-T-P scheme: 3-1-0 **Credit: 4**

Prerequisite: Students must have already studied course, "Mathematics-I" and should have the Knowledge of Differential & Integral Calculus.

Objective: Objective of this course is to provide a foundation in the theory and applications of probability and stochastic processes and an understanding of the mathematical techniques relating to random processes in the areas of signal processing, detection, estimation, and communication. Topics include the axioms of probability, random variables, and distribution functions; functions and sequences of random variables; stochastic processes; and representations of random processes.

Learning Outcomes:

Course Outcome	**Description**
CO1	Construct sample spaces of random experiments; identify and specify events, and perform set operations on events; compute probabilities by counting; evaluate conditional probability, and apply Bayes' theorem to simple situations.
CO2	Express random variables by using CDFs, PMFs; calculate moments related to random variables; understand the concept of inequalities and probabilistic limits. Understand the axiomatic approach of probability theory and intrinsic need of (functions of) random variables for the analysis of random phenomena.
CO3	Compute probability distributions and correlation measures of bivariate random variables; obtain marginal and conditional distributions of random variables; find probabilities for outcomes of various events related to an uncertain phenomenon using appropriate probability distributions as models.
CO4	Conduct hypotheses tests concerning population parameters based on sample data; perform and interpret chi-square test of goodness-of-fit and test of independence; find the equation of regression line and second degree curve, and to predict the value of one variable based on the value of the other variable.
CO5	Identify and classify random processes and determine covariance and spectral density of stationary and ergodic random processes; demonstrate specific applications to Gaussian process.
CO6	Students are able to provide the theories associated with the random variable and random process. The course particularly provides the student with an ability to apply to real-world problems in the communication and physical systems.

Course Contents:

Unit-1: Random experiments, sample space and events. Three basic approaches to probability, conditional probability, total probability theorem, Bayes' theorem of Probability of causes, Bayes' theorem of future events, total independence, mutual independence and pair wise independence.

Unit-2: One dimensional random variables (discrete and continuous) and their distributions, bivariate distributions, joint, marginal and conditional distributions, characteristic function.

Unit-3: Covariance and correlation of random variables. Some special probability distributions: Binomial, Poisson, probability distributions. Negative Binomial, Geometric and Normal probability distributions. Fitting of probability distributions.

Unit-4: Concept of reliability: Reliability function, Hazard rate function, Mean time to failure, cumulative and average failure rate, Conditional reliability and failure rates, residual MTTF, some special failure rate distributions- exponential distribution and the Weibull distribution, reliability of systems- series configuration and some deductions, parallel-series configuration, series -parallel configuration.

Unit-5: Introduction and description of random processes, average values of random processes, stationary processes and computation of their averages, autocorrelation function and its properties, Cross correlation and its properties. Power spectral density function and its properties. Ergodicity of a random process, Poisson processes.

Teaching 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 Scheme:

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	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Probability Theory and Random Processes (will be added from time to time): Digital copy will be available on the JUET server.

Text books:

1. T. Veerarajan ,Probability, Statistics and Random Processes, Tata McGraw Hill.
2. J.J. Aunon & V. Chandrasekhar, Introduction to Probability and Random Processes, Mc- Graw Hill International Ed.
3. A. Papoulis & S.U. Pillai, Probability, Random Varibles and Stochastic Processes, Mc-Graw Hill.
4. H. Stark, and J.M. Woods, Probability and Random Processes with Applications to Signal Processing, Pearson Education.

Title: Theory of Computation **Code:** 18B11C511

L-T-P scheme: 3-1-0 **Credit: 4**

Prerequisite:
Students must have already studied for the course Set algebra, elementary formal logic, constructing proofs, recurrence relations.

Objective:

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To explain the hierarchy of problems arising in the computer sciences.
4. To familiarize Regular grammars, context frees grammar.

Learning Outcomes:

Course Outcome	Description
CO1	Students will demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.
CO2	To Design Finite Automata's for different Regular Expressions and Languages
CO3	To Construct grammar for various languages and applying normal forms and push down automata
CO4	To solve various problems of Turing Machines and types of TM

Course Content:

UNIT – I
Mathematical Concepts: Review definitions and notations for sets, relations and functions. Basic concepts and definitions Set operations; partition of a set, Equivalence relations; Properties on relation on set; Proving Equivalences about Sets. Central concepts of Automata Theory.

UNIT – II
FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT – II
REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions.
REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.

UNIT - IV
CONTEXT FREE GRAMMER (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted).

UNIT – V

PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA.

UNIT VI

TURING MACHINES (TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.

RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability.

Teaching Methodology:

Teaching in this course is designed to engage the students in active and experimental learning by taking a problem solving and design oriented approach with special emphasis on real world applications. Students are expected to carry out lot of design and programming.

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-6 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:

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

Text Books:

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India.

Reference Books:

1. Papadimitriou, Elements of the Theory of Computation, Prentice-Hall, 1998
2. Peter Dehning, Jack B. Dennis, “Machines, Languages and Computation”, Second Edition, Prentice-Hall, 1978
3. Harry R. Lewis, Christos H. Papadimitriou, "Elements of the theory of computation", Second Edition, Prentice-Hall, 1998

Title of Course: Minor Project-1 **Course Code: 18B91CI591**
Course Credits: 2

Course Learning Outcome:

After successful completion of this course student will be able to:

Course Outcome	Description
CO1	Acquire practical knowledge within the chosen area of technology for project development
CO2	Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach
CO3	Contribute as an individual or in a team in development of technical projects
CO4	Develop effective communication skills for presentation of project related activities

Syllabus:

A project to be developed based on one or more of the following concepts.

Introduction to Java 2 SDK Tool Set Object Oriented paradigm, arrays, collection objects, data types, variables, functions, Wrapper Class, Object Class Inheritance, Interfaces, Abstract Class, Inner Class Exception Handling, Customization of Exception classes Event Handling, Adapter Classes Introduction To Application Programming In Java2, Creating Window Application, Writing Console Application, Use of Utility and Math Packages Introduction To Swing, MVC Architecture, Swing AWT and JFC, Writing Swing Application, Swing Components, Changing Look and Feel of Application Enhancing Application Using Clipboard, Drag and Drop, I/O Stream Enhancement, Printing, Internationalization Garbage Collection and Application Cleanup Applet and Applet Security Network Programming, Sockets, URL Class, Internet Address Class Java database Programming, Java.Sql Package Study, JDBC, Different Types of Drivers of JDBC

Evaluation scheme:

Exam	Marks
P1	10 marks
P2	15 marks
P3	30 marks
Term paper	20 marks
Guide marks	25 marks (continuous evaluation-15, documentation-10)
Total	**100 marks**

Title: Open Source Software Lab **Code: 18B17CI507**

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

This Lab will be based on the subject run in CSE-Elective -1

Title of Course: Advanced Programming Lab-II **Course Code: 18B17CI573**

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

Prerequisite: Students must have already registered for the course, "OOP".

Objective:

1. Demonstrate basic problem-solving skills: analyzing problems, modeling a problem as a system of objects, creating algorithms, and implementing models and algorithms in an object-oriented computer language (classes, objects, methods with parameters, abstract classes, interfaces, inheritance and polymorphism).
2. To learn using advanced features of a Programming Language.
3. To learn working with different APIs and make faster, reusable and efficient programs.

Learning Outcomes: At the end of the course students should:

Course Outcome	Description
CO1	Possess an ability to apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems.
CO2	Be able to deconstruct problems to develop algorithms and eventually program code.
CO3	Develop substantial Java programs, when appropriate reusing previously created classes, writing programs requiring three or more classes.
CO4	Demonstrate ability to define the computing requirements of a problem and to design appropriate solutions based on established design principles and with an understanding of the tradeoffs involved in design choices.
CO5	Diligently leverage sound development principles to implement computer-based and software systems of varying complexity, and to evaluate such systems.

Course Contents:

Unit-1: Relooking classes, methods, objects, relationships, polymorphism, overriding and other object-oriented concepts.

Unit-2: Object oriented analysis and design, making inheritance-based designs, containership, abstract classes and interfaces.

Unit-3: Exception handling, polymorphic nature of exceptions, Multithreading, Race condition, Synchronization.

Unit-4: Introduction to design patterns, intents and class diagrams, singleton, factory, template, adapter pattern etc.

Unit-5: Project based on team work. The project may be menu-driven and should provide a design-oriented solution to a well-defined problem. The students should be able to identify the nature of the problem and perform object-oriented analysis followed by creating design solutions by identifying an appropriate design pattern. The code should justify the designs created.

References:

1. Horstmann, "CoreJava", Addison Wesley.
2. Urma, Fusco and Mycroft, "Java 8 In ACTION", Manning Publications, 1st edition, 2015.

3. Herbert Schieldt, “The Complete Reference: Java”, TMH.
4. John Hunt, Alexander g. McManus,“Key Java: Advanced Tips and Techniques”, Springer, 1998.
5. Y.Daniel Liang**, “**Introduction to Java programming”, Comprehensive Version (9th Edition)
6. Cay S. Horstmann and Gary Cornell, “Core Java, Vol.2 Advanced Features” (8th Edition).

Evaluation Scheme:

Exams		**Marks**	**Coverage**
P-1		15 Marks	
P-2		15 Marks	
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

6th Semester:

Course Name: Computer Organization and Architecture **Course Code: 18B11CI414**
L-T-P scheme: 3-1-0 **Credits: 4**

Pre-requisite: Digital System and Microprocessors

18B11CI414: Computer Organization & Architecture	
Course Outcome	**Description**
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-1: Digital Logic Circuits - Logic Gates, Boolean Algebra, Map Specification, Combinational Circuits, Flip-Flops, Sequential Circuits, Memory Components, Integrated Circuits. Data Representation - Data Types, Complements, Fixed Point Representations Floating Point Representations, Other Binary Codes, Error Detection Codes.

Unit-2: 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, Timing And Control, Instruction Cycle, Memory Reference Instructions, Input-Output And Interrupt, Complete Computer Description, Design Of Basic Computer, Design Of Accumulator Logic.

Unit-3: Programming The Basic Computer - Introduction to Machine Language, Assembly Language, Assembler, Program Loops, Programming Arithmetic And Logic Operations Subroutines, Input-Output Programming. Micro programmed Control-Control Memory, Sequencing Microinstructions, Micro program Example, Design Of Control Unit, Microinstruction Format.

Unit-4: Central Processing Unit – Introduction To CPU, General Register Organization, Stack Organization, 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.

Unit-5: Computer Arithmetic – Introduction to Computer Arithmetic, Addition and Subtraction, Multiplication algorithms, Division algorithms, floating point arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations. Input-Output Organization - Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, Serial Communication.

Unit-6: Memory Organization - Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware. Multiprocessors-Characteristics of Multiprocessors.

Text Books

1. "Computer System Architecture", M. Morris Mano, Third Edition.
2. "Computer Organization and Architecture", William Stalling, Tenth Edition.

Other References:

1. Yu-cheng Liu,Glenn A. Gibson , "The 8086/8088 Family Architecture, Programming & design", Second Edition, PHI.
2. Douglas Hall, "Microprocessors & Interfacing, Programming & Hardware",2nd Edn. Tata McGraw Hill.
3. Kenneth Ayala **"**The 8086 microprocessor programming and Interfacing the PC".
4. Tom Shanley, Protected Mode Software Architecture, Addison-Wesley (1996), ISBN 0-201-55447-X .

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)
- Official Data Sheet for the Intel 8259A Programmable Interrupt Controller (.pdf file-format)

Evaluation Scheme:

Test-1	15 marks
Test-2	25 marks
Test-3	35 marks
Assignments	10 marks
Tutorial	5 marks
Quizzes	5 marks
Total	**100 marks**

Title of Course: Software Engineering **Course Code** 18B11CI612
L-T-P Scheme: 3-0-0 **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

Software Engineering	
Course Outcome	**Description**
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:

Exams	Marks	Coverage
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	
Total	**100 Marks**	

Text Book

1. The Unified Modeling Language Users Guide: Grady Booch, James Rambaugh, Ivar Jacobson, Addision 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", 8th Edition, Pearson Education Ltd.
7. Pressman S. Roger, "Software Engineering: A practitioner's Approach", 7th Edition, McGraw Hill.

Web References:

1. 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: Minor Project-2 **Course Code: 18B91CI691**
Course Credits: 3

Course Learning Outcome:

After successful completion of this course student will be able to:

Course Outcome	Description
CO1	Analyze chosen literature addressing real world research problem to identify the requirements
CO2	Build technical report detailing the software specification, design, test plan, and implementation details.
CO3	Build a practicable solution for the research problem
CO4	Evaluate results to test the effectiveness of the proposed solution
CO5	Develop effective communication skills for presentation of project related activities

Syllabus:

A project to be developed based on one or more of the following concepts.

Project based learning: Each student in a group of 3-4 will have to develop a Minor Project based on different engineering concepts. The students can opt any real-world application for the implementation of Minor Project. The students have to implement the real world problem using any open-source programming language. Project development will enhance the knowledge and employability of the students in IT sector.

Evaluation scheme:

Exam	Marks
P1	10 marks
P2	15 marks
P3	30 marks
Term paper	20 marks
Guide marks	25 marks (continuous evaluation-15, documentation-10)
Total	**100 marks**

Title of Course: **Computer Organization and Architecture Lab** **Course Code: 18B17CI474**
L-T-P scheme: 0-0-2 **Credit: 1**

Prerequisite: Students must have knowledge of Digital Systems and Microprocessors (DSM) subject.

Objective:

1. To acquire the generic hardware development skill through various stages of designing.
2. To design and verify computer system digital circuits in VHDL.
3. To ensure the quality of hardware through various levels of verifications with Xilinx software and ISim simulator.

Learning Outcomes:

Course Outcome	**Description**
CO1	Designing of basic building blocks of a computer system.
CO2	Implementation of basic adder-subtractor units.
CO3	Learn to design the ALU of a computer system.
CO4	Understand the designing of computer data bus architecture.
CO5	Memory (RAM/ROM) system designing.
CO6	Designing of sequential logic circuits for a computer system.

Course Content:
Unit-1; Introduction to VHDL and Xilinx ISE Software.
Unit-2: Design of All-in-One logic gate circuits.
Unit-3: Design of 4-bit adder-subtractor circuits.
Unit-4: Design of combinational logic circuits.
Unit-5: Design of multiplexer based N-bit common bus system, logic system, and shift system.
Unit-6: Design of Arithmetic Logic Shift Unit (ALU).
Unit-7: Design of registers and counters.
Unit-8: Design of ROM and RAM.

Evaluation Scheme:

Exams		**Marks**	**Coverage**
P-1		15 Marks	**Based on Lab Exercises: 1-4**
P-2		15 Marks	**Based on Lab Exercises: 5-8**
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:

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

Text Book

1. "VHDL Primer"; J. Bhasker , 3 rd Edition.
2. "Computer System Architecture" by M Morris Mano, Third Edition.

Other References:

3. The student's guide to VHDL"; Peter. J. Ashenden, 2nd Edition.
4. 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.

- Xilinx Documentation Portal: https://docs.xilinx.com/r/en-US/xilinx-documentation-portal
- 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: Software Engineering Lab **Course Code: 18B17CI672**
L-T-P scheme: 0-0-2 **Course Credit: 1**
Prerequisite: Students must have already registered for the course, "Software Engineering".

Objectives: Students will be capable to acquire the generic software development skill through various stages of software life cycle. He will also be able to ensure the quality of software through software development with various protocol based environment.

Software Engineering Lab	
Course Outcome	**Description**
CO1	Outline various software models with respect to their needs of the customer requirement and concepts of some modelling language.
CO2	Describe the real world problems using software engineering concepts and tools.
CO3	Develop the software design to meet customer expectations using modelling 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 Contents:

Unit I- Introduction to software engineering: Code comprehension.

Unit II- Requirement engineering: Requirement Elicitation, specification, IEEE standard template for SRS, Requirement Engineering tools.

Unit III- UML Modeling: Use case diagram , State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram, Event trace diagram , c++ code generation, Introduction to Sec UML.

Unit IV- Software Metrics: Product, process and project metrics.

Unit V- Software Testing: Structural testing, functional Testing, Testing Strategies and Tactics, Test Case design.

Note: Lab exercises will be based on project-oriented. Each student has work on a project and completes the development of software product using software engineering principles

Evaluation Scheme:

Exams		**Marks**	**Coverage**
P-1		15 Marks	**Software Analysis and design**
P-2		15 Marks	**Software implementation and testing**
Day-to-Day Work	Viva	20 Marks	**70 Marks**
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		**100 Marks**	

Text Books

1. Software Engineering: A practitioner's approach: Roger S. Pressman, McGraw-Hill Publications (Sixth Edition)
2. The Unified Modeling Language Users Guide: Grady Booch, James Rambaugh, Ivar Jacobson, Addision Wesley

References

1. Modern Structured Analysis: Edward Yourdon , PHI Publications

Web References:

1. 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: Advanced Programming Lab-3 **Course Code: 18B17CI673**

L-T-P scheme: 0-0-2 **Credit: 3**

Prerequisite: Students must have already registered for the course, "***Introduction to Computers and Programming***" and "**Object Oriented Programming**".

Objective:

1. To learn and be able to implement the front-end and back-end web-technologies.
2. To develop the abilities to call oneself full-stack web developer.

Learning Outcomes:

Course Outcome	**Description**
CO1	Get familiar with processes of Full Stack Web Development.
CO2	Have a good grounding of Web Application Terminologies, Internet tools and languages like HTML5 and CSS.
CO3	Possess demonstrative skills in using and applying JavaScript.
CO4	Build modern, fast and scalable server-side web applications with NodeJS and databases like SQL or MongoDB.
CO5	Apply web engineering approaches required to create web applications
CO6	Work as a team on a project.

