DAYANANDA SAGAR UNIVERSITY

SHAVIGE MALLESHWARA HILLS, KUMARASWAMY LAYOUT
BENGALURU – 560 111, KARNATAKA.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B.Tech) – I YEAR

COMMON TO ALL BRANCHES

(With effect from 2019-20)

SCHEME - B.TECH – 2019 -20 ONWARDS

I SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
					L	T	P	S/P	C	CIA	END EXAM
1	101 to 105	19EN1101	ENGINEERING MATHEMATICS – I	CR	03	01	--	--	04	50	50
2	101 to 105	19EN1102	ENGINEERING CHEMISTRY	CR	03	01	--	--	04	50	50
3	101 to 105	19EN1103	COMPUTER PROGRAMMING & PROBLEM SOLVING	CR	03	--	--	--	03	50	50
4	101 to 105	19EN1104	BASIC ELECTRONICS	CR	03	--	02	--	04	50	50
5	101 to 105	19EN1171	ENGINEERING CHEMISTRY LABORATORY	CR	--	--	03	--	1.5	50	50
6	101 to 105	19EN1172	COMPUTER PROGRAMMING & PROBLEM SOLVING LABORATORY	CR	--	--	04	--	02	50	50
7	101 to 105	19EN1173	WORKSHOP PRACTICE	CR	01	--	03	--	2.5	50	50
GRAND TOTAL = 700					**13**	**02**	**12**		**21**	**350**	**350**
8	101 to 105	19AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	--	50
9	101 to 105	19AU0021	KANNADA KALI – II	AU	02	--	--	--	--	--	50
		19AU0022	KANNADA MANASU								

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,
CIA – Continuous Internal Assessment

SCHEME - B.TECH – 2019 -20 ONWARDS

I SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
					L	T	P	S/P	C	CIA	END EXAM
1	101 to 105	19EN1101	ENGINEERING MATHEMATICS – I	CR	03	01	--	--	04	50	50
2	101 to 105	19EN1202	ENGINEERING PHYSICS	CR	03	01	--	--	04	50	50
3	101 to 105	19EN1203	BASIC ELECTRICAL ENGINEERING	CR	03	--	--	--	03	50	50
4	101 to 105	19EN1204	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	50	50
5	101 to 105	19EN1205	TECHNICAL COMMUNICATION	CR	02	--	03	--	3.5	50	50
6	101 to 105	19EN1271	ENGINEERING GRAPHICS & DRAWING	CR	01	--	04	--	03	50	50
7	101 to 105	19EN1272	ENGINEERING PHYSICS LABORATORY	CR	--	--	03	--	1.5	50	50
GRAND TOTAL = 700					**14**	**02**	**10**		**21**	**350**	**350**
8	101 to 105	19AU0009	ENVIRONMENTAL SCIENCES	AU	02	--	--	--	--	--	50
9	101 to 105	19AU0005	DESIGN THINKING & INNOVATION	AU	01	--	03	--	--	--	50

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,
CIA – Continuous Internal Assessment

SCHEME - B.TECH – 2019 -20 ONWARDS

II SEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
					L	T	P	S/P	C	CIA	END EXAM
1	101 to 105	19EN1201	ENGINEERING MATHEMATICS – II	CR	03	01	--	--	04	50	50
2	101 to 105	19EN1202	ENGINEERING PHYSICS	CR	03	01	--	--	04	50	50
3	101 to 105	19EN1203	BASIC ELECTRICAL ENGINEERING	CR	03	--	--	--	03	50	50
4	101 to 105	19EN1204	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	50	50
5	101 to 105	19EN1205	TECHNICAL COMMUNICATION	CR	02	--	03	--	3.5	50	50
6	101 to 105	19EN1271	ENGINEERING GRAPHICS & DRAWING	CR	01	--	04	--	03	50	50
7	101 to 105	19EN1272	ENGINEERING PHYSICS LABORATORY	CR	--	--	03	--	1.5	50	50
GRAND TOTAL = 700					**14**	**02**	**10**		**21**	**350**	**350**
8	101 to 105	19AU0009	ENVIRONMENTAL SCIENCES	AU	02	--	--	--	--	--	50
9	101 to 105	19AU0005	DESIGN THINKING & INNOVATION	AU	01	--	03	--	--	--	50

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,
CIA – Continuous Internal Assessment

SCHEME - B.TECH – 2019 -20 ONWARDS

II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					SCHEME OF EVALUATION	
					L	T	P	S/P	C	CIA	END EXAM
1	101 to 105	19EN1201	ENGINEERING MATHEMATICS – II	CR	03	01	--	--	04	50	50
2	101 to 105	19EN1102	ENGINEERING CHEMISTRY	CR	03	01	--	--	04	50	50
3	101 to 105	19EN1103	COMPUTER PROGRAMMING & PROBLEM SOLVING	CR	03	--	--	--	03	50	50
4	101 to 105	19EN1104	BASIC ELECTRONICS	CR	03	--	02	--	04	50	50
5	101 to 105	19EN1171	ENGINEERING CHEMISTRY LABORATORY	CR	--	--	03	--	1.5	50	50
6	101 to 105	19EN1172	COMPUTER PROGRAMMING & PROBLEM SOLVING LABORATORY	CR	--	--	04	--	02	50	50
7	101 to 105	19EN1173	WORKSHOP PRACTICE	CR	01	--	03	--	2.5	50	50
GRAND TOTAL = 700					**13**	**01**	**12**		**21**	**350**	**350**
8	101 to 105	19AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	--	50
9	101 to 105	19AU0021	KANNADA KALI – II	AU	02	--	--	--	--	--	50
		19AU0022	KANNADA MANASU								

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,
CIA – Continuous Internal Assessment

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1101**
TITLE OF THE COURSE	**:**	**ENGINEERING MATHEMATICS – I**
L : T : P : S/P : C	**:**	**3 : 1 : 0 : 0 : 4**

Course Aim and Summary

The course '**Engineering Mathematics-I**' aims at introducing basic concepts of engineering mathematics and problem solving. The course deals with introductory topics such as functions, limits, continuity, sequences and series, theory and applications of differential and integral calculus. The course also covers linear system of equations, structure of matrices and determinants, diagonilization, Singular Value Decomposition (SVD) and quadratic forms.

Course Objectives

The objectives of the Course are:

- To train the students in basic mathematics essential for modelling and solving engineering problems
- To familiarize the prospective engineers with techniques in calculus and linear algebra
- To solve fundamental engineering problems(electronic circuits and kinetics) by using methods introduced in functions, limits, vector algebra, differentiation and integration
- To understand the concepts of rate of change in single variable differential calculus
- To learn the basics of integral calculus and its applications area between curves, volume, average value of a function etc.
- To expand functions in series form to represent the properties of electrical signals, to predict the life of machine components
- To understand the solution sets of linear system of equations
- To understand the concept of matrices and linear algebra for solving engineering problems
- To demonstrate graphically and numerically two vector algebra treatment consists of geometry of lines and planes.
- To understand and solve eigenvalues and eigenvector problems

Course Outcomes

After undergoing this course students will be able to:

- **Solve** problem of curvature and improper integrals using differential and integral calculus
- **Describe** Rolle's and Mean Value Theorem to solve problems of maxima and minima
- **Develop** functions of single variable for time dependent and steady state problems
- **Solve** sequence and series problems in engineering domain
- **Solve** system of linear equations
- **Solve** problem of eigen values and eigen vectors and apply them to engineering problems

Course Content

SINGLE VARIABLE DIFFERENTIAL CALCULUS

Review: Functions and graphs, Limits and Continuity, Differentiation, Maxima and minima of a function, Rolle's Theorem, Mean Value Theorem, Indeterminate forms and L'Hopitals rule.

Infinite sequences and series, Power series, Taylor's and Maclaurins series, Convergence of Taylor's series, Error Estimates, Polar coordinates and Polar equations.

SINGLE VARIABLE INTEGRAL CALCULUS

Estimating with finite sums and limits of finite sums, Definite integral, The fundamental theorem of calculus, Trigonometric substitutions, Integration by reduction formula for powers of some trigonometric functions, Improper integrals, Beta and Gamma integrals.

LINEAR EQUATIONS

Linear transformations, Matrix of Linear Transformations, Matrix Operations, Row reduction and echelon forms, Inverse of a matrix Systems of linear equations, Vector equations, Solution sets of linear equations, Properties of invertible matrices.

LINEAR ALGEBRA

Linear spaces, Subspaces, Linear independence, Bases and Dimensions,Orthogonality, Gram Schmidt Orthogonalization process.

MATRICES & DETERMINANTS

Determinants, Eigen values and Eigenvectors, Characteristic equation, Diagonalization, Diagonalization of symmetric matrices, Quadratic forms and Singular Value Decomposition.

Text Books:

1. Thomas, Weir and Hass(2009), Thomas's Calculus, Twelfth edition, Pearson, India.
2. Lay D C, S R Lay and JJ McDonald(2016), Linear Algebra and its Applications, Fifth edition, Pearson, India.