Course Content:

Part-1: Fundamentals of Full Stack Web Development

Unit-1 Creating first web-application, hosting a web application, creating websites, authoring tools, domain names.

Part-2: Front End Tools & Technologies

Unit-2 Markup and Styling: HTML, Cascading Style Sheets, using Bootstrap.

Unit-3 JavaScript Fundamentals: Language Features, JSON, Ajax, jQuery, Popular Frameworks like React, Angular JS.

Part-3: Back End Tools & Technologies

Unit-4 Web Programming through Node.js and/or Java. Node.js Modules, NPM, Events, Upload File, Email, Get/Post methods, Java Servlets vs. JSP, Request vs. Response objects, other Java objects and features.

Unit-5 Databases and Web Storage: Designing and creating databases, database connection through back end programming languages, Web storage to store sessions, cookies, and cached data in the browser.

Part-4: Project Development

Unit-6 Using Git, Common Git commands, Project Development.

Teaching Methodology:

This course is introduced to help students transition from a simple developer to a full stack developer. Starting from frontend development, the student will slowly progress to become to other aspects of development including backend, database, version control and other essential technologies that are helpful for a developer. The entire course is broken down into four separate parts: Fundamentals of Web Development, Front End tools & Technologies, Back End Tools & Technologies, and Project Development. Each section includes multiple technologies to help a student gain more experience as a developer. This lab course is well complemented by a theory course under the name Web Development 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	**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**	

Learning Resources:

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

Course Description

7th Semester:

Title: Major Project Part – I Code: 18B19CI791

L-T-P scheme: 0-**0-8** **Credit: 04**

Prerequisite: Students must have knowledge about software development.

Objective:

1. To apply engineering knowledge in practical problem solving
2. To foster innovation in design of products, processes or systems
3. To develop creative thinking in finding viable solutions to engineering problems.

Learning Outcomes:

Course Outcome	Description
CO1	Summarize the contemporary literature and explore tools for hands-on in the respective project area
CO2	List out the specific requirements to develop the workable solution for the identified computing problem.
CO3	Develop a working model for the identified problem
CO4	Inspect the developed solution using exhaustive test cases and evaluate its performance using statistical methods and relevant metrics
CO5	Compile the results and findings of the project in written and verbal formats
CO6	Report the results and findings of the project in written and verbal formats.

Course Content:

Project based learning: Each student in a group of 2-3 will have to develop a Major Project based on different real-world problems using any open-source programming language. Students have to study the state-of-the-art methods before finalizing the objectives. Project development will enhance the knowledge and employability of the students in IT sector.

Teaching Methodology:

- Regular supervision by project guide

Evaluation Scheme:

Exams	Marks	Coverage
Mid Semester Viva	20 Marks	Based on Unit-1, Unit-2, Unit-3
Final Viva	30 Marks	Based on Unit-4,Unit-5,Unit-6 and Unit-7
Project Report	20 Marks	
Day to Day Work	30 Marks	

Total	**100 Marks**	

Text Book/Reference material:

- Seven latest international journal papers having high impact factor. MOOC Courses from Coursera, NPTEL etc.

Journals References:

[1] ieee.org
[2] dl.acm.org
[3] Elsevier
[4] Springer

Course Description

8th Semester:

Title: Major Project Part – II Code: 18B19CI891

L-T-P scheme: 0-**0-16** **Credit: 08**

Prerequisite: Students must have already completed Project Part-1.

Objective:

1. To apply engineering knowledge in practical problem solving
2. To foster innovation in design of products, processes or systems
3. To develop creative thinking in finding viable solutions to engineering problems.

Learning Outcomes:

Course Outcome	Description
CO1	Summarize the contemporary scholarly literature, activities, and explored tools for hands-on in the respective project area
CO2	List out the specific requirements to develop the workable solution for the identified computing problem.
CO3	Develop a workable computing solutions for the identified problem
CO4	Evaluate the performance of the developed solution
CO5	Compile the results and findings of the project in written and verbal formats
CO6	Developing the ability of develop a complete IR system from scratch.

Course Content:

Unit-1: In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester.

Unit-2: Review and finalization of the approach to the problem relating to the assigned topic.

Unit-3: Preparing a detailed action plan for conducting the investigation, including team work Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed.

Unit-4: Final development of product/process, testing, results, conclusions and future directions.

Unit-5: Preparing a paper for Conference presentation/Publication in Journals, if possible.

Unit-6: Preparing a report in the standard format for being evaluated by the dept. assessment board.
Unit-7: Final project presentation and viva voce by the assessment board including external expert.

Teaching Methodology:

- Regular supervision by project guide

Evaluation Scheme:

Exams	Marks	Coverage
Mid Semester Viva	20 Marks	Based on Unit-1, Unit-2, Unit-3
Final Viva	30 Marks	Based on Unit-4,Unit-5,Unit-6 and Unit-7
Project Report	20 Marks	
Day to Day Work	30 Marks	
Total	**100 Marks**	

Text Book/Reference material:

- Seven latest international journal papers having high impact factor. MOOC Courses from Coursera, NPTEL etc.

Journals References:

[1] ieee.org
[2] dl.acm.org
[3] Elsevier
[4] Springer

Course Description

CSE Electives:

Title: Compiler Design **Code: 18B14CI541**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite:

Students must have already registered for the course, "Data Structures" and "Theory of Computation ".

Objective:

- Deepen the understanding of compiler design
- Develop problem solving ability using programming
- Develop ability to design and analyze a compiler

Learning Outcomes:

Course Outcome	Description
CO1	Specify and analyze the lexical, syntactic and semantic structures of advanced language features.
CO2	Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation
CO3	Write a scanner, parser, and semantic analyzer without the aid of automatic generators
CO4	Turn fully processed source code for a novel language into machine code for a novel computer
CO5	Describe techniques for intermediate code and machine code optimization
CO6	Design the structures and support required for compiling advanced language features.

Course Content:

UNIT I: Introduction to Compilers
Translators-Compilation and Interpretation, Language processors, The Phases of Compiler, Errors Encountered in Different Phases,The Grouping of Phases of Compiler , Programming Language basics.

UNIT II: Lexical Analysis
Need and Role of Lexical Analyzer,Lexical Errors,Expressing Tokens by Regular Expressions, Converting Regular Expression to DFA ,Minimization of DFA, Language for Specifying Lexical Analyzers, LEX (Design of Lexical Analyzer for a sample Language).

UNIT III: Syntax Analysis
Need and Role of the Parser, Context Free Grammars , Top Down Parsing ,General Strategies, Recursive Descent Parser ,Predictive Parser ,LL(1) Parser,Shift Reduce Parser-LR Parser, LR (0)Item, Construction of SLR Parsing Table , Introduction to LALR Parser ,Error Handling and Recovery in Syntax Analyzer, YACC (Design of a syntax Analyzer for a Sample Language) .

UNIT IV: Syntax Directed Translation & Run Time Environment
Syntax directed Definitions, Construction of Syntax Tree, Bottom-up Evaluation of S-Attribute Definitions, Design of predictive translator, Type Systems, Specification of a simple type checker, Equivalence of Type Expressions, Type Conversions.
RUN-TIME ENVIRONMENT: Source Language Issues, Storage Organization-Storage Allocation, Parameter Passing, Symbol Tables.

UNIT V :Code Optimization
Principal Sources of Optimization, DAG, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithms.

UNIT VI: Code Generation
Issues in Design of a Code Generator, a Simple Code Generator Algorithm.

Teaching Methodology:
Teaching in this course is designed to engage the students in active and experimental learning by taking a problem solving and design oriented approach with special emphasis on real world applications. Students are expected to carry out lot of design and programming.

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-6 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:
Tutorials and lecture slides on Compiler Design (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:
1. Compilers : Principles, Techniques and Tools, Aho, Sethi and Ullman, Pearson Education
2. Principles Of Compiler Design by Alfred V Aho and Ullman, Narosa Publication

Reference Books:
1. Compiler Design in C, Holub, Prentice Hall of India
2. Advanced Compiler Design and Implementation, Muchnick Steven, Morgan Kauffman Publishers
3. Compiler Design, Santanu Chattopadhyay, PHI
4. Compiler Construction Principles and Practice, Kenneth C. Louden, Thomson
5. Compiler Construction and Design, Rajni Jindal , Umesh Publications

Title of Course: Embedded System **Course Code: 18B14CI544**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Objectives: To develop an appreciation of the technology capabilities and limitations of the hardware, software components for building embedded systems, and methods to evaluate design tradeoffs between different technology choices-microcontroller, DSP and FPGA based. To model and specify an embedded system at a high –level of abstraction.

Learning Outcomes: Students will be able to

Course Outcome	Description
CO1	Express the evolution of Embedded Systems and Study the Real time Operating system
CO2	Illustrate CISC and RISC instruction set architecture and processor architecture and its applications
CO3	Understand various types of memory used in embedded system
CO4	Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.
CO5	Identify the hardware and software components of an embedded system
CO6	Work as a team on a project.

Course Contents:

Unit I: Introduction to Embedded Computing Overview- Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design. Design Process- Requirements, Specifications, Architecture Design, Designing of Components, System Integration

Unit II: Embedded System Architecture CISC and RISC instruction set architecture, Basic Embedded Processor/Microcontroller Architecture-CISC (Motorola-68HC11 and 8051 processor), CISC (ARM), DSP Processors and Harvard Architecture (PIC). Memory System Architecture-Caches and Virtual Memory. I/o Sub-system - Busy-wait I/0, DMA and Interrupt driven I/0.

Unit III: Designing Embedded Computing Platform Using CPU Bus- Bus Protocols and Bus Organization. Memory Devices and their Characteristics- RAM, ROM, UVROM, EEPROM, Flash Memory, DRAM. I/O Devices- Timers and Counters, Interrupt Controllers, DMA Controllers, A/D and D/A Converters, Displays, Keyboards and Infrared devices. Component Interfacing- Memory Interfacing and I/O Device Interfacing.

Unit IV: Design of Embedded Processors Application Specific Logic Design using Field Programmable Devices and ASICs, Introduction to Hardware Description Languages. Design Examples- Data Compressor and Alarm Clock

Unit V: Software Development and Tools Embedded system evolution trends, round-robin, robin with interrupts, function – one scheduling architecture, algorithms, introduction to- assembler - compiler-cross compilers and integrated development environment (IDE). Object oriented interfacing, recursion, debugging strategies, simulators

Teaching Methodology:

This course is introduced to help students transition from a simple understand the scientific principles and concepts behind embedded systems and "big ideas" in embedded systems.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. F. Vahid & T. Givargis “Embedded System Design”, Wiley & Sons, 2002.
2. D. Gajski, F. Vahid, S.Narayan, and J. Gong “Specification and Design of Embedded Systems”, Prentice Hall.
3. H.Kopetz “Real-Time Systems”, Kluwer, 1997.

References

1. R.Gupta “Co-synthesis of Hardware and Software for Embedded Systems”, Kluwer 1995.
2. Steve Heath, “Embedded Systems Design”.
3. Ken Coffman “Real World FPGA Design with Verilog”, PHI 1999.
4. W. Wolf “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman, 2001.
5. Rozenberg, Grzegorz, Vaandrager, Frits W. (Eds.) “Lectures on Embedded Systems”, Springer.
6. Valvano Jonathan W “Embedded Microcomputer Systems: A Real Time Interfacing” Cengage Learning.

Title of Course: Advanced Concepts in DBMS **Course Code: 18B14CI547**
L-T Scheme: 3-0 **Course Credit: 3**

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

Learning Outcomes:

Course Outcome	Description
CO1	Ability to build normalized databases.
CO2	Ability to design systems by using ER Modeling.
CO3	Ability to develop the skills of writing applications by using SQL.
CO4	Ability to understand query optimization techniques.
CO5	Understanding of transaction processing.
CO6	Ability to handle recovery and concurrency issues

Course Contents:

Unit-1 (Introduction): Overview of object-oriented concepts and characteristics, Objects, OIDs and reference types, Database design for ORDBMS, Comparing RDBMS, OODMBS, and ORDBMS.

Unit-2 (Distributed DBMSs-Concepts and Design): Introduction, Homogeneous and heterogeneous databases, Advantages and Disadvantages of DDBMS, Homogeneous and Heterogeneous DDBMSs, Overview of Networking , Functions and Architectures of a DDBMS, Distributed Relational Database Design, Date's Twelve Rules for a DDBMS.

Unit-3 (Distributed DBMSs- Advanced Concepts): Distributed Transaction Management, Distributed Concurrency Control, Distributed Deadlock Management, Distributed Database Recovery, Distributed Query Optimization.

Unit-4 (Replication and Mobile Databases): Introduction to Database Replication, Benefits of Database Replication, Applications of Replication, Basic Components of Database Replication, Database Replication Environments, Synchronous Versus Asynchronous Replication, Introduction to Mobile Databases.

Unit-5 (Object DBMS): Advanced Database Applications, Weaknesses of RDBMSs, Object-Oriented Concepts, Storing Objects in a Relational Database, Object-Oriented Database Design, Comparison of Object-Oriented Data Modeling, Conceptual Data Modeling ,Object-Oriented Analysis and Design with UML.

Unit-6 (Object-Oriented DBMSs Concepts): Introduction to Object-Oriented Data Models and OODBMSs, OODBMS Perspectives, Persistence, Issues in OODBMSs, Advantages and Disadvantages of OODBMSs.

Unit-7 (Object-Oriented DBMSs Standards and Systems): Object Management Group, Object Data Standard ODMG, Object Store.

Unit-8 (Object-Relational DBMSs): Introduction to Object-Relational Database Systems, The Third-Generation Database Manifestos, The Third-Generation Database System Manifesto The Third Manifesto, Postgres - An Early ORDBMS, SQL: 1999 and SQL: 2003, Query Processing and Optimization, Object-Oriented Extensions in Oracle, Comparison of ORDBMS and OODBMS.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Thomas M. Connolly Carolyn E. Begg, Database Systems: A Practical Approach to Design, implementation, and Management Fourth Edition.

Reference Books

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
3. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw-Hill.
4. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C. J. Date & Longman, Introduction to Database Systems, Pearson Education

Title: Information Security **Code 18B14CI550**
L-T-P scheme: 3-0-0 **Credit: 3**

Objectives:

1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security.
2. Master the key concepts of information security and how they "work."
3. Develop a "security mindset:" learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, viewpoints, and trade-offs.
4. To provide the ability to examine and analyze real-life security cases.

Learning Outcome:

Course Outcome	Description
CO1	Evaluate vulnerability of an information system and establish a plan for risk management.
CO2	Demonstrate basic principles of Web application security
CO3	Evaluate the authentication and encryption needs of an information system.
CO4	Demonstrate how to secure a network
CO5	Understanding of transaction processing.
CO6	Evaluate a company's security policies and procedures

Course Contents:

Introduction: Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets
Software Security: Vulnerabilities and protections, malware, program analysis
Practical Cryptography: Encryption, authentication, hashing, symmetric and asymmetric cryptography, Digital Signatures and Certificates
Network Security: Network security issues, Sniffing, IP spoofing, Common threats, E-Mail security, IPSec, SSL, PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.
Cyber Security: Cyber Crime and security, Security tools, Introduction to Digital Forensic, OS fingerprinting, TCP/IP stack masking, Social Engineering.
Applications and special topics: Web application Security, Privacy and Anonymity, public policy

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. William Stallings; Lawrie Brown, Computer Security: Principles and Practice, Pearson; 4th edition, 2017

References:

1. Introduction to Computer Security, 2004 Matt Bishop, Addison-Wesley, ISBN 0-321-24744
2. Buchmann J. A., Introduction to Cryptography, Springer Verlag (2001).
3. Stallings William, Cryptography and Network Security, Pearson Education (2006).
4. Schneier Bruce, Applied Cryptography, John Wiley and Sons (1996).
5. **Britz M., Computer Forensic and cyber crime, Upper Saddle River, Prentice Hall (2003).**

Course Title: Computer Graphics **Course Code: 18B14CI643**
L-T Schème : 3-0 **Course Crédits: 3**

Scope and Objectives:

1. To learn and understand the basics of computer graphics applications and graphics devices
2. To learn and understand the geometric figure drawing algorithm on graphic device
3. To learn and understand the Two-Dimensional transformations
4. To learn and understand the Three-Dimensional transformations
5. To understand the concepts of solid modelling and representation
6. To learn about the Visible-Surface, Illumination and Shading

Learning Outcome:

Course Outcome	Description
CO 1	Student will learn about the overview of computer graphic applications and graphics devices (Display Technologies, Raster Refresh (Raster-Scan), CRT, LCD displays, etc.)
CO 2	Student will learn about the scan conversion - lines, circles and Ellipses, filling, clipping and aliasing
CO 3	Student will learn about the Two-Dimensional transformations and matrix representation of 2D Transformations (Translations, Rotation, Reflection, Scaling and Combined Transformation) and Window-to-Viewport transformations
CO 4	Student will learn about the Three-Dimensional transformations and viewing in 3D
CO 5	Student will learn about the solid modelling: representing solids, regularized Boolean Set operations, primitive instancing, sweep representations, spatial-partitioning representations - Octree representation, B-Reps and Constructive Solid Geometry
CO 6	Student will learn about the visible surface detection, illumination and shading

Course Contents:

Unit 1: Introduction to Computer Graphics: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Colour CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays, Touch screen, Graphics Primitives.

Unit II: Scan conversion – lines, circles and Ellipses; Filling polygons and clipping algorithms, Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components

Unit III: Two-Dimensional Transformations: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D

Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.

Unit IV : Three-Dimensional Transformations and Viewing in 3D: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections.

Unit V: Solid Modelling: Representing Solids, Regularized Boolean Set Operations, Primitive Instancing, Sweep Representations, Spatial-Partitioning Representations: Octree representation, B-Reps, Constructive Solid Geometry, Comparison of Representations

Unit VI: Visible-Surface Determination: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods

Unit VII: Illumination and Shading: Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenuation, Phong's model, Gouraud shading, some examples.

Unit VIII: Image Manipulation and Storage: What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text book:

1. D. Hearn and M. P. Baker, Computer Graphics using C

Reference Books:

1. Foley, Van Darn, Feiner, Hughes, Computer Graphics, Second edition
2. D.F. Rogers, Mathematical elements for computer graphics, Second edition
3. Rogers, Procedural elements for Computer Graphics, Second edition

Online Resources: https://nptel.ac.in/courses/106106090
https://in.coursera.org/learn/interactive-computer-graphics

Title of Course: Graph Algorithm and Applications **Course Code: 18B14CI645**
L-T Scheme: 3-0-0 **Course Credits: 3**

Prerequisite: Data Structure and Algorithms

Objectives:

- Students will achieve command of the fundamental definitions and concepts of graph theory.
- Students will understand and apply the core theorems and algorithms, generating examples as needed, and asking the next natural question.
- Students will achieve proficiency in writing proofs, including those using basic graph theory proof techniques such as bijections, minimal counterexamples, and loaded induction.
- Students will work on clearly expressing mathematical arguments, in discussions and in their writing.
- Students will become familiar with the major viewpoints and goals of graph theory: classification, extremality, optimization and sharpness, algorithms, and duality.
- Students will be able to apply their knowledge of graph theory to problems in other areas, possibly demonstrated by a class project.

Learning Outcome:

Course Outcome	Description
CO1	Enhance your understanding of real-world graph properties and how to generate synthetic graphs
CO2	Describe parallelism and how it can be used to speed up graph processing
CO3	Examine performance characteristics of graph algorithms
CO4	Assess the state-of-the-art graph processing tools available today and learn to use certain graph software
CO5	Explore the pros and cons of different graph processing approaches
CO6	Acquire a new set of tools for improving the effectiveness and performance of graph algorithms

Course Contents:

Unit-I: Planar graphs: planarity testing, problems that are easier on planar graphs, drawing planar graphs.

Unit-II: Planar separators

Unit-III: Intersection graphs and related classes: interval and chordal graphs, unit disc graphs, etc.

Unit-IV: Trees and related graphs: treewidth, series parallel graphs, problems that are easier on these.

Unit-V: Introduction to graph minors.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus

Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Introduction to Graph Theory by West Prentice Hall, ISBN: 0-13-227828-6
2. Graph Theory by Deistel, Springer, ISBN: 3-540-26183-4

Reference Books

1. Extremal Graph Theory by Bollobs, Academic Press, ISBN: 0-12-111750-2
2. Computers and Tractability, Grey and Johnson, Freeman, ISBN: 0-7167-1045-5

Links- 1 : https://nptel.ac.in/courses/111106102
2 : https://archive.nptel.ac.in/courses/128/106/128106001

Title of Course: Image Processing **Course Code: 18B14CI647**
L-T Scheme: 3-0 **Course Credits: 3**

Objectives: To introduce the students to the basic concepts and analytical methods of satellite remote sensing as applied to environmental systems (e.g., land-cover classification, vegetation monitoring, etc.). The course emphasizes the application of processing and analysis of digital satellite images, especially Landsat, SPOT, and AVHRR data, for classification of land cover, land-cover/land-use change analysis, and other geographic topics. The primary objective of the course is to provide students with the skills and knowledge to apply remote sensing to their own research problems.

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

Course Outcome	Description
CO1	Describe the processes and hardware of image acquisition
CO2	Apply pre-processing operations in image enhancement
CO3	Compare various image segmentation and feature extraction operations
CO4	Identify image processing applications in various fields

Course Contents:

Unit-1 (Introduction and Digital Image Fundamentals): Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbors, connectivity, Distance measure between pixels, Imaging Geometry.

Unit-2 (Image Transforms): Discrete Fourier Transform, Some properties of the two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT.

Unit-3 (Image Enhancement): Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Lowpass filtering, Highpass filtering, Homomorphic filtering, Colour Image Processing.

Unit-4 (Image Restoration): Degradation model, Diagnolization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

Unit-5 (Image Compression): Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.

Unit-6 (Image Segmentation): Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Unit-7 (Representation and Description): Representations schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

Unit-8 (Recognition and Interpretation): Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretation.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", AWL.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI.

References

1. Rosefield Kak, "Digital Picture Processing".
2. W. K. Pratt, "Digital Image Processing".
3. Paul Mather, "Computer Processing of Remotely-Sensed Imag", Third Edition. Wiley, ISBN 0-470-84919-3, 2004.
4. Awcock, G.W & R. Thomas. 1995. Applied image processing. McGraw Hill.
5. Gonzalez, Rafel C.; Richard E. Woods. 1993. Digital image processing.

Title: Soft Computing **Course Code: 18B14CI74**

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

Pre-requisite: Artificial Intelligence & Application

Course Objectives:

This course aims to develop students' abilities in using some contemporary approaches in solving problems in automation.

It will enable students to:
(a) Appreciate the advantages and limitations of fuzzy systems and their potential impacts and applications in intelligent control and automation;
(b) Appreciate the advantages and limitations of neural networks and their potential impacts and applications in intelligent automation; and
(c) Develop an understanding of generic algorithms and their potential applications.

Learning Outcomes:

After completing this course, you will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problems using GAs.
- Solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).
- Applications of Soft computing to solve problems in varieties of application domains.

Course Outcome	Description
CO1	Demonstrate knowledge of the building blocks of Soft Computing as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	Develop algorithms for real life problems problems and also design intelligent systems.
CO4	Attain the capability to represent various real life problem domains using fuzzy logic, Artificial Neural Network and Genetic Algorithms based techniques.
CO5	Formulate and solve problems with uncertain information using Soft Computing approaches.
CO6	Apply concept of Soft Computing for processing to problems leading to understanding of cognitive computing.

Course Contents:
Basics of Soft Computing
Fundamental of Neural Networks
Back-propagation Networks
Associative Memory
Adaptive Resonance Theory
Fuzzy Set Theory

Fuzzy Systems
Fundamentals of Genetic Algorithms
Genetic Modeling
Integration of Neural Networks, Fuzzy Logic, and Genetic Algorithms

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

Text Book:
1. "Neural Networks, Fuzzy Logic, and Genetic Algorithms" by **S. Rajasekaran, G.A. Vijayalakshmi Pai,** (Prentice-Hall of India Private Ltd.),

Other References:

1. "Neuro-Fuzzy And Soft Computing" by J. S. R. Jang, C. T. Sun, E. Mizutani (Pearson Education)
2. "Soft Computing in Human-Related Science" by Horia-Nicolai Teodorescu, Abraham Kandel, Lakhmi C. Jain (CRC Press)
3. "Genetic Algorithms" by David E. Goldberg (Pearson Education)
4. "Soft Computing and Intelligent Systems: theory and Application" by Sinha, Naresh K.
5. "Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence" by Kosko, Bart

Title of Course: Network Management **Course Code: 18B14CI742**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Objectives:
The course covers Concepts of Computer networks and fundamental aspects of managing computer networks in a modern networked environment. It also dwells into details of Simple Network Management Protocol & Broadband Network Management like ATM networks.

Learning Outcomes:
After completing this course, students will be able to use network management tools, systems and applications in an organization. They should be able to explain the use of simple network management protocol & broadband network management

Introduction: Overview of Computer Network and Tele-Communications and Network, Basics of network management system, Need of NMS, Users of NMS, Network management standards, NMS models and languages, Challenges in NMS Operation: Domain management, Software Architecture, Quantifying Management Integration Complexity

NMS functional areas: Fault management, Configuration management, Accounting management, Performance management, Security management

NMS Components: Management information base, schema and Meta-schema, structure of management information, MIB-1 MIB-2

NMS Protocol: role of SNMP protocol, SNMP Header, SNMP Nodes, SNMP Agents, SNMP operations, BER, ASN.1, Versions of SNMP i.e. SNMPv1, SNMPv2, SNMP v3, SNMP management RMON, Netconf, Netconf Data-stores, Architecture and Operations

NMS Metrics: Network Management Business Impact: cost of ownership, enabling of revenues, network availability, trading off the benefits and cost of network management investments, factors that determine management effectiveness, assessing network management effectiveness, management metrics to track business impact, management metrics to track contribution to management effectiveness, assessing and tracking the state of management, using metrics to direct management investment

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

T1. Mani Subramanian, Network Management Principals and Practices, Pearson Education.
T2. J. Richard Burke, Network Management: Concepts and Practice: A Hands-on Approach, Pearson Education

Reference Books:

R1. Behrouz A. Forouzan, Data Communication and Networking.
R2. Andrew S. Tanenbaum, Computer Networks.
R3. John Larmouth , ASN.1 Complete, Open system solution.

Title of Course: Ad-hoc and Wireless Networks **Course Code: 18B14CI744**
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Students must have knowledge of Wireless Communication fundamentals and Wired Networks

Objectives:

To understand wireless and ad hoc networks and design efficient protocols and algorithms for wireless networks, we need to understand the characteristics of wireless communications. Important building blocks of wireless and ad-hoc networks studies are various models like propagation models, energy models, interference models and mobility models. Apart from this, students should understand various existing standards for Wireless, Ad-hoc and Sensor networks.

Learning Outcomes:

This course will introduce students various aspects on Wireless as well as ad-hoc networks, and expose them to the fundamental concepts and issues in designing and analyzing wireless and ad-hoc networks. Students will study wireless transmission fundamentals as well models related to wireless networking. Learning these models should allow students understand and designing various protocols related to wireless networks. Students will be introduced with various wireless standards like IEEE 802.11 and IEEE 802.15.4. Students will be able to find issues related to Medium Access Control (MAC) and routing protocols.

Course Outcome	Description
CO1	Outline various wireless networks, their classification based on network architecture and communication coverage area.
CO2	Describe concept of wireless channels, free space propagation model, path loss model, basic propagation mechanisms
CO3	Develop the concept of interference and mobility models, RTS-CTS model, IEEE 802.11 protocols
CO4	Identify different approaches for contention based MAC, Distributed coordination function, WiMAX.
CO5	Applications ,challenges and deployment of wireless sensor network
CO6	Demonstrate the performance of routing protocols, design issues, classification.

Course Contents:

Unit-1 (History of Wireless Networks): Introduction, Wireless Network classification based on Network Architecture and Communication coverage area, Introduction to various wireless networks

Unit-2 (Radio wave Propagation models): Wireless Channels, Antenna gain, Aperture, Wavelength, Wireless channel models - Free-Space Propagation Model, Two-Ray Ground Model, The Log-Distance Path-Loss Model, Large-Scale and Small-Scale Variations, basic propagation mechanisms

Unit-3 (Interference and mobility models): Power Assignment and Topology Control, Wireless interference graph- Protocol-Interference Model, Fixed Power-Protocol-Interference Model, RTS/CTS Model and Physical-Interference Model, Energy consumption models for , Mobility models–Properties of mobility models, Random-Walk and Random-Direction Models, Random-Waypoint Model, Random-Trip Mobility Model, Markov Mobility Models, Smooth Random-Mobility Model, Group Mobility.

Unit-4 (Wireless Medium-Access Control Protocols): Contention based MAC, IEEE 802.11 Architecture and Protocols - Various IEEE 802.11 Protocols, Distributed Coordination Function, Problems and Solutions for the Ad Hoc Model, WiMAX.

Unit-5 (Wireless Sensor Networks): Introduction, need of WSNs, Applications, Challenges, Deployment of ad-hoc/sensor networks, MAC for WSNs, Introduction to IEEE 802.15.4, CSMA/CA for IEEE 802.15.4, Bianchi's Markov chain analysis of throughput for the CSMA protocol.

Unit-6 (Routing protocols): Issues in designing routing protocols, Classification of routing protocols, Routing protocols, various performance metrics

Teaching Methodology:

The Students will be able to learn basic concepts of information theory, memoryless channels and shannon's capacity. They will also learn different types of codes like block codes, cyclic codes and convolutional codes.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-2, 3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 and 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:

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

Text Books

1. Wireless Ad-hoc and Sensor Network by Xiang Yang Li, Cambridge Press, 2008.

Reference Books

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport, Pearson Publications, 2010.
2. Holger Karl and Andreas Willig Protocols and Architectures for Wireless Sensor Networks WILEY, ISBN: 0-470-09510-5.
3. Ad Hoc Wireless Networks: Architectures and Protocols by C. Siva Ram Murthy and B. S. Manoj, Prentice Hall, 2004.

Title of Course: Design Patterns **Course Code: 18B14CI746**
L-T-P Scheme: 3-0-0 **Credits: 3**

Pre-requisite: Object Oriented Programming (OOP), Java as an OOP language.

Post Course: Object Oriented Software Engineering, Software Quality Management

Objective: To engineer good quality software from its specification

Learning Outcomes

After learning this course, a student should be able to:

Course Outcome	Description
CO1	Understand and use the basic design principles in solving real life problems
CO2	Appreciate the concept of pattern based analysis and design in software development
CO3	Identify appropriate patterns for design of solution to given problem.
CO4	Distinguish between different categories of design patterns.
CO5	Implement design patterns to solve the real life software design problems.

Course Outline:

Unit-I Software Maintenance and maintainability issues, Need for software design, Rules of an effective software design.
Unit-II Classes and objects revisited, class relationships, composition, inheritance versus interface, inheritance versus composition.
Unit-III Scope and aim of design patterns, object generation, object-object interaction, determining object granularity, specifying object interfaces, specifying object implementations, relating compile-time and run-time structures, frameworks.
Unit-IV Types of design patterns, Creational Patterns: Abstract Factory, Singleton, Factory, Prototype etc. Structural Patterns: Adapter, Composite, Decorator, Façade, etc. Behavioral Patterns: Chain of responsibility, Command, Interpreter, Mediator, Observer, State, Template, Strategy, Visitor, etc.
Unit-V Organization of design patterns, selection of design patterns, model-view-controller, an introduction to architectural and other software engineering patterns.

Teaching Methodology:

This course should be conducted in a highly interactive environment. Students will be taught on different software design principles and how each design pattern fulfils the requirements of one or more design principles. Design patterns will be introduced by taking a real-life example and then the importance of that design pattern in solving the problem will be discussed. Exercises shall almost exclusively consist of design work and students will be required to perform these exercises in the following lectures/ tutorials. Good solutions by students will be appreciated and discussed in the same class. There is a self learning component that shall be announced.

Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1^{st} - 4^{th} Week
T-2	25 Marks (1:30 Hours)	5^{th} - 10^{th} Week
T-3	35 Marks (2-Hours)	11^{th} - 16^{th} Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Grady Booch, James Rambaugh, Ivar Jacobson, "The Unified Modeling Language Users Guide", Addision Wesley.
2. Pressman S. Roger, "Software Engineering: A practitioner's Approach", 7^{th} Edition, McGraw Hill.
3. The Gang of Four, "Design Patterns: Elements of Reusable Object-Oriented Software", Addision Wesley.

Title of Course: Internet of Things **Course Code: 18B14CI747**

L-T-P scheme: 2-0-2 **Course Credits: 3**

Prerequisite: Students are expected to have a good understanding of computer networks, familiarity with network programming, and object oriented programming.

Objective:

The course is designed to provide an introduction to the Internet of Things (IoT) for postgraduate students who already have a background in electronic engineering or a related subject, an understanding of basic networking and some programming experience. The course is designed to give the students a solid grounding of the key technologies involved and how they are integrated to form complete IoT systems.

The course has a significant practical content in that half of the time will be spent on practical lab exercises, involving IoT system design and software development.

Learning Outcomes:

On completion of this course, students should be able to:

Course Outcome	Description
CO1	Explain the definition and usage of the term "The Internet of Things" in different contexts.
CO2	Understand where the IoT concept fits within the broader ICT industry and possible future trends.
CO3	Understand the various network protocols used in IoT.
CO4	Be familiar with the key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.
CO5	Design a simple IoT system comprising sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.

Course Contents:

Introduction to the Internet of Things (IoT)

- What is the Internet of Things (IoT)?
- Technology drivers
- Business drivers
- Typical IoT applications
- Trends and implications

IoT Architectures

- Architectures for IoT
- Elements of an IoT Architecture
- Architectural design considerations

IoT Network protocols (MAC layer)

- Wireless sensor networks (WSNs) and power consumption
- CSMA/CA and slotting
- Centralized vs. distributed
- State-of-the-art MAC-layer protocols for WSNs

Wireless technologies for IoT

- WiFi (IEEE 802.11)
- Bluetooth/Bluetooth Smart
- ZigBee/ZigBee Smart
- UWB (IEEE 802.15.4)
- 6LoWPAN
- Proprietary systems

IoT application programming

- - Introduction to IoT device programming.
- - IoT application development.

Data analytics for IoT

- A framework for data-driven decision making
- Descriptive, Predictive and Prescriptive Analytics
- Business Intelligence and Artificial Intelligence
- Importance of impact and open innovation in data-driven decision making

IOT lab exercises

- Lab exercise: Programming for IoT system/Connection/Data Transfer etc.
- Lab exercise : Android programming

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books:

1. Zhao, Feng, and Leonidas J. Guibas. *Wireless sensor networks: an information processing approach*. Morgan Kaufmann, 2004.
2. Karl, Holger, and Andreas Willig. *Protocols and architectures for wireless sensor networks*. John Wiley & Sons, 2007.
3. Dargie, Waltenegus W., and Christian Poellabauer. *Fundamentals of wireless sensor networks: theory and practice*. John Wiley & Sons, 2010.