Reference Books:

1. Apostol(2007), One Variable Calculus with an introduction to Linear Algebra, Second Edition, John
   Wiley and Sons.

2. Gilbert Strang (2016), Introduction to Linear Algebra, Pearson, India.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1102**
TITLE OF THE COURSE	**:**	**CHEMISTRY**
L : T : P : S/P : C	**:**	**4 : 0 : 0 : 0 : 4**

Course Aim and Summary

The course 'Chemistry' aims at introducing the principles of chemistry to solve the problems in the field of engineering. The course introduces Schrodinger equation, the concept of molecular orbitals, spectroscopic techniques and its applications, chemical equilibria, periodic properties, stereochemistry and mechanistic aspects of organic chemistry.

Course Objectives

The objectives of the Course are:

- To introduce Schrodinger equation and its application
- To explain the concept of molecular orbitals
- To understand the spectroscopic techniques and their applications
- To understand the principles of intermolecular forces and potential energy surfaces
- To understand the concepts of thermodynamics, electrochemistry and water chemistry
- To learn the basic properties of elements in the periodic table
- To understand the concept of conformation and configuration of molecules
- To learn the mechanism of different organic reactions
- To learn the synthesis of a drug molecule

Course Outcomes

After undergoing this course students will be able to:

- **Discuss** major chemical reactions that are used in the synthesis of molecules and concepts of stereochemistry of molecules
- **Classify** various spectroscopic techniques
- **Paraphrase** periodic properties such as ionization potential, electronegativity, oxidation states etc
- **Discuss** intermolecular forces, water chemistry and corrosion
- **Explain** chemical equilibrium and factors governing them
- **Explain** atomic and molecular structures

Course Content

(i) Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

(ii) Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomer configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

(iii) Spectroscopic techniques and applications

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

(iv) a. Intermolecular forces and potential energy surfaces

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

b. Use of free energy in chemical equilibria

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

c. Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(v) Atomic and molecular structure

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of

butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Text Book and References

Text Book/s:

1. Uma Maheswari (2019), Engineering Chemistry, McGraw Hill Education (India) Pvt Ltd, Bengaluru

References:

1. B. H. Mahan (1998) , University chemistry, Narosa Publishing, New Delhi
2. M. J. Sienko and R. A. Plane ,Chemistry: Principles and Applications (1980), McGraw Hill Higher Education,London
3. C.N. Banwell (1983), Fundamentals of Molecular Spectroscopy, by McGraw Hill Education,NewYork
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan, NPTEL, India
5. P. W. Atkins (2009) ,Physical Chemistry, OUP Oxford,London
6. K. P. C. Volhardt and N. E. Schore, 5th Edition (2005) ,Organic Chemistry: Structure and Function , W.H.Freeman and Company , New York

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1103**
TITLE OF THE COURSE	**:**	**COMPUTER PROGRAMMING AND PROBLEM SOLVING**
L : T : P : S/P : C	**:**	**3 : 0 : 0 : 0 : 3**

Course Aim and Summary

The course '**Computer Programming and Problem Solving**' aims at introducing computer programming with C language. The course deals with language fundamentals, control flow statements, decision making statements, loops and derived data types like arrays, strings, functions, pointers, structures and unions. The course emphasises on improving problem solving capabilities of students using computers. During the course, the students will be taught to design algorithms, implement and execute problems in the form of C programs.

Course Objectives

The objectives of the Course are:

- To introduce concept of a computer and its applications
- To introduce C language fundamentals
- To design algorithms and flowcharts to solve problems
- To give an introduction to programming
- To understand the structure of a C program
- To introduce various data types and operators supported by C
- To explain various control flow statements, loops and decision making statements
- To introduce derived data types such as arrays
- To introduce strings and functions
- To introduce the concept of pointers, structures and unions
- To introduce concepts of files
- To provide an introduction to data structures such as stacks and queues
- To train students in writing, executing and debugging C programs

Course Outcomes

After undergoing this course, students will be able to:

- **Outline** basic concepts of a computer and its applications
- **Construct** algorithms and flowcharts for given problems
- **Write,** execute and debug C programs
- **Demonstrate** control flow, decision making and iterative statements
- **Discuss** the concepts of derived data types
- **Outline** concepts of files and various data structures

Course Content

Introduction to Computer, Algorithms:
Introduction to Computer, Problem Solving and Algorithm Development, Flowchart. Introduction to Programming, Writing and executing programs. Use of a high-level programming language for the systematic development of programs.

Fundamentals of C: Datatypes And Operators:
Structure of a C program, standard I/O in C. Fundamental data types: character types, integer, short, long, unsigned, single and double-precision floating point. Operators and expressions: using numeric and relational operators, mixed operands and type conversion, logical operators, bit operations, ternary operator, increment &decrement operators. Evaluation of expressions, operator precedence and associativity.
Conditional program execution: applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch. Program loops and iteration: uses of while, do and for loops, multiple loop variables, assignment operators, use of break and continue.