Title of Course: Network Security **Course Code: 18B14CI748**

L-T Scheme: 3 **Course Credits: 3**

Prerequisites: Knowledge of Computer Networks

Objectives:

To study the concepts of network security and various cryptographic algorithms, hardware and software security, IDS, wireless security, web security, security laws with Internet Governance & Email policy.

Learning Outcome:

Course Outcome	Description
CO1	Discuss the basic concepts of network security and various cryptographic algorithms.
CO2	Describe various hardware and software securities for information.
CO3	Discuss how Intrusion Detection System helps to provide security along with various types of firewalls.
CO4	Describe how wireless security provided to information
CO5	Discuss various concepts of web security.
CO6	Discuss security and law along with Internet Governance and Email policy.

Course Contents:

UNIT I : Introduction and Cryptography

Introduction: Computer security concepts, The OSI security architecture, Security attacks, Security services, Security mechanisms, A model for network security, Standards Cryptography: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation, Approaches to Message Authentication, Secure Hash Function, Message Authentication Codes, Public Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures.

UNIT II: Hardware and Software Security

Hardware Security, Smart Cards, Biometrics, Virtual Private Networks, Types of VPN's, Trusted Operating Systems, Pretty Good Privacy (PGP), Security Protocols, Security Socket Layer, Transport Layer Security, IPSec, S/MIME(Secure/Multipurpose Internet Mail Extension).

UNIT III: Intrusion Detection System and Firewalls

IDS: What is not an IDS?, Infrastructure of IDS, Classification of IDS, Host-based IDS, Network based IDS, Anomaly Vs Signature Detection, Normal Behaviour Patterns-Anomaly Detection, Misbehaviour Signatures-Signature Detection, Parameter Pattern Matching, Manage an IDS. Malicious Software, Safeguards, Firewalls, Packet-Filtering Firewalls, State full Inspection Firewalls, Proxy firewalls, Guard, Personal Firewalls, Limitations of Firewalls.

UNIT IV: Wireless Security

Wireless Application Protocol, WAP Security, Authentication, Integrity, Confidentiality, Security Issues with Wireless Transport Layer Security (WTLS), Wireless LAN, WLAN Configuration, WLAN Technology consideration, Wireless LAN Security, Access Point Security, Work Station Security, Safeguarding Wireless LAN's.

UNIT V: Web Security

Client/Server Architecture, Security considerations and Threats, Web traffic security approaches, SSL/TLS for secure web services, The Twin concept of "SSL Connection" and "SSL Session", SSL session state, SSL Connection State, SSL Record Protocol, SSL Handshake Protocol, Secure Hypertext Transport Protocol(S-HTTP), Secure Electronic Transaction(SET), Business Requirements, SET Participants, SET Transaction Flow.

UNIT VI: Security and Law, Internet Governance and Email Policy

Security and Law: Regulations in India, Information Technology Act 2000, Cyber Crime and the IT Act 2000, Indian Contract Act, 1872, Indian Penal Code, Indian Copyright Act, Consumer Protection Act, 1986, Specific Relief Act, 1963, Government Initiatives, Future Trends-Law of Convergence.

Internet Governance and Email Policy: Internet Governance, Network Security Aspects in E-Governance, Security Monitoring Tools, Electronic Mail, What are the e-mail Threats that Organization's face?, Why do you need an E-mail Policy?, How do you create an E-mail Policy?, Publishing the E-mail Policy, University E-mail Policy, Electronic mail policy.

Teaching Methodology:

The course will be covered through lecture (power point presentation), Practical/Lab Assignment sheets and practical simulations in network security; Some Section of the course will include the study of additional literature to allow them to see how the leading edge is advanced in this area of the discipline. Full engagement in the course is a critical part of learning methods appropriate to this area of the discipline.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books:

1. W. Stalling, Cryptography and Network Security: Principles and Practices.
2. William Stallings, Network Security Essentials: Applications and Standards, Pearson Educaiton, ISBN: 9788131716649,
3. B. A. Forouzan, Cryptography and Network Security.

References:

1. Eric Cole, Network Security Bible, Wiley Publisher, ISBN:9788126523313
2. J. M. Kizza, Computer Network Security, Springer, 2005.
3. Peterson and Davie, Computer Networks a System Approach, Elsevier.

Title of Course: Software Engineering Management **Course code: 18B14CI750**
L-T Scheme: 3-0-0 **Course Credits: 3**

Pre-requisites
Students must have knowledge of "Software Engineering"

Objectives
1. To strengthen their ability to apply Software Engineering Principles and practices to manage individuals and teams in software projects.
2. To strengthen their skills in Requirements engineering, Configuration management, quality management, applying design patterns and software testing techniques.
3. To provide experience in the use of project management planning tools.

Learning Outcomes
Student will be able to:

Course Outcome	Description
CO1	Manage and Plan Team based Projects.
CO2	Elicit, document and validate requirements for projects.
CO3	Learn and apply Design pattern concepts in developing applications of varying complexities.
CO4	To achieve good quality software.
CO5	To ensure the delivery of the system is on time and within budget.
CO6	Develop test cases and automate software testing.

Course content:

1. **Introduction to Software Engineering & Project Management**
   Modeling Processes and Life-Cycle , Software process models , Process iteration , Process activities , Cost estimation, Project scheduling, Staffing,
2. **Software Configuration management**
   Base line, Software Configuration Items, The SCM Process, Version Control , Change Control , Configuration Audit , Status Reporting , SCM Standards
3. **Software Quality Management**
   Quality concepts, Quality Assurance, Quality Planning, Quality control, Software measurement And metrics.
4. **Software Reengineering and Maintenance:**

   Reverse engineering, Forward engineering, Restructuring, Reengineering Process Model.
5. **Risk Management**

   Risk strategies, Reactive & Proactive Risk strategies, Software Risk, Risk Identification, Risk projection, Risk Assessment, Risk Refinement, Risk Mitigation, monitoring and Management.
6. **AGILE**

   Agile development, Classification of methods, Agile principals, Agile project management, SCRUM, XP, EVO and UP Method overview, Life cycle, Work product, role and services, Common mistakes and misunderstandings, Process mixture, Adoption strategy.
7. **Software Reuse**

Introduction of software reuse, Basic Issues in any Reuse Program,Reuse Approach,Reuse at Organization Level, Introduction of Reusable Component, COTS,Component Adaptation Technoques.

Teaching Methodology

Course will be delivered through lecture sessions and assignments. Course will emphasize more on Mini-Projects. Students will apply advance concepts of Requirements Engineering, Agile methods, Design patterns, RMMM in their mini-projects. They will design test cases for their problem domain and also work on automated testing tools. Students will have to maintain a report on each mini-project. Research literature on topics mentioned in course outline will be studied and presented by the students.

Evaluation Scheme

Evaluations	**Marks**	**Remarks**
T-1	15 Marks(1-Hour)	
T-2	25 Marks (1 Hour 30 Min.)	
T-3	35 Marks (2- Hours)	
Tutorials and Case Study	5 Marks	
Assignments	10 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Reference Material

1. Agile and Iterative Development: A Manager's Guide, Craig Larman
2. Introduction to the Personal Software Process (SM), Watts Humphrey
3. Introduction to the Team Software Process(SM),Watts Humphrey
4. Software Engineering, R.S. Pressman, McGraw Hill
5. Software Engineering Project Management, by Richard Thayor, Forwarded By Edward Yourden
6. Software Testing Techniques, B. Beizer
7. Software Testing ,Louis Tamres
8. Aspect-Oriented Analysis and Design: The Theme Approach (The Addison-Wesley Object Technology Series)
9. Engineering and Managing Software Requirements, by Claes. Wohlin
10. Requirements Engineering, by Elizabeth. Hull, Ken. Jackson, Jeremy. Dick
11. User-Centered Requirements Engineering, by Alistair Sutcliffe

Title of Course: Information Retrieval & Data Mining **Course Code: 18B14CI752**
L-T Scheme: 3-0-0 **Course Credits: 3**

Pre-requisite: Students must have already registered for the course, "Database Management System".

Course Description: This Course introduces the core concepts of data mining (DM), its techniques, implementation, and benefits. Course also identifies industry branches that most benefit from DM, such as retail, target marketing, fraud protection, health care and science, and web and e-commerce. Detailed case studies and using leading mining tools on real data are presented.

Course Objective: This subject enables students to-

- Learn data mining concepts by means of data analysis techniques to make better decisions through proper data preparation and simple tools for solving data mining problems.
- Understand core topics like classification, clustering and association rules are exhaustively dealt with.
- learn the role that software tools/applications play in DM, with emphasis on industrial case studies and practical applications;
- Have an overall understanding of the major issues and applications in data mining, including a basic grasp of the algorithm classes and best practices for building successful data mining projects.

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

Course Outcome	Description
CO1	Examine the concepts of data warehousing and OLAP
CO2	Design various types of data models.
CO3	Apply the concepts of DM techniques for clustering, association, and classification on real datasets.
CO4	Select appropriate DM tools and methods to manipulate and achieve data
CO5	Apply DM concepts for formulating business strategies and programs to enhance business intelligence.

Course Contents:

Unit- I (Data Warehousing): Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

Unit- II (Data Preprocessing): Overview of different type of data and its format. Data collection, extraction and loading (ETL tools), data interestingness measures. Data cleaning, data integration and transformation, data reduction, discretization, concept hierarchies.

Unit-III (Data Mining): Data Mining Functionalities- Interestingness of Patterns-Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse.

Unit-IV (Association Rule Mining And Classification): Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree.

Induction-Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

Unit-V (Clustering And Applications And Trends In Data Mining): Cluster Analysis - Types of Data, Categorization of Major Clustering Methods, Kmeans, Partitioning Methods, Hierarchical

Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis, Data Mining Application.

Unit-VI (Advance Topic in Data Mining): Mining Complex Data Types, Mining text databases, mining the Web, mining time-series and sequence datasets.

Teaching Methodology: This course relies on lectures to guide through the material, tutorial classes to provide students with class, and a sequence of written and online assignments to provide formative assessment opportunities for students to practice techniques and develop their understanding of the course.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, 2007.

Reference Books

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction To Data Mining”, Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay “, Insight into Data mining Theory andPractice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Daniel T. Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006

Title of Course: Component Based Software Engineering **Course Code: 18B14CI756**
L-T Scheme: 3 **Course Credits: 3**

Course Objectives:

The Course focuses on an approach to software development based on extensive use of pre-existing standard (or customizable) components. It also illustrates how a repository of reusable candidate components can be integrated into a typical evolutionary process model. The Component-based Software Engineering process involves identifying candidate components; qualify each component interface, and adapting components.

Learning Outcomes:

Course Outcome	Description
CO1	Describe the role of Component Based Software Engineering (CBSE) within the software life cycle.
CO2	Apply key elements and common methods for CBSE.
CO3	Describe, Compare, contrast and evaluate structured, Object Oriented, Data Oriented and formal approaches to component modeling.
CO4	Conduct a review of CBSE requirements and using best practices to determine the quality of the CBS.
CO5	Demonstrate the capacity to use a range of software tools in support of CBS.

Course Contents:

Introduction- Component definition, Definition of a Software Component and its elements, The Component Industry Metaphor, Component Models and Component Services, An example specification for implementing a temperature regulator Software Component. The Case for Components- The Business Case for components, COTS Myths. CBSE implementation in Java 8.

Planning Team Roles for CBD, **Common High-Risk Mistakes, and CBSE Success Factors**: Integrating Architecture, Process, and Organization. Software Engineering Practices - Practices of Software Engineering, From Subroutines to Subsystems: Component-Based Software Development, Case study of Car Navigation System.

The Design of Software Component Infrastructures - Software Components and the Modelling (UML), Component Infrastructures, Business Components, Components and Connectors, An OPEN process for CBD, Designing Models of Modularity and Integration. Software Architecture, Software Architecture Design Principles, Product-Line Architectures.

The Management of Component-Based Software Systems - Measurement and Metrics for Software Components, Implementing a Practical Reuse Program for Software Components, Selecting the Right COTS Software, Building instead of Buying, Software Component Project Management, The Trouble with Testing Components, Configuration Management and Component Libraries, The Evolution, Maintenance and Management of CBS.

Component Technologies - Overview of the CORBA Component Model, Overview of COM+, Overview of the EJB Component Model, Bonobo and Free Software GNOME Components, Choosing between COM+, EJB, and CCM, Event-driven component based architecture, Software Agents as Next Generation Software Components.

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. The partly two Problem solving session will have conceptual and numerical questions that would aid in strengthening the component based software engineering.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Component - Based Software Engineering, G.T. Heineman and W.T. Councill, Addison-Wesley, Pearson Education.

Reference Books

1. Component Software, C.Szyperski, D.Gruntz and S.Murer, Pearson Education.
2. Software Engineering, Roger S. Pressman, 6th edition, Tata McGraw-Hill.
3. Software Engineering, Ian Sommerville, seventh edition, Pearson education, 2004.
4. Software Engineering Principles and Practice, Hans Van Vliet, 3rd edition, Wiley India edition.

Title of Course: Parallel Computing **Course Code: 18B14CI758**
L-T Scheme: 3-0-0 **Course Credits: 3**

Prerequisites: Data Structures

Objectives: To familiarize the students with classical results of parallel computing and to provide practical insights into how algorithms are made to run efficiently on processor arrays, multiprocessors and multi-computers.

Learning Outcomes: Students will be able to

Course Outcome	Description
CO1	Apply knowledge of mathematics, science, and engineering to real world problems
CO2	Design and conduct experiments, as well as to analyze and interpret data
CO3	Design a system, component, or process to meet desired needs within realistic constraints
CO4	Function on multi-disciplinary teams.
CO5	Ability to identify, formulates, and solves engineering problems.
CO6	Understand professional and ethical responsibility

Course Contents:

Unit-1 (Introduction): Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm. Need for Higher-Performance computers, Methods used to achieve Higher Performance, Classifying Architectures Hardware taxonomy: Flynn's classifications, Handler's classifications.

Unit-2 (Abstract parallel computational models): Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism, Models of Parallel Computation: Processor organization, Processor arrays, Multiprocessors and Multi-computers.

Unit-3 (Performance Matrices): Laws governing performance measurements. Matrices- speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks. Parallel Processors: Taxonomy and topology - shared memory multiprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections.

Unit-4 (Parallel Programming & Designing Parallel Algorithms): Developing algorithms for Processor Arrays, Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

Unit-5 (Sorting on different models of SIMD, Matrix Multiplication): Matrix multiplication for different models of Processor arrays and multiprocessors. Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. M. J. Quinn. Parallel Computing: Theory and Practice, McGraw Hill, New York, 1994.

References

1. T. G. Lewis and H. El-Rewini. Introduction to Parallel Computing, Prentice Hall, New Jersey, 1992.
2. T. G. Lewis. Parallel Programming: A Machine-Independent Approach, IEEE Computer Society Press, Los Alamitos, 1994. Research articles.

Title of Course: Data Mining Tools and Applications **Course Code: 18B14CI759**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: To study advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the technologies.

Learning Outcomes:
At the end of the course the students will have knowledge of:

Course Outcome	Description
CO1	Data analysis methods, covering traditional methods but with greater emphasis on modern methods that locate and address common data foibles
CO2	Survey design & data collection issues
CO3	Multivariate methods: supervised/unsupervised classification, data reduction
CO4	Univariate methods: both basic (e.g. t-tests, ANOVA, linear models) and advanced (e.g. Generalized Linear Models, Generalized Additive Models).
CO5	Data mining methods: tree methods with boosting and bagging; Multivariate Adaptive Regression Splines; Random Forests; Neural Nets; model diagnostics
CO6	Tools for difficult data: ridge regression; basic data imputation

Course Contents:

Unit-I: Data Mining and Knowledge Discovery, The KDD process and methodology, Data preparation for knowledge discovery, Overview of data mining and Machine Learning techniques, Review of Python and overview of Python tools for Data Analysis.

Unit-II: Supervised Techniques, Classification and Prediction using K-Nearest-Neighbor, Classifying with Probability Theory; Naïve Bayes, Building Decision Trees, Forecasting and Regression models, Evaluating predictive models.

Unit-III: Unsupervised Learning, Clustering using K-Means, Association Rule discovery, Sequential Pattern Analysis, Principal Component Analysis and Dimensionality, Reduction.

Unit-IV: Possible Applications (covered throughout the course), Collaborative Recommender Systems, Content Based personalization, Predictive User Modeling, Concept Discovery from Documents, Blogs, Social Annotations, Finding groups using social or behavioral data, Building predictive models for target marketing, Customer or user segmentation.

Unit-V: Advance Topics (if time permits), SVD and Matrix Factorization, Search and Optimization Techniques, Markov Models, Dealing with Big Data and Map Reduce.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	

Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. "Building the Data Warehouse", W. H. Inman, 3rd edition, John Wiley & Sons.
2. "Data Mining Techniques", Arun K. Pujari, University Press.

References

1. W.H.Inmon, C.L.Gassey, "Managing the Data Warehouse", John Wiley & Sons.
2. Fayyad, Usama M. et. al., "Advances in knowledge discovery & Data-Mining", MIT Press.
3. Dunham, Margaret H.,"Data Mining –Introductory and Advanced Topics.

Title of Course: Distributed Systems **Course Code: 18B14CI760**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: Distributed systems techniques developed over the last two to three decades, such as inter-process communication and remote invocation, distributed naming, cryptographic security, distributed file systems, data replication and distributed transaction mechanisms, to provide the run-time infrastructure supporting today's networked computer applications will be covered under this course.

Learning Outcomes: With this course we will be able to convey insight into, and knowledge of, the principles and practice underlying the design of distributed systems, both Internet-based and otherwise. Information will be provided in sufficient depth to allow students to evaluate existing systems or design new ones. Detailed case studies illustrate the concepts for each major topic.

Course Contents:

Unit-1 (Introduction): Introduction to distributed systems, Definition of distributed systems, goals, hardware concepts, software concepts, the client-server model.

Unit-2 (Communication): Layered protocols, remote procedure call, remote object invocation, message-oriented communication, stream-oriented communication.

Unit-3 (Processes): Threads, clients, servers, code migration, software agents.

Unit-4 (Naming): Naming entities, location mobile entities, removing unreferenced entities.

Unit-5 (Synchronization): Clock synchronization, logical clocks, global state, election algorithms, mutual exclusion, and distributed transaction.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Tanenbaum, Andrew S. Steen, Maarten Van , “Distributed Systems Principles and Paradigms”, Pearson Education.

References

1. Coulouris, George ,Dollimore, Jean , Distributed Systems: Concepts and Design” Person
2. Buchanan, William “Distributed Systems and Networks” TMGH
3. Ghosh, Sukumar, “Distributed Systems: An Algorithmic Approach”

Course Title: Cryptography Systems **Course Code: 18B14CI841**
L-T-P Scheme: 3-0-0 **Credit: 3**

Course Objective:

1. To provide comprehensive understanding of cryptographic principles, techniques, and applications.
2. To enable students to design, implement, and analyze secure cryptographic solutions.

Learning Outcomes:

CO1	Remember: Recall fundamental cryptographic principles, including encryption methods, cryptographic algorithms, and security properties such as confidentiality and integrity.
CO2	Understand: Explain the workings of various cryptographic techniques, such as symmetric-key cryptography, public-key cryptography, and cryptographic hash functions, and analyze their strengths and weaknesses.
CO3	Apply: Implement cryptographic algorithms and protocols using programming languages, demonstrate proficiency in encryption, decryption, digital signatures, and key management.
CO4	Analyze: Evaluate the security of cryptographic systems by identifying vulnerabilities, analyzing potential attacks, and assessing the effectiveness of cryptographic countermeasures.
CO5	Create: Design secure cryptographic solutions for real-world scenarios, including secure communication protocols, data encryption schemes, and authentication systems, considering factors such as efficiency, scalability, and resistance to attacks.

Course Content:

Unit-1: Introduction and Classical Ciphers

Security: Computer Security, Information Security, Network Security, CIA Triad, Cryptography, Cryptosystem, Cryptanalysis, Security Threats and Attacks, Security Services, Security Mechanisms. Classical Cryptosystems: Substitution Techniques: Ceasar, Monoalphabetic, Playfair, Hill, Polyalphabetic ciphers, One-time pad Transposition Techniques: Rail Fence Cipher, Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Ciphers

Unit-2: Symmetric Ciphers

Feistel Cipher Structure, Substitution Permutation Network (SPN), Data Encryption Standards (DES), Double DES, Triple DES, Finite Fields: Groups Rings, Fields, Modular Arithmetic, Euclidean Algorithm, Galois Fields (GF(p) & GF(2n)), Polynomial Arithmetic, International Data Encryption Standard (IDEA), Advanced Encryption Standards (AES) Cipher, Modes of Block Cipher Encryptions (Electronic Code Book, Cipher Block Chaining, Cipher Feedback Mode, Output Feedback Mode, Counter Mode)

Unit-3: Asymmetric Ciphers

Number Theory: Prime Numbers, Fermat's Theorem, Euler's Theorem, Primality Testing, Miller-Rabin Algorithm, Extended Euclidean Theorem, Discrete Logarithms, Public Key Cryptosystems, Applications of Public Key Cryptosystems, Distribution of public key, Distribution of secret key by using public key cryptography, Diffie-Helman Key Exchange, Man-in-the-Middle Attack, RSA Algorithm, Elgamal Cryptographic System

Unit-4: Cryptographic Hash Functions and Digital Signatures

Message Authentication, Message Authentication Functions, Message Authentication Codes, Hash Functions, Properties of Hash functions, Applications of Hash Functions, Message Digests: MD4 and MD5Secure Hash Algorithms: SHA-1 and SHA-2.

Digital Signatures: Direct Digital Signatures, Arbitrated Digital Signature, Digital Signature Standard: The DSS Approach, Digital Signature Algorithm, Digital Signature Standard: The RSA Approach

Unit-5: Authentication

Authentication System, Password Based Authentication, Dictionary Attacks, Challenge Response System, Biometric System, Needham-Schroeder Scheme, Kerberos Protocol

Unit-6: Network Security and Public Key Infrastructure

Overview of Network Security, Digital Certificates and X.509 certificates, Certificate Life Cycle Management, PKI trust models, PKIX, Email Security: Pretty Good Privacy (PGP), Secure Socket Layer (SSL) and Transport Layer Security (TLS), IP Security (IPSec), Firewalls and their types.

Unit-7: Malicious Logic

Malicious Logic, Types of Malicious Logic: Virus, Worm, Trojan Horse, Zombies, Denial of Service Attacks, Intrusion, Intruders and their types, Intrusion Detection System

Teaching Methodology:

In this course, we will employ a multifaceted teaching methodology to ensure a comprehensive understanding of cryptography and network security principles, as well as practical application skills. Our teaching approach will encompass the following strategies:

1. Lecture Sessions: Engage in interactive lectures to introduce theoretical concepts, historical context, and fundamental principles of cryptography and network security.
2. Interactive Discussions: Encourage active participation through discussions, debates, and Q&A sessions to promote critical thinking and deeper understanding of the material.
3. Case Studies and Real-world Examples: Analyze case studies and real-world examples to demonstrate the relevance of cryptography and network security in various industries and contexts.
4. Group Projects: Assign group projects where students will apply their knowledge to solve real-world security challenges, design secure communication protocols, or propose innovative cryptographic solutions for specific applications.
5. Assessment: Evaluate student learning through quizzes, assignments, exams, and project presentations, assessing both theoretical understanding and practical skills.
6. Continuous Feedback: Provide regular feedback to guide student learning, address misconceptions, and encourage continuous improvement. Stay Updated: Incorporate the latest developments, research papers, and industry trends into the course content to ensure relevance and currency.

Evaluation Scheme:

Exams		Marks	Coverage
T-1		15 Marks	**Based on Units: 1-3**
T-2		25 Marks	**Based on Units: 1-5**
T-3		35 Marks	**Based on Units:1-7**
Teacher's Assessment	Assignment	10 Marks	**25 Marks**
	Tutorial	05 Marks	
	Quiz	05 Marks	
	Attendance	05 Marks	
Total		**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Cryptographic Systems (will be added from time to time): Digital copy will be available on the JUET server/ Google Classroom.

Books:

Text Book

[1] W. Stallings, Cryptography and Network Security, Pearson Education.

Reference Books

[1] William Stallings, Network Security, Principles and Practice
[2] Matt Bishop, Computer Security, Art and Science.
[3] Mark Stamp, Information Security: Principles and Practices.
[4] Bruce Schneier, Applied Cryptography.
[5] Douglas. R. Stinson. Cryptography: Theory and Practice.
[6] B. A. Forouzan, Cryptography & Network Security, Tata Mc Graw Hill.

Web References:

[1] https://www.w3schools.com/cybersecurity/
[2] https://www.geeksforgeeks.org/cryptography-and-its-types/

Course Title: Mobile Computing **Course Code: 18B14CI842**
L-T-P Scheme: 3-0-0 **Credit: 3**

Course Objective:

The objective of the course is to make the student understand the concept of mobile computing paradigm, its novel applications and limitations.

Learning Outcomes:

CO1	To understand the basic concepts of Mobile Computing, its characteristics, applications and limitations.
CO2	To explain the typical mobile networking infrastructure through a popular GSM protocol.
CO3	To understand the issues and solutions of various layers of mobile networks- MAC layer, Network Layer & Transport Layer
CO4	To analyze various protocols of all layers for mobile and wireless communication networks.
CO5	Able to explain & develop any existing or new protocol related to mobile environment

Course Content:

UNIT I Introduction

Introduction to Mobile Computing, Applications of Mobile Computing, Generations of Mobile Communication Technologies, Mobile Computing Vs wireless Networking , Mobile Computing Applications ,Characteristics of Mobile computing, Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II Mobile Telecommunication System

Introduction to Cellular Systems, GSM — Services & Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, GPRS- UMTS Architecture, Handover. Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA

UNIT III Mobile Network Layer

Mobile IPIP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP

UNIT IV Mobile Transport Layer

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT V Mobile Application Layer

Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAPWDP, WTLS, WTP, WSP, WAE, WTA Architecture, WML, Introduction to 4G, features and challenges, Applications of 4G, OFDM

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

References:

1. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
2. Mobile Computing, Raj Kamal by Oxford
3. Wireless Communications, Second Edition, Theodre S Rappaport
4. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
5. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

Title of Course: Introduction to Machine Learning **Course Code: 18B11CI843**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Prerequisite: Students must have knowledge of statistical techniques

Objectives:
In this course we will study the basic component of an intelligence system i.e. machine learning, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes:
The students will have

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 Contents:

1. Introduction:
   What Is Machine Learning?, Why Use Machine Learning? ,Types of Machine Learning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Hypothesis generation, Main Challenges of Machine Learning, Data sets and Testing and Validating.

2. Concept Learning:
   Introduction to Concept Learning, Concept Learning Task, Notation, Inductive Learning Hypotheses, Concept Learning as Search: Generic-to-Specific Ordering of Hypotheses, Finding a Maximally Specific Hypotheses, Version Spaces, Candidate-Elimination Algorithms.

3. Classification:
   MNIST Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label and Multi output classification
4. Training Models:
   Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Estimating Probabilities, Training and Cost Function, and Decision Boundaries
5. Support Vector Machines
   Linear SVM Classification, Soft Margin Classification, Nonlinear SVM Classification,
   Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, Decision Function and Predictions, and The Dual Problem
6. Decision Trees
   Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy, Regularization of hyper parameters, and Random Forests

7. Dimensionality Reduction:
   The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Choosing the Right Number of Dimensions
8. Unsupervised Learning Techniques:
   Clustering, K-Means, Limits of K-Means, Using clustering for image segmentation, Using Clustering for Pre-processing and for Semi-Supervised Learning
9. Introduction to Neural Networks:
   From Biological to Artificial Neurons, Biological Neurons, Logical Computations with Neurons, The Perceptron, Multi-Layer Perceptron and Backpropagation

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Reference Books:

1: Machine Learning, TOM M MITCHELL, TMH
2: Introduction to Machine Learning, 2nd Ed, Ethem Alpaydin, The MIT Press Cambridge, Massachusetts,London, England.
3. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Ed, Aurelien Geron, O'RIELLY

Title: Cloud Computing **Code: 18B14CI847**
L-T-P scheme: 3-0-0 **Credit: 3**

Objectives:

1. To provide introduction to the fundamental principles of cloud computing
2. Students should able to identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Students should learn and investigate the hardware and software architecture of Cloud Computing and understand how virtualization is key to a successful Cloud Computing solution.

Learning Outcomes:

CO1.	Understand Cloud Computing Architectural Framework with Service Models.
CO2.	Demonstrate with different levels of Virtualization by creating Virtual Machine for different applications.
CO3.	Analyse cloud computing security challenges to design the security model.
CO4.	Appraise the cloud management with migration techniques.
CO5.	Develop the applications on Microsoft Azure, Google App Engine, Web 2.0 platforms.

Course Contents:

Fundamentals of Cloud Computing:

Fundamental concepts of Distributed Systems, IT Challenges, Technology Foundations of Cloud Computing, What is Cloud Computing? NIST Definition and Overview of Cloud Computing, Journey of the Cloud, Essential Characteristics of Cloud Computing, Cloud Components, Cloud Challenges, Economics of the Cloud

Understanding Cloud Architecture And Services:

Cloud Architecture, Service Model and Deployment Model, Stack, Management Layers, Standards, Interoperability, Cloud Maturity, Introducing SOA, Relating SOA and Cloud Computing, Architectural Influences, Services: Storage-as-a-Service, Database-as-a-Service, Information-as-a-Service, Identity-as-a-Service, Process-as-a-Service, Integration-as-a-Service, Compliance-as-a-Service, Security-as-a-Service, Management/Governance-as-a-Service, Testing-as-a-Service

Infrastructure-As-A-Service (Iaas):

Virtualization Overview, **Virtualized Data Center (VDC) – Compute**: Why Virtualize, How to Virtualize, Types of Virtualization, Understanding Hypervisors, Virtual Machine and its Components, Resource Management, Share, Limit and Reservation, Optimizing Memory Resource, Memory Ballooning, Virtual Machine Affinity, Physical to Virtual Conversion: Hot and Cold Conversion Process , **Virtualized Data Center (VDC) – Storage**: Benefits, Storage Virtualization at different Layers, Virtual Machine Storage Options and Considerations, Virtual Provisioning, Storage Tiering, **Virtualized Data Center (VDC) – Networking**: BenefitsComponents of VDC network infrastructure, Virtual Network Components, Virtual LAN, VLAN, Trunking, VLAN Tagging, Network Traffic Management, **Virtualized Data Center (VDC) - Desktop and Application**, VMware vSphere

Platform-As-A-Service (Paas):

PaaS: Overview, Web Application Frameworks, Web Hosting Services- 1: Google App Engine
Web Hosting Services- 2: Microsoft Azure Service

Software-As-A-Service (Saas):

SaaS: Overview, Web Services 2.0, REST API, SOAP API, User Authentication, Case Study: Healthcare or Banking

Cloud Security:

Cloud Security: Information Security, Basic Terminology, Security Domains, Security Concerns and Threats, Access Control and Identity Management in Cloud, Governance, Risk and Compliance, Virtualization Security Management, Cloud Security Risk, Incident Response, Retirement, Cloud

Computing Security Architecture, Architectural Consideration, Trusted Cloud Computing, Data Privacy, Testing from SOA to the Clouds

Business Continuity In Cloud:

Business Continuity in Cloud: Fault Tolerance Mechanisms in VDC, Backup in VDC, Replication and Migration in VDC, Capacity Planning, Vertical Scaling, Private Cloud Planning, Business Continuity Plan, Availability

Cloud Infrastructure, Management And Migration:

Cloud Infrastructure and Service Creation, Cloud Service Management, Cloud Administration, Cloud Monitoring, Cloud Migration Consideration: Migration Considerations, Phases to Adopt the Cloud

Hadoop In Cloud Computing:

Overview of Big Data Analytics, Overview of Hadoop and Map Reduce, Example of Map Reduce, Hadoop as a Service in Public Cloud, Hadoop in Private Cloud, HDInsight

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. Rajkumar Buyya (Editor), James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley India Pvt Ltd, 2013.

References:

1. Rajkumar Buyya, Christian Vecchiola , Tamarai Selvi, Mastering Cloud Computing, First edition, McGraw Hill Education, 2013.
2. John Rhoton, Cloud Computing Explained, 2nd Edition , Recursive Press, , 2010.
3. Barrie Sosinsky, Cloud Computing: Bible, Wiley India, 2011
4. John W. Rittinghouse and James F. Ransome, Cloud Computing, Implementation, Management and Security, CRC Press, 2010
5. David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, Addison Wesley, 2009
6. Andrew S. Tanenbaum, Modern Operating Systems, 3rd Edition, Prentice Hall, 2007
7. George Reese, Cloud Application Architectures, O'Reilly, 2009
8. Mark C. Chu-Carroll, Code in the Cloud: Programming Google App Engine, Pragmatic Programmers, LLC, 2011
9. Roger Jennings, Cloud Computing with the Windows Azure Platform, Wrox, Wiley India, 2010

Title of Course: Software Quality Management **Course Code: 18B14CI850**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Pre-requisites: Students must have knowledge of "Software Engineering and Software Management"

Objectives: The course has the basic scope to provide the students with theoretical knowledge about concepts of software quality, about the quality- models, - standards and –methodologies used in the software industry. The theory is supported and supplemented by the lecturer's 10 years experience in software quality management. Understanding and usage of the theory are consolidated by the case studies and exercises.

Course Outcome	Description
CO1	List various principles Software Quality Management.
CO2	Describe the real world problems that may arise during software development and affects the quality.
CO3	Develop a appropriate plan for software quality management.
CO4	Explore key contributors / metrics for effective quality control
CO5	Identify appropriate international standard for real life software project for controlling and managing the quality of product.
CO6	Demonstrate and present the learning of course on real life problems.

Course Contents:

Introduction to Software Quality Engineering: what is software quality, who cares for software quality, benefits of software quality, phases in software development, views of quality, hierarchical models of quality**,** types of defects, cost of fixing defects, cost of poor quality, definitions used in software quality engineering, software quality assurance, quality control, software configuration management.

Software Testing: guiding principles of testing, composition of a testing team, skills of a tester, types of testing, evaluating the quality of test cases, techniques for reducing number of test cases, requirements for effective testing, test oracle, economics of software testing, handling defects, risk in software testing, requirement traceability matrix.

Metrics for Software Quality: categories of software metrics, metrics program, goal question metric method, types of metrics, commonly used software metrics, process metrics, product metrics, metrics for resources.

Tools for Quality Improvement: basic quality control tools, check sheet, cause and effect diagram, pareto diagram, histogram, scatter plot, run chart, control chart, orthogonal defect classification.

Software Quality Measurement: Measuring quality, software metrics, problems with metrics, an overall measure of software quality. Developments in Measuring Quality**:** The work of Gilb, the COQUAMO project.

The ISO9000 series of quality management standards: The purpose of standards, the ISO9000 series: a generic quality management standard, ISO9000-3: notes for guidance on the application of ISO9001 in software development, the impact of ISO9000 and TickIT. Models and standards for process improvement: The Capability Maturity Model, individual levels of CMM, the role of the CMM, SPICE modeling.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. “Software Quality : Theory and Management” by Alan C Gillies, CENGAGE Learning, Second edition.
2. “ Software Quality Assurance, Testing and Metrics” by Anirban Basu, PHI Publication.

References:

1. Agile and Iterative Development: A Manager's Guide, Craig Larman.
2. Practical Guide to Software Quality Management, John W. Horch.
3. Introduction to the Team Software Process(SM),Watts Humphrey.
4. Software Engineering, R.S. Pressman, McGraw Hill.

Title of Course: Neural Network & Applications **Course Code: 18B14CI852**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: To introduce some of the fundamental techniques and principles of neural computation and to investigate some common models and their applications.

Prerequisites:
Basic knowledge of computer architecture, basics of algorithms.

Learning Outcomes:
On completion of this course, a student should be able to:

Course Outcome	Description
CO1	Understand the learning and generalization issue in neural computation.
CO2	Understand the basic ideas behind most common learning algorithms for multilayer perceptrons, radial-basis function networks, and Kohonen self-organising maps.
CO3	Implement common learning algorithms using an existing package
CO4	Apply neural networks to classification and recognition problems

Course Content:

1. **What Are Neural Networks:**
   History, Artificial and biological neural networks, Artificial intelligence and neural networks.
2. **Neurons and Neural Networks**
   Biological neurons, Models of single neurons, Different neural network models.
3. **Single Layer Perceptrons**
   Least mean square algorithm, Learning curves, Learning rates, Perceptron
4. **Multilayer Perceptrons**
   The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples
5. **Radial-Basis Function Networks**
   Interpolation, Regularization, Learning strategies
6. **Kohonen Self-Organizing Maps**
   Self-organizing map, The SOM algorithm, Learning vector quantization

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Introduction to Artificial Neural Systems, by Jacek Zurada
2. An Introduction to Neural Networks K. Gurney, UCL Press, London.
3. Introduction to Neural Networks, R. Beale and T. Jackson, IOP Press.
4. The Essence of Neural Networks, R. Callan, Prentice Hall Europe.
5. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall.
6. Book by Haykins
7. Book by Hassoul
8. Book by Yagnanarayana
9. Perceptrons, by Minsky and Papert
10. Parallel and Distributed Processing, by McClelland and Rumelhart
11. Neuro Computing - Volume 1 and Volume 2, edited by Anderson

Journals

1. IEEE transactions on Neural Networks
2. IEEE transactions on Systems, Man and Cybernetics (SMC)
3. IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)
4. Neural Networks
5. Neuro Computing
6. Machine Learning

Title of Course: Web Engineering **Course Code: 18B14CI858**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Prerequisite: Students must have already registered for the courses, Software Engineering, Web Technology Lab.

Objective: To develop an ability to design and implement static and dynamic web-applications and mobile applications.

Web Engineering	
Course Outcome	**Description**
CO1	Outline various terminologies of web development based engineering approaches.
CO2	Describe the real world problems and able to identify suitable solution in terms of appropriate web development models.
CO3	Understanding the customer requirements and the complexities that may arise in achieving these requirements in web development.
CO4	Develop and analyze the approaches for designing web based applications
CO5	Identify and use various tools in various processes in web based application development
CO6	Apply suitable approach in controlling and managing quality in web based application.

Course Content:

Unit-1: Web-Based Systems**,** Web Applications, WebApps—A Philosophical View; Web Engineering: What Is Web Engineering?, The Components of Web Engineering, Web Engineering Best Practices; Communication: The Communication Activity, Formulation, Elicitation, Identifying WebApp Increments, Negotiation; Planning: Understanding Scope, Refining Framework Activities, Building a WebE Team,

Unit-2: The Modeling Activity: Modeling as a Concept, The Models We Create, Modeling Frameworks, Modeling Languages, Existing Modeling Approaches; Analysis Modeling for WebApps: Understanding Analysis in the Context of WebE, Analysis Modeling for WebApps, Understanding the Users.

Unit-3: Construction and Deployment: Construction and Deployment within the WebE Process, Construction Principles and Concepts, Deployment, Construction and the Use of Components, Component-Level Design Guidelines, Component Design Steps; Testing WebApps: Testing Concepts, The Testing Process—An Overview, Content Testing, User Interface Testing, Usability Testing, Compatibility Testing, Component-Level Testing, Navigation Testing, Configuration Testing, Security and Performance Testing.

Unit-4: The ISO9000 series of quality management standards: The purpose of standards, the ISO9000 series: a generic quality management standard, ISO9000-3: notes for guidance on the application of ISO9001 in software development, the impact of ISO9000 and TickIT. Models and standards for process improvement: The Capability Maturity Model, individual levels of CMM, the role of the CMM, SPICE modeling.

Unit-5: Tools for Quality Improvement: basic quality control tools, check sheet, cause and effect diagram, pareto diagram, histogram, scatter plot, run chart, control chart, orthogonal defect classification.

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Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1st - 4th Week
T-2	25 Marks (1:30 Hours)	5th - 10th Week
T-3	35 Marks (2-Hours)	11th - 16th Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Teaching Methodology:

The course will be delivered through lecture oriented towards understanding and designing of web pages using the web tools. It will impart strong foundation of Web Application Terminologies, Internet Tools, E – Commerce and other web services.

Text Books

1. Web Engineering: A Practitioner's Approach/ Roger Pressman, David Lowe.
2. Web Technologies: Achyut Godbole, Atul Kahate, McGraw-Hill Publications (Third Edition).
3. Beginning Android Application Development, Wei-Meng Lee, Wrox.

Reference Books

1. Internet & World Wide Web How to Program / Deitel, H.M.
2. Web Design with HTML/Flash/Java Script and E-Commerce Bible / Crowder, David
3. Database Driven Web Sites / Feiler, Jesse
4. Web design: the complete reference / Powell Thomas A
5. Internet 101: a beginner's guide to the Internet and the WorldWideWeb/Lehnert Wendy G
6. E-Commerce: Fundamentals and Applications / Chan, Henry
7. E-commerce: strategy, technology & applications / Whiteley, David
8. E-Commerce Logistics & Fulfillment: delivering the goods / Bayles, Deborah L.

Web References

1. www.w3schools.com
2. http://www.techtutorials.info/ecommerce.html

Journals

1. ACM Transactions on the Web (TWEB).
2. ACM Transactions on the Information Systems (TOIC).
3. ACM Transactions on Graphics (TOG).
4. ACM Transactions on Internet Technology (TOIT).

Title of Course: Machine Learning **Course Code: 18B11CI918**
L-T-P scheme: 3-0-0 **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 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:

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	
Total	**100 Marks**	

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 of Course: Data Analytics Systems and Algorithms **Course Code: 18B11CI917**
L-T-P Scheme: 3-0-0 **Credits: 3**

Pre-requisite:

- Students must have the minimal concept of Data Base Management Systems
- They must also have the concept of different types of algorithms used for searching data
- Students must have already studied the course "Business Analysis Techniques"

COURSE OVERVIEW:

This course will introduce students to this rapidly growing field of data analytics and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data analytics practice, including data collection and integration, exploratory data analysis, predictive modelling, descriptive modelling, data product creation, evaluation, and effective communication.

Objective: The primary aim of this course is to further expand your understanding of data analytics and algorithms. To understand Data Analytics Life Cycle and Business Challenges. To understand Analytical Techniques and Statically Models

Learning Outcomes

Course Outcome	Description
CO1	**Demonstrate** proficiency with statistical analysis of data.
CO2	**Understand** the ability to build and assess data-based models.
CO3	**Demonstrate** skill in data management
CO4	**Illustrate** statistical analyses with professional statistical software.
CO5	**Implement** clustering algorithms like hierarchical Agglomerative clustering and k-means algorithm.
CO6	**Apply** data analytics concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Course Outline:

Unit I: Introduction and Data Pre-processing: Data Science Introduction, Big Data and Data Science, Current landscape of perspectives

Unit II: Data Analysis and Correlations: Basic Concepts and Methods Populations and samples, Statistical modelling, probability distributions, Regression, fitting a model, Dimensionality Reduction: PCA & DWT, Correlation and regression analysis. Chi-square t and F distributions (definitions only) Confidence interval Single mean and difference known and unknown variances.

Unit III: Introduction to machine learning and Cluster Analysis: Basic Concept and Methods Supervised and unsupervised learning, Training and testing data, over fitting and under fitting. Distance measures: - Manhattan, Chebbychev, Mahalanobis Distance Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Clustering High-Dimensional Data Clustering Graph and Network Data

Unit IV: Classification Algorithms: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors)

Unit V: Introduction to Web Search and Social Media Analytics: Data Wrangling: APIs and other tools for scrapping the Web Mining Complex Data Types, Other Methodologies of Data, Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends Social Media Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better and, in many contexts, enable us to make better decisions.

Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1^{st} - 4^{th} Week
T-2	25 Marks (1:30 Hours)	5^{th} - 10^{th} Week
T-3	35 Marks (2-Hours)	11^{th} - 16^{th} Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Data Mining, Concepts and Techniques: Jiawei Han and Micheline Kamber, Elsevier 2nd edition.
2. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline, O'Reilly. 2014.
3. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Refernce Books:

1. Data Mining: Introductory and Advanced Topics: Margaret H. Dunham, Prentice Hall.
2. Data Warehousing, Data Mining and OLAP: Alex, Berson, Stephen J. Smith, Tata McGraw- Hill, 2004.
3. Mining the Web : Discovering knowledge from hypertext data: Soumen Chakrabarty, Morgan Kaufmann
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.

Title of Course: Full Stack Development **Course Code: 21B14CI742**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Students must have already registered for the course, "***Introduction to Computers and Programming***" and "**Object Oriented Programming**".

Objective:

1. To learn and be able to implement the front-end and back-end web-technologies.
2. To develop the abilities to call oneself full-stack web developer.

Learning Outcomes:

At the end of the course, students will:

1 Get **familiar** with process of full stack Web Development.

2 Have a good grounding of Web Application Terminologies, Internet tools and languages like HTML5 and CSS, and identify the typical use cases where to **apply** these tools.

3. **Analyze** a problem and possess demonstrative skills in using and applying JavaScript to provide solutions.
4. **Design and code** the business requirements to come up with a technical solution using different web-based technologies including front-end and back-end frameworks; databases like MySQL and MongoDB.
5. Work as a team on a project.

CO	PO [As per NBA]
CO1	
CO2	PO1
CO3	PO2
CO4	PO3
CO5	PO5

Course Content:

Part-1: Fundamentals of Web Development

Unit-1 Creating first web-application, hosting a web application, creating websites, authoring tools, domain names. architectures.

Part-2: Front End Tools & Technologies

Unit-2 Markup and Styling: HTML, Cascading Style Sheets, using Bootstrap.

Unit-3 JavaScript Fundamentals: Language Features, JSON, Ajax, jQuery, Popular Frameworks like React, Angular JS.

Part-3: Back End Tools & Technologies

Unit-4 Web Programming through Node.js and/or Java. Node.js Modules, NPM, Events, Upload File, Email, Get/Post methods, Java Servlets vs. JSP, Request vs. Response objects, other Java objects and features.

Unit-5 Databases and Web Storage: Designing and creating databases, database connection through back-end programming languages, Web storage to store sessions, cookies, and cached data in the browser.

Part-4: Miscellaneous

Unit-6 HTTP & REST, RESTful API, Chrome DevTools, SSL Certificates, Web Application Architecture, MVC, Platforms as a service, Heroku and AWS, Web Security.

Unit-7 Git, Common git commands, Data Structures & Algorithms, Understanding hash tables, trees, graphs, Big-O analysis, object vs an array, pros and cons of in-memory vs disk storage, difference between queues and stacks.

Teaching Methodology:

This course is introduced to help students transition from a simple developer to a full stack developer. Starting from frontend development, the student will slowly progress to become to other aspects of development including backend, database, version control and other essential technologies that are helpful for a developer. The entire course is broken down into four separate parts: Fundamentals of Web Development, Front End tools &

Technologies, Back End Tools & Technologies, and Project Development. Each section includes multiple technologies to help a student gain more experience as a developer. This theory course is well complemented by a lab course under the name Full Stack Development Lab in the same semester that helps a student learn and discuss the technical details of the underlying technologies.

Evaluation Scheme:

Exams		Marks	Coverage
T-1		15 Marks	**Based on Units: 1-2**
T-2		25 Marks	**Based on Units: 1-4**
T-3		35 Marks	**Based on Units:1-6**
Teacher's Assessment	Assignment	10 Marks	**25 Marks**
	Tutorial	05 Marks	
	Quiz	05 Marks	
	Attendance	05 Marks	
Total		**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Full Stack Development (will be added from time to time): Digital copy will be available on the JUET server/ Google Classroom.

Text Book

[1] Web Technologies: Achyut Godbole, Atul Kahate, McGraw-Hill Education (Third Edition).
[2] Web Engineering: A Practitioner's Approach by Roger Pressman and David Lowe, McGraw-Hill, 2009.
[3] HTML and CSS: Comprehensive 7th edition, by by Denise M. Woods and William J. Dorin. Publisher: Cengage Learning; (2012) ISBN-10:1133526144
[4] Internet & World Wide Web How to Program, 5/e Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, Pearson Education 2012.

Reference Books

[3] Internet & World Wide Web How to Program / Deitel, H.M.
[4] Web Design with HTML/Flash/Java Script and E-Commerce Bible / Crowder, David
[5] Database Driven Web Sites / Feiler, Jesse
[6] Web design: the complete reference / Powell Thomas A
[7] Internet 101: a beginner's guide to the Internet and the WorldWideWeb/Lehnert Wendy G
[8] E-Commerce: Fundamentals and Applications / Chan, Henry
[9] E-commerce: strategy, technology & applications / Whiteley, David
[10] E-Commerce Logistics & Fulfillment: delivering the goods / Bayles, Deborah L.

Web References:

[1] www.w3schools.com
[2] http://www.techtutorials.info/ecommerce.html

Journals:

[1] ACM Transactions on the Web (TWEB).
[2] ACM Transactions on the Information Systems (TOIC).
[3] ACM Transactions on Graphics (TOG).
[4] ACM Transactions on Internet Technology (TOIT).

Course Description

HSS Electives:

Course Name: Concept of Digital Marketing **Code: 18B14HS441**
L-T-P Scheme: 3-0-0 **Credit:3**

Prerequisite: None

Objective:

1. Learn cutting-edge Digital Marketing techniques like Search Engine Optimization, Search Engine Marketing, Social Media Marketing, Mobile Marketing, Analytics and Digital Strategy.
2. Measure, Analyze and Optimize Social Media Marketing Campaigns

Learning Outcome

At the end of the course, the students should:

CO1	Develop successful written, visual, and digital communication skills essential for a career in digital marketing including social media marketing. Discuss the key elements of a digital marketing strategy.
CO2	Apply digital marketing methods to select the best digital & social media tools for the target audience to achieve optimum results.
CO3	Acquire and illustrate social media listening skills for effective evaluation of social media tools and marketing.
CO4	Understand the need to identify cultural, global and societal influences to digital marketing.
CO5	Identify the social trends that influence digital and social media tools and strategy.
CO6	Describe how changing technology impacts the Digital Marketing environment.

Course Description

Unit 1: Introduction to Digital Marketing, Strategies in Digital Marketing. Search Engine Optimization – (Understand the search engine as default entry point to internet. Learn how to get website listed among top search engine results) - Search Engine working, Crawlers, ranking algorithm and techniques.Types of search engines, white hat SEO, black hat and grey hat SEO, on page optimization and techniques.
Unit 2: Search Engine Marketing – Basics of marketing, Inbound and outbound marketing, Appreciate the role of pay per click in website listing. Learn how to effectively run ads on Search Engines. Email Marketing– Learn how to effectively build your users lists, deliver e-mails & generate relevant clicks.
Unit 3: Social Media Marketing– Learn how to build brand, generate leads & aggregate audience on Social Media. Inbound Marketing– Learn how to attract & convert customers by earning their trust through various techniques such as content marketing.
Unit 4: Web Analytics – Basic web analytics process, web analytics technologies, log file analysis, Best Web Analytics Tools: Clickstream Analysis Tools, Content and Blog Marketing– Increasing audience

engagement through content marketing. Learn to use white paper, brochure, and case studies for unique interaction.
Unit 5: Mobile Marketing– Strategizing marketing through smart devices. Learn App-based marketing, QR codes, Location-based marketing, SMS marketing.

Teaching Methodology:
This course will be taught through the PowerPoint, case studies and discussions.

Evaluation Scheme:

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	
Total	**100 Marks**	

Learning Resources:

Lecture slides and other study material on Digital Marketing (will be added from time to time): Digital copy will be available on the JUET server.

Text Books

1.”Digital Marketing: Strategy, Implementation & Practice”; Dave Chaffey & Fiona Ellis-Chadwick, Pearson, 2019
2. “The Power of Visual Storytelling”; Ekaterina Walter, McGrawHill, 2014

Web References:
1. https://neilpatel.com › what-is-digital-marketing
2.https://www.digitalvidya.com › blog › learn-digital-marketing-guide

Title: Concept of Economics **Code: 21B14HS547**
L-T-P scheme:2-1-0 **Credit:** 3

Prerequisite: None

Objectives:

1. The course is concerned with the application of economic principles and methodologies to key management decisions within organizations.
2. It provides principles to foster the goals of the organization, as well as a better understanding of the external business environment in which an organization operates.
3. It is fundamentally a unique way of thinking about problems, issues and decisions that managers face in each of the functional areas of the organization as well as the strategic ones faced by general managers.

Learning Outcomes:

Course Outcome	Description
CO1	Outline what economics is and how micro and macro economics differ from each other. Describe basic concepts of Demand and Supply&Elasticity's of demand
CO2	Develop an understanding of factors of production. And demand forecasting
CO3	Identify different types of cost and revenue. Deploy and be proficient in contribution and break even analysis
CO4	Apply logic to understand different market structures viz Perfect Competition; Monopoly; Monopolistic Competition; and Oligopoly.
CO5	To understand the concept of national income, inflation, monetary policy and fiscal policy and business cycles
CO6	Develop an understanding Foreign Trade of India, Foreign Exchange and Balance of Payments

Course Content:

Unit-1: Introduction of Micro& Macro-economic Concepts: Scope, Micro and Macro economics, Fundamental concepts of Economics, Law of demand**,**Law of SupplyMarginal Utility theory, Elasticity of demand – Price, Income, Cross, Advertising, Demand forecasting- Quantitative and Qualitative methods

Unit-2: Production and Cost Theory and Analysis: Production with one variable, optimal employment of a factor of production, Productionwith two variable inputs, Production Isoquants, Production Isocosts, **Cost Theory and Analysis :** Cost concepts – Opportunity, Explicit, Marginal, Incremental and Sunk, Relation between Production & Cost, Short run cost function, Long run cost function, Profit contribution analysis, Break Even analysis

Unit-3: Pricing under Different Market Structures: Perfect Competition -Determination of Price output relationship in short run, long run, Monopoly -Determination of Price output relationship in short run & long run , Price discrimination, Monopolistic Competition - Determination of Price output relationship in short run & long run , Product Differentiation ,Oligopoly -Types ,Determination of Price output relationship ,Price leadership model, Collusive and Non Collusive Oligopoly

Unit-4: National Income, -concepts, components, Methods and problems in measuring national income, Per capita income, Circular flow of income, Inflation, Monetary and fiscal policy, Business cycles

Unit-5: Foreign Trade of India, Foreign Exchange, Balance of Payments

Teaching Methodology:
Teaching methodology in this course involves classroom lectures as well tutorials. The tutorials allow a closer interaction between the students and the teacher as each student gets individual attention. In tutorials, the teacher will be keeping track of each student's progress and address her/his individual difficulties. Written assignments and projects submitted by students as part of the course will also discussed in tutorials.

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**	

Reference Books/Material:

[1] Osborne, M. (2004), An introduction to game theory. Oxford University Press.
[2] Snyder, C., Nicholson, W. (2010), Fundamentals of microeconomics. Cengage Learning.
[3] Varian, H. (2010), Intermediate microeconomics: A modern approach, 8th ed. W. W. Norton.
[4] Bergstrom, T., Varian, H. (2014),Workouts in intermediate microeconomics. W. W. Norton
[5] Bernheim, B., Whinston, M. (2009). Microeconomics. Tata McGraw-Hill.
[6] Mankiw, N. (2007). Economics: Principles and applications, 4th ed. Cengage Learning.
[7] Snyder, C., Nicholson, W. (2010). Fundamentals of microeconomics. Cengage Learning.

Title: Logical & Quantitative Technique **Code: 18B14HS650**
L-T-P scheme: 2-1-0 **Credit: 3**

Prerequisite: None

Objective:

1. To familiarize the students with the concept and pattern of aptitude tests.
2. To solve quantitative aptitude problems and questions applying logical reasoning, within a short time span given during the placement drives.
3. To acquaint them with types of questions asked in quantitative aptitude, logical reasoning and verbal ability.

Learning Outcomes:

Course Outcome	Description
CO1	Outline the basic concepts of quantitative ability, logical reasoning skills, and verbal aptitude.
CO2	Explain and pratice the concepts and questions related to data interpretation, data sufficiency and verbal ability.
CO3	Describe the quick ways to solve quantitative aptitude problems and questions applying logical reasoning, within a short time span.
CO4	Develop a thorough understanding of the concepts of quantitative ability and verbal reasoning, enabling students to manage the placement challenges more effectively.
CO5	Identify and work out the frequently asked patterns in quantitative aptitude and logical reasoning.
CO6	Deployment and solve previous campus placements aptitude papers facilitating the students to compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Course Content:

Unit-1: Numbers and Arithmetic: Number system, Percentages, Profit & Loss, Interest, Ratio, Proportion and Variation, Time and Work, Time, Speed and Distance. Trains, Boats and streams, Pipes and cisterns, Mixture and Allegations, Calendar.

Unit-2: Counting and Data Interpretation: Permutation & Combinations, Probability. Data Interpretation, Data Sufficiency, Set theory, Venn Diagrams.

Unit-3: Logical Reasoning: Important concept in logical reasoning, Logical reasoning based on arrangements, Logical reasoning based on rankings, Team formation, Quantitative reasoning, Puzzle test.

Unit-4: Verbal Reasoning: Syllogism, Logical deduction, Binary Logic, Critical Reasoning. Blood Relations.

Unit-5: Verbal Ability: Spotting Errors, Vocabulary and Reading Comprehension, Antonyms, Spellings, Ordering of Words, Sentence Improvement, Ordering of Sentences, Closet Test, One Word Substitutes, Change of Voice, Verbal Analogies, Synonyms, Selecting Words, Sentence Formation, Sentence Correction, Completing Statements, Paragraph Formation, Comprehension, Idioms and Phrases, Change of Speech, Precis writing.

Teaching Methodology:

The course "Logical & Quantitative Technique" is introduced with an integral focus on campus placement. This course would train the students on a variety of question types used by the companies and improve their language skill. The course will train the students on the quick ways to solve quantitative aptitude problems and questions applying logical reasoning, within a short time span given during the placement drives. The course will also suit the need of the students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning. The course will be taught with the aid of lectures, handouts, case studies, task-based language learning, and comprehensive language learning through language lab.

Evaluation Scheme:

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 & 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:

Lecture handouts and e-books on Logical & Quantitative Technique (will be added from time to time):
Digital copy will be available on the JUET server.

Text Book:

[1] "Verbal and Non-Verbal Reasoning"; R.S. Agarwal, S. Chand Publishing, New Delhi, 2013.

Reference Books/Material:

[1] "Quantitative Aptitude"; R.S. Agarwal, S. Chand Publishing, New Delhi, 2013.
[2] "English Grammar & Composition"; Wren and Martin, S. Chand Publishing, New Delhi, 2012.
[3] "Business Communication"; K.K. Sinha, Taxmann Publications, New Delhi, 4e, 2012.

Title: Knowledge Management **Code:** 18B14HS841

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

Prerequisite: None

Objective:

1. To strengthen the understanding of different methods for work with knowledge management.
2. To understand the theoretical foundation for knowledge and to build capabilities to manage knowledge within and across organizational boundaries.

Learning Outcome

Course Outcome	Description
CO1	To strengthen the understanding of different methods for work with knowledge management.
CO2	Understand the various KM Cycle that is most useful for capturing/acquiring, organizing, distributing, and sharing knowledge within an enterprise.
CO3	Understand the key tenets of the major knowledge management theoretical models in use today.
CO4	Outline the general taxonomic approaches used in classifying knowledge that has been captured.
CO5	Understand how user and task modeling approaches can help promote effective knowledge use at the individual, group, and organizational level.
CO6	Discuss and evaluate the different approaches that may be undertaken in order to achieve an optimal balance between creativity and organizational structure.

Course Content

Unit 1:INTRODUCTION TO KNOWLEDGE MANAGEMENT IN THEORY AND PRACTICE: What Is Knowledge Management? Multidisciplinary Nature of KM, The Two Major Types of Knowledge, The Concept Analysis Technique, History of Knowledge Management, From Physical Assets to Knowledge Assets, Organizational Perspectives on Knowledge Management, Why Is KM Important Today?,KM for Individuals, Communities, and Organizations, The knowledge management cycle, Major Approaches to the KM Cycle,The Zack KM Cycle,The Bukowitz and Williams KM Cycle ,The McElroy KM Cycle ,The Wiig KM Cycle,An Integrated KM Cycle,Strategic Implications of the KM Cycle,Practical Considerations for Managing Knowledge

Unit 2 : KNOWLEDGE MANAGEMENT MODELS : Major Theoretical KM Models ,The von Krogh and Roos Model of Organizational, Epistemology ,The Nonaka and Takeuchi Knowledge Spiral Model ,The Knowledge Creation Process, Knowledge Conversion ,Knowledge Spiral ,The Choo Sense-making KM Model ,The Wiig Model for Building and Using Knowledge, The Boisot I-Space KM Model, Complex Adaptive System Models of KM, Strategic Implications of KM Models, Practical Implications of KM Models, Knowledge capture and codification, Tacit Knowledge Capture, Tacit Knowledge Capture at Individual and Group Levels, Interviewing Experts, Structured Interviewing, Stories, Learning by Being Told, Learning by Observation, Other Methods of Tacit Knowledge Capture, Tacit Knowledge Capture at the Organizational Level, Explicit Knowledge, Codification Cognitive Maps, Decision Trees, Knowledge Taxonomics, Strategic Implications of Knowledge Capture and Codification, Practical Implications of Knowledge Capture and Codification

Unit 3 :KNOWLEDGE SHARING AND COMMUNITIES OF PRACTICE :The Social Nature of Knowledge, Sociograms and Social Network Analysis, Community Yellow Pages, Knowledge-Sharing Communities ,Types of Communities ,Roles and Responsibilities in CoPs ,Knowledge Sharing in Virtual CoPs ,Obstacles to Knowledge Sharing, The Undernet, Organizational Learning and Social Capital, Measuring the Value of Social Capital, Strategic Implications of Knowledge Sharing,Practical Implications of Knowledge Sharing, knowledge application, Knowledge Application at the Individual Level, Characteristics of Individual Knowledge Workers, Bloom's Taxonomy of Learning Objectives, Task Analysis and Modeling, EPSS, Knowledge Application at Group and Organizational Levels, Knowledge Reuse, Knowledge Repositories, Strategic Implications of Knowledge Application, Practical Implications of Knowledge Application

Unit 4 : KNOWLEDGE MANAGEMENT TOOLS: Knowledge Capture and Creation Tools, Content Creation Tools, Data Mining and Knowledge Discovery, Blogs ,Content Management Tools, Knowledge Sharing and Dissemination Tools, Groupware and Collaboration Tools, Wikis Networking Technologies, Knowledge Acquisition and Application Tools, Intelligent Filtering Tools ,Adaptive Technologies ,Strategic Implications of KM Tools and Techniques, Practical Implications of KM Tools and Techniques, km strategy and metrics, Knowledge Management Strategy, Knowledge Audit, Gap Analysis,The KM Strategy Road Map, The Management of Organizational Memory ,Balancing Innovation and Organizational Structure, Historical Overview of Metrics in KM,KM Metrics ,The Benchmarking Method, Knowledge management in theory and practice, The Balanced Scorecard Method, The House of Quality Method

Unit 5 :FUTURE CHALLENGES FOR KM : Political Issues Regarding Access, The Politics of Organizational Context and Culture, How to Provide Incentives for Knowledge Sharing, Shift to Knowledge-Based Assets, Future Challenges for KM ,KM Research Issues ,A Postmodern KM? Concluding Thoughts

Teaching Methodology:

This course will be taught through the Powerpoint, case studies and discussions

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**	

Text Books:

[1] Knowledge Management in Theory and Practice,KimizDalkir,Elsevier publication

Reference Books:

[1] Hislop, D., Knowldege Management in Organisations, 2nd Ed, Oxford, 2009

[2] R. Maier, Knowledge Management Systems. Information and Communication Technologies for Knowledge Management. 2nd ed., Springer, Berlin et al., 2004.

[3] A. Tiwana, The Knowledge Management Tool Kit, Prentice Hall, 2000.

E. M. Awad and H. M. Ghaziri, Knowledge Management , 2nd ed., Pearson Education,2004.

Course Description

Science Electives:

Course Title: Data Science **Course Code: 18B14MA541**
L-T-P Scheme: 3-0-0 **Credit: 3**

Prerequisite: Students must have already studied the course "Business Analysis Techniques"

Course Objectives:
This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data Science practice, including data collection and integration, exploratory data analysis, predictive modelling, descriptive modelling, data product creation, evaluation, and effective communication.

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

Course Outcome	Description
CO1	Develop relevant programming abilities.
CO2	Demonstrate proficiency with statistical analysis of data.
CO3	Develop the ability to build and assess data-based models.
CO4	Execute statistical analyses with professional statistical software.
CO5	Demonstrate skill in data management.
CO6	apply data science concepts and methods to solve problems in real-world contexts

Course Content:

Unit I: Introductionand Data Pre-processing
Data Science Introduction, Big Data and Data Science, Current landscape of perspectives

Unit II: Data Analysis and Correlations: Basic Concepts and Methods
Populations and samples, Statistical modelling, probability distributions, Regression,fitting a model Dimensionality Reduction: PCA & DWT, Correlation and regression analysis. Chisquare t and F distributions (definitions only) Confidence interval Single mean and difference known and unknown variances.

Unit III: Introduction to machine learning and Cluster Analysis: Basic Concept and Methods
Supervised and unsupervised learning, Training and testing data, over fitting and under fitting. Distance measures :- Manhattan, Chebbychev, Mahalanobis Distance, Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data

Unit IV: Classification Algorithms
Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors)

Unit V: Introduction to Web Search and Social Media Analytics

Data Wrangling: APIs and other tools for scrapping the Web Mining Complex Data Types, Other Methodologies of Data, Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends Social Media Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better and, in many contexts, enable us to make better decisions.

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk fromthe Frontline. O'Reilly. 2014.
2. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Refernce Books:

1. Jure Leskovek, Anand Rajaraman and Je_rey Ullman. Mining of Massive Datasets. v2.1,
2. Cambridge University Press. 2014.
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know aboutData Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.

Title of Course: Science of Web **Course Code: 18B14MA542**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Prerequisites: Students must have already registered for the course, "Introduction to Computers and Programming".

Objectives:

1. To make students aware of the concepts, vocabulary and procedures associated with Internet, Web Designing & Web Development.

Learning Outcomes: Student shall be able to-

1. Explain different procedures and technologies underlying Web Applications.
2. Analyze and decompose problems associated with risk and management of Web Based Systems.

Course Outcome	Description
CO1	Get **familiar** with process of Web Development.
CO2	Have a good grounding of Web Application Terminologies, Internet tools and languages like HTML5 and CSS, and identify the typical use cases where to **apply** these tools.
CO3	**Analyze** a problem and possess demonstrative skills in using and applying web science to provide solutions.
CO4	**Design and code** the business requirements to come up with a technical solution using different web-based technologies.
CO5	Work as a team on a project.

Course Contents:

Unit-I: Web Basics: Networking Protocols and OSI Model, Internet Working Concepts, Devices and Internet Basics like repeaters, Virtual Networks, Routers, Gateways etc. TCP/IP, IP, UDP, ARP, DNS, Email, FTP, TELNET, HTTP, HTML etc.

Unit-II: Client Side and Server Side Technologies: CSS, JavaScript, CSS & JavaScript Frameworks, AJAX, PHP/MySQL, ASP.NET, Java Web Technologies like Servlets, JSP, JDBC, Beans, Database, Introduction to XML.

Unit-III: Web Security: Principles of Security, Cryptography, Digital Certificates, Digital Signatures, SSL, Online Payments, 3-D Secure Protocol.

Unit-IV: Mobile Applications and Cloud Computing: Embedded Device Programming, Open Handset Alliance and Android, Cloud Computing, Benefits of Cloud Computing and Challenges, Internet of Things.

Unit-V: Miscellaneous: Website Effectiveness: Strategies and Challenges, SEO, XHTML and Web Browser Compatibility Issues.

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Jeffrey Zeldman, “Designing with Web Standards”, O’Reilly Media, third edition, 2001.
2. Kogent Learning Solutions Inc, “Black Book: Web Technologies”, dreamtech, edition, 2013.

References

Janice Reynolds, “The Complete E-Commerce Book”, Focal Press, Second Edition, 2004.

Title of Course: Fuzzy Systems and Applications **Course Code: 18B14MA544**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Course Objectives

This course aims to develop students' abilities in using some contemporary approaches in solving problems which are fuzzy in nature..

It will enable students to appreciate the advantages and limitations of fuzzy systems and their potential impacts and applications in intelligent control and automation;

Learning Outcomes: Student shall be able to-

1. Explain different procedures and technologies underlying Web Applications.
2. Analyze and decompose problems associated with risk and management of Web Based Systems.

Course Outcome	Description
CO1	Get **familiar** with fuzzy logic control and adaptive fuzzy logic..
CO2	Identify and describe Fuzzy Logic techniques in building intelligent machines.
CO3	Apply Fuzzy Logic models to handle uncertainty and solve engineering problems.
CO4	Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem.
CO5	Integrate neural network and fuzzy logic to extend the capabilities for efficient and effective problem solving methodologies.

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Course content:

Unit -1

Introduction to classical set theory, fuzzy set theory, crisp and non-crisp sets: representation, capturing uncertainty, examples. Fuzzy Set: Fuzzy membership, graphic interpretation of fuzzy sets, small, prime numbers, universal, finite infinite, empty space,

Unit -2

Fuzzy Operations: inclusion, comparability, equality. Complement, Union, Intersection, Difference. Fuzzy Properties: Related to union – Identity, Idempotence, Associatively, Commutativity. Related to Intersection – Absorption, Indentity, Idempotence, Associatively. Additional properties – Distributivity. Law of excluded middle, law of contradiction, Cartesian product.

Unit -3

Fuzzy Relations – Definition of Fuzzy Relation, examples. Forming Fuzzy Relations – Membership matrix, graphical form, Projections of fuzzy relations- first, second and global, Max-Min and Min-Max compositions.

Unit -4

Fuzzy Systems : Fuzzy system elements : Input vector, Fuzzification, Fuzzy Rule Base, Membership function, Fuzzy Inferencing, Defuzzyfication, Output vector. Statement, Symbols, Tautology, Membership functions from facts, Modus Ponens and Modus Tollens; Fuzzy logic : Proposition, Connectives, Quantifiers.

Unit -5

Fuzzification Examples and applications, Fuzzy Inference Approximate reasoning; Generalized Modus Ponens (GMP); Generalized Modus Tollens (GMT), Fuzzy Rule Based System Example, Defuzzification Centroid method.

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Readings

Ross, T. J. (2009). Fuzzy Logic with Engineering Applications: Wiley, will be used as the main text book, however the inputs will be supplemented with information from elsewhere wherever the same is required.

Other References:

1. "Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence" by Kosko, Bart
2. "Neural Networks, Fuzzy Logic, and Genetic Algorithms" by S. Rajasekaran, G.A. Vijayalakshmi Pai, (Prentice-Hall of India Private Ltd.)
3. An Introduction to Fuzzy Logic for Practical Applications by by Kazuo Tanaka
4. Fuzzy Sets and Fuzzy Logic: Theory and Applications by George J. Klir Bo Yu

Title of Course: Introduction to Quantum Computing **Course Code: 18B14PH541**
L-T Scheme: 3-0 **Course Credits: 3**

Objective: The course Introduction to Quantum Computing is specifically designed to offer a pedagogical exposure for the students pursuing undergraduate level studies in computer science and electronics. This newly emerging discipline provides many exciting opportunities for the practitioners of physics and engineering. In the first half of the course we intend to cover some fundamental concepts of quantum computation and quantum information theory. In the second half of the course, we will touch upon advanced topics e.g., quantum algorithms and quantum communication.

Prerequisites: Students taking up this course are expected to be familiar with elementary calculus and matrix analysis. The necessary background in quantum mechanics and mathematical physics will be introduced as we go on in the course.

Learning Outcome:

Course Outcome	Description
CO1	Provides basic ideas and limitations of classical computation. Introduces quantification of information in terms of Shannon's Entropy. Provides fundamental ideas of Quantum Physics and their applicability in computation and information processing.
CO2	Demonstrates theoretical framework of Quantum Computation, Linear Algebra, Dirac's notation, linear operators, tensor product, Hilbert spaces. Enables one to work with Gram- Schmidt orthogonalization process. Introduces ideas of quantum measurement, quantum states, their time-evolution and geometrical representation using Bloch-sphere. Provides examples of manipulation of single qubit states.
CO3	Establishes ideas of the Quantum Model of Computation, enabling one to work with simple quantum circuits and quantum logic gates; involving single and multi-qubit states.
CO4	Provides a comparison of probabilistic and quantum algorithms. Demonstrates quantum algorithms such as Deutsch, Deutsch-Jozsa algorithms, Shor's algorithm, Grover's search algorithm.
CO5	Establishes fundamental ideas of quantum entanglement, entanglement in pure and mixed states, No-Cloning theorem for quantum states. Quantum teleportation and Quantum communication.

Course Contents:

Unit I: Introduction & Overview: A brief historical review of basic ideas of classical computation and its scope and limitations. Basic definitions of quantum logic and quantum information. Basic ideas of classical information theory; measures of information (information content and entropy); Maxwell's demon, classical theory of computation; universal computer; Turing machine; computational complexity; uncomputable functions; shortcomings of classical information theory and necessity of quantum information theory. Stern-Gerlach experiment for illustration and existence of electron spin, basic idea of superposition of states. [10]

Unit II: Theoretical Framework of Quantum Computation: Dirac notation and Hilbert spaces, dual vectors, linear operators. The spectral theorem, functions of operators. Tensor products, Schmidt decomposition theorem. State of a quantum system, time evolution of a closed quantum system, measurement in quantum mechanics. Pure and mixed states, density operator, partial trace, general

quantum operators. Bloch Sphere representation of single qubit states, qubit rotations, single qubit gates. [12]

Unit III: Quantum Model of Computation: The quantum circuit model, single and multiqubit operations, universal sets of quantum gates. Efficiency of approximating unitary transformations, implementing measurements with quantum gates. [10]

Unit IV: Quantum Algorithms: Probabilistic versus quantum algorithms. Phase kickback. The Deutsch and Deutsch-Jozsa algorithms. Quantum phase estimation and quantum Fourier transform, error analysis in arbitrary phase estimation. Finding orders, Shor's algorithm for order estimation. Quantum algorithms based on amplitude amplification, Grover's quantum search algorithm and related topics. [8]

Unit V: Quantum Entanglement & Teleportation: Mathematical and physical conceptions of quantum entanglement, entanglement distillation, entanglement of formation. Entanglement in pure and mixed states. No-Cloning theorem for quantum states. Quantum teleportation and quantum communication. [5]

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books & References:

1. Quantum computing explained, D.M. McMahon
2. Approaching Quantum Computing, D.C. Marinescu and G.M. Marinescu
3. Quantum Computation and Quantum Information, M.A. Nielsen and I.L. Chuang
4. An Introduction to Quantum Computing, P. Kaye, R. Laflamme and M. Mosca
5. Explorations in quantum computing, C.P. Williams and S.H. Clearwater
6. Introduction to quantum computers, G.P. Berman
7. The Physics of Information Technology, N. Gershenfeld
8. Quantum Computing, M. Hirvensalo
9. Quantum computing and communications: an engineering approach, S. Imre, F. Balazs
10. Quantum computing: a short course from theory to experiment, J. Stolze, D. Suter
11. The Principles of Quantum Mechanics, P.A.M. Dirac
12. Modern Quantum Mechanics, J.J. Sakurai
13. Problems and solutions in quantum computing and quantum information, W.H. Steeb, Y. Hardy
14. Mathematical Physics, S. Hassani, Springer Verlag

Title of Course: Nano science **Course Code: 18B14PH542**
L-T Scheme: 3-0 **Course Credits: 3**

Objective: The course aims to provide students an understanding of materials and their properties at the atomic level. The course is focused at imparting the effect of scale and size of materials on the properties of engineering materials. Modern development in the area of nano science and nanotechnology emphasizes the manufacturing and processes for the synthesis of nanostructured materials, which are prime objectives to be addressed in this course.

Learning Outcome:

Course Outcome	Description
CO1	Introduction to the concept of Nanoscience and classification of nanostructured materials
CO2	Basic concept of crystal structure and quantum mechanics
CO3	Size effect and its effect on structural properties of materials.
CO4	Introducing basic concepts of defects, crystal structures, band theory of solids in 1D, 2D and 3D.
CO5	Synthesis and characterization of nanostructured materials.

Course Contents :

Unit I (Introduction and Classification of Nano-structured Materials): Nanoscience and Nanotechnology, Brief History and future scope, Gleiter's classification of nano-structured materials, Classification of nanostructures by dimensionality. Properties of Fullerene, Nanotubes, Graphene. [10]

Unit II (Conceptual Background): Concept of matter waves, Schrodinger wave equation, confinement, particle in a potential box, barrier penetration and tunnelling effects, concept of density of states. [6]

Unit III (Size Effects & Properties of Nano-structured Materials): Concept of characteristic time and length scales of physical phenomena, Definition and types of size effects, extended internal surface, increasing surface energy and tension, Grain boundaries, classical and quantum size effects, size dependent thermal, mechanical, electrical, magnetic and optical properties of nano-structured materials e.g. Reduction of lattice parameters, decrease in melting point, decreasing thermal conductivity, diffusion enhancement, increasing plastic yield strength and 8 hardness, blue shift, broadening of energy bands, phase transitions in ferromagnetic and ferroelectric materials. [14]

Unit IV (Synthesis & Characterisation of Nanostructures): Top-down and Bottom approaches, Vapor – phase synthesis, Liquid phase synthesis, Sol-gel technique, Solid – state phase synthesis, consolidation of nano-powders. X-ray diffraction (XRD), UV- visible, FTIR, TGA, Scanning Electron microscopy (SEM), Transmission electron Microscopy (TEM), Scanning probe microscopy, Scanning tunnelling Microscopy (STM) and Atomic Force microscopy (AFM). [10]

Unit V (Application of Nanotechnology): Applications of Nanostructures for diversified fields of Engineering. [5]

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Nano Structures & Nano Materials, Synthesis, Properties & Applications by Guozhong Cao, Imperial College Press.
2. Concept of modern Physics by Arthur Beiser, 6 th Edison, McGraw-Hill

References

1. Introduction to Solid State Physics by C.Kittel 7th ed. Wiley
2. Nanoscale Energy Transport and Conversion: A Parallel Treatment of Electrons, Molecules, Phonons, and Photons by Gang Chen, Oxford University Press
3. Nano/Micro scale heat transfer by Zhuomin M. Zhang, Mc Graw-Hill Nanoscience and Technology series
4. Nanoscale materials in chemistry, 2 nd edition, by Kenneth J. Klabunde and Ryan M. Richards, John Wiley & Sons.

Course Description

Title of Course: Materials Science and Applications **Course Code: 18B14PH543**
L-T Scheme: 3-0 **Course Credits: 3**

Objective: Materials are the building blocks for almost all the technologies associated with electronic gadgets, electrical components, communication systems, signal processing, storing of information, hardware components and their related accessories. Therefore, search for new materials and study of their properties, useful for electronics, electrical and computer technology has become an area of current interest to the scientists and technologists. The present course aims at giving the students a basic knowledge necessary for understanding electric, magnetic, semiconducting, polymeric, solar and superconducting materials used in engineering applications.

Learning Outcome:

Course Outcome	Description
CO1	Provides basic ideas about the crystal structure, lattice planes and unit cells for the understanding of various physical, electrical and optical properties of solids. Also, to analyse the different crystal structure using the X-ray diffraction technique.
CO2	To understand different polarisation mechanisms related to dielectric materials, which is useful for understanding the mechanism of capacitors and their applications in devices.
CO3	Establishes ideas of magnetic hysteresis in different ferromagnetic materials for their application in magnetic memories, hard drives etc. The topics are significant to understand their soft and hard magnetic behaviour on basis of their magnetic structure and type of materials.
CO4	Provides basic knowledge about the components and working of the battery and other storage devices. Also, these topics explain the basics of solar cells to be used in solar panels and other device applications.
CO5	It gives understanding about the critical temperature and critical magnetic field of the superconductors. Provides explanation of superconductors and HTSC using the BCS theory. It explains how these materials are applicable in Maglev and Squid devices.

Course Contents:

Unit I (Elementary Crystallography): Introduction to crystallography, Lattice translation vectors, Basis and Crystal structure, Symmetry operations, Primitive Lattice cell, Two-dimensional lattice types, systems, Number of lattices, Point groups, Three-dimensional lattice types, Systems, Number of Lattices, Points groups and space groups. Indexing system for crystal planes, Miller indices, Simple crystal structures, NaCl, hcp, diamond structure. 10 X-ray diffraction and Bragg's law; Determination of Crystal structure using Bragg's diffractometer. [10]

Unit II (Dielectric Materials): Polarisation mechanism & Dielectric Constant, Sources of polarizability, Behaviour of polarisation under alternating field, Applications of Dielectric Materials in capacitor, Different types of capacitor, Charging-discharging mechanism of capacitor, Energy stored in capacitor, Design of capacitor banks for specific requirements, Piezo motor and transformer, ferro memory cell. [10]

Unit III (Magnetic Materials): Concept of magnetism, Classification – dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Concepts of electromagnetic induction, application of magnetic materials for motors, transformers, generators and magnetic storage devices. [10]

Unit IV (Materials for Energy Storage & Conversion Devices): Different types of energy storage devices, concept of battery, choice of electrode and electrolyte material for rechargeable battery. Concepts of p-n junction, Solar cell, Applications of solar cells in making solar panels. [10]

Unit V (Superconducting Materials:): Meissner effect, Critical field, type-I and type-II superconductors; Field penetration and London equation; BCS Theory, High temperature Superconductors and their Applications. [5]

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 around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid-State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
4. Solid State Physics by S. O. Pillai.

Course Description

Title of Course: Reinforcement Learning **Course Code: 18B14CI853**
L-T Scheme: 3-0 **Course Credits: 3**

Objectives: The Reinforcement Learning Specialization consists of 3 courses exploring the power of adaptive learning systems and artificial intelligence (AI).

Harnessing the full potential of artificial intelligence requires adaptive learning systems. Learn how Reinforcement Learning (RL) solutions help solve real-world problems through trial-and-error interaction by implementing a complete RL solution from beginning to end.

By the end of this Specialization, learners will understand the foundations of much of modern probabilistic artificial intelligence (AI) and be prepared to take more advanced courses or to apply AI tools and ideas to real-world problems. This content will focus on "small-scale" problems in order to understand the foundations of Reinforcement Learning, as taught by world-renowned experts at the University of Alberta, Faculty of Science.

The tools learned in this Specialization can be applied to game development (AI), customer interaction (how a website interacts with customers), smart assistants, recommender systems, supply chain, industrial control, finance, oil & gas pipelines, industrial control systems, and more.

Course Outline:

Reinforcement learning is an area of machine learning, where an agent or a system of agents learn to archive a goal by interacting with their environment. RL is often seen as the third area of machine learning, in addition to supervised and unsupervised areas, in which learning of an agent occurs as a result of its own actions and interaction with the environment.

In recent years there has been success in reinforcement learning research in both theoretical and applied fields. It was applied in a variety of fields such as robotics, pattern recognition, personalized medical treatment, drug discovery, speech recognition, computer vision, and natural language processing. This course primarily focuses on training students to frame reinforcement learning problems and to tackle algorithms from dynamic programming, Monte Carlo and temporal-difference learning. Students will progress towards larger state space environments using function approximation, deep Q-networks and state-of-the-art policy gradient algorithms. We will also go over the recent methods that are based on reinforcement learning, such as imitation learning, meta learning and more complex environment formulations.

Learning Outcomes:

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

Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning (as assessed by the exam).

Given an application problem (e.g. from computer vision, robotics, etc), decide if it should be formulated as a RL problem; if yes be able to define it formally (in terms of the state space, action space, dynamics and reward model), state what algorithm (from class) is best suited for addressing it and justify your answer (as assessed by the exam).

Implement in code common RL algorithms (as assessed by the assignments).

Describe (list and define) multiple criteria for analyzing RL algorithms and evaluate algorithms on these metrics: e.g. regret, sample complexity, computational complexity, empirical performance, convergence, etc (as assessed by assignments and the exam).

Describe the exploration vs exploitation challenge and compare and contrast at least two approaches for addressing this challenge (in terms of performance, scalability, complexity of implementation, and theoretical guarantees) (as assessed by an assignment and the exam).

Course Outcome	Description	BL
CO1	Demonstrate knowledge of the basic building blocks of Reinforcement Learning and its classification.	BL2
CO2	Analyze problems related to intelligent search and formalize as a Reinforcement Learning	BL3
CO3	Develop Reinforcement Learning algorithms for constraint satisfaction problems and other automation problems.	BL4
CO4	Evaluate Reinforcement Learning techniques to represent problem with certain and uncertain information to perform inference/planning	BL5
CO5	Reinforcement Learning techniques to solve life problem.	BL5

Course Contents:

Course Catalog Description

This course is intended for students interested in artificial intelligence. Reinforcement learning is an area of machine learning where an agent learns how to behave in an environment by performing actions and assessing the results. Reinforcement learning is how Google Deep Mind created the Alpha Go system that beata high-ranking Go player and how AlphaStar become the first artificially intelligent system to defeat a top professional player in StarCraft II. We will study the fundamentals and practical applications of reinforcement learning and will cover the latest methods used to create agents that can solve a variety of complex tasks, with applications ranging from gaming to finance to robotics. The course is comprised of assignments, short weekly quizzes, a final project and a final exam.

The following topics will be covered during the course duration:

Unit 1: Reinforcement Learning - an introduction, Examples, Elements of Reinforcement Learning, Limitations and Scope , An Extended Example: Tic-Tac-Toe

Unit 2: Tabular Solution Methods: Multi-armed Bandits, A k-armed Bandit Problem, Action-value Methods , The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit Algorithms, Associative Search (Contextual Bandits), Finite Markov Decision Processes, The Agent–Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks,

Policies and Value Functions, Optimal Policies and Optimal Value Functions, Optimality and Approximation

Unit 3: Dynamic Programming: Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming, Monte-Carlo & Temporal Difference and Q-Learning: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off policy Prediction via Importance Sampling, Incremental Implementation, Off policy Monte Carlo Control, Discounting-aware Importance Sampling, Per-decision Importance Sampling

Unit 4: Planning and Learning with Tabular Methods, Dyna: Integrated Planning, Prioritized Sweeping, Acting, and Learning, Real-time Dynamic Programming, Planning at Decision Time, Heuristic Search, Rollout Algorithms, Monte Carlo Tree Search,

Unit 5: Applications and Case Studies : Psychology, Neuroscience Basics, TD-Gammon, Samuel's Checkers Player, Watson's Daily-Double Wagering, Optimizing Memory Control, Human-level Video Game Play, Mastering the Game of Go, AlphaGo, lphaGo Zero, Personalized Web Services, Thermal Soaring

Key Topics

1. RL task formulation (action space, state space, environment definition)

2. Tabular based solutions (dynamic programming, Monte Carlo, temporal-difference)

Evalution Scheme:

Evaluation	Marks	Remarks
T1	15 Marks(1 Hr.)	1^{st} -4^{th} Week
T2	25 Marks(1:30 Hr.)	5^{th} – 10^{th} Week
T3	35 Marks(2:00 Hr.)	11^{th} -16^{th} Week
Tutorial/Presentation	10	
Assignments	5	
Quiz	5	
Attendance	5	
Total	**100**	

Text Books

1. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.

Some other additional references that may be useful are listed below:

1. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds.
2. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig
3. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
4. David Silver's course on Reinforcement