Arrays: Array notation and representation, reading and writing array elements, declaration of two dimensional arrays. Sorting techniques: Bubble sort and Selection sort. Searching techniques: linear and binary search. Programs using one-dimensional and two-dimensional arrays.

Strings: definition, declaration, initialization, and representation. String handling functions and character handling functions.

Functions: definition and declaration. Built-in functions and User-defined functions. Categories of functions, Recursion, Programming and problem solving using functions and recursion.

Pointers: Definition and declaration of pointers. Accessing values using pointers, Accessing array elements using pointers, Pointers as function arguments, Call-by-value and call-by-reference.

Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures.

Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.

Files: Defining, opening and closing of files. Input and output operations. Applications

and libraries. Introduction to Stacks and Queues

2.5 Text Book and References

Text Book:

1. Behrouz A. Forouzan, Richard F. Gilberg, (2007) "Computer Science - A Structured Approach Using C", Cengage Learning

References:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. R. S Bichkar,(2014) "Programming with C and Data Structure", University Press,
3. Reema Thareja, (2014) "Computer Fundamentals and Programming in C", Oxford Press
4. Vikas Gupta, (2013) "Computer Concepts and C Programming", Dreamtech Press

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1104**
TITLE OF THE COURSE	**:**	**BASIC ELECTRONICS**
L : T : P : S/P : C	**:**	**3 : 0 : 2 : 0 : 4**

Course Aim and Summary

Course Summary

The course 'Basic Electronics', aims at teaching the basic principles and design of electronic circuits and the laws of Boolean algebra. The course introduces basic electronics terminology and deals in detail with characteristic study of various semiconductor devices, building power supplies, analysing their operations. It also deals with study of modulation techniques, amplifiers and oscillators. Through this course, students will be trained to design electronic circuits found in all most all products or machines, or things.

Course Objectives

The objectives of the Course are:

- To distinguish between semiconductor, insulator and conductor based on electrical conductivity
- To introduce the concepts of fundamentals of semiconductor devices with the basic knowledge of the flow of current in semiconductor devices such as diodes and transistors
- To Explain the characteristics of various semiconductor devices and the concept of Integrated circuits
- To categorize transistors based on semiconductor material used and also to understand their characteristics
- To understand the principles of electronic circuits for operations of energy conversions from AC to DC, noise removal and building the required power supply
- To understand how a particular electronic device can increase the power of a signal and also to be acquainted with gain calculations
- To implement the boolean functions and to realize basic logic gate operations and logic functions
- To understand the basics of communication system, to modify the characteristics of carrier signals according to the information signals
- To study the fundamentals of electromagnetic waves
- To identify and understand the different blocks present in transmitter and receiver.
- To categorize and understand the architecture and applications of microprocessors and microcontrollers

Course Outcomes

After undergoing this course students will be able to:

- **Explain** the fundamentals of semiconductor devices, analog and digital circuits
- **Design and analyse** the behaviour of analog and digital circuits
- **Develop** the analog and digital circuits using simulation tool
- **Outline** the overview of microprocessor/ microcontroller and communication system
- **Solve** numerical problems for determining the frequency of oscillators, gain of the amplifiers, and communication wavelength specifications

Course Content

Module 1 Semiconductors

Semiconductor diodes, Diode types, Bi-polar junction transistors: BJT, FET characteristics, Packages and coding, Integrated circuits.

Power supplies: Rectifiers, Reservoir and smoothing circuits, improved ripple filters, Full-wave rectifiers, Voltage regulators, Practical power supply circuits, Related Problems.

Module 2 Amplifiers

Types of amplifier, Gain, Class of operation, Input and output resistance, Frequency response, Bandwidth, Phase-shift, Negative feedback, Transistor amplifiers Bias, Predicting amplifier performance, Practical amplifier circuits.

Oscillators: Positive feedback, conditions for oscillation, types of oscillators, practical oscillator circuits, Related Problems.

Module 3 Operational Amplifiers

Symbols and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier applications, Related Problems

Circuit simulation: Introduction, types of analysis, net lists and component models. (Practical)

Module 4 Logic Circuits

Logic functions, Switch and lamp logic, logic gates, combinational logic, bi-stables/flip-flops, Integrated circuit logic devices, Logic simulation using SPICE. (Practical)

Microprocessors: Microprocessor and microcontrollers, Microprocessor systems, architecture, operation, microcontroller systems, Related Problems.

Module 5 Radio

The radio frequency spectrum, Electromagnetic waves, A simple CW transmitter and receiver, Modulation, Demodulation, Types of transmitters and receivers, aerials, Related Problems.

2.5 Text Book and References

Text books:

1. Michael Tooley B A (2006) Electronic Circuits: Fundamentals and Applications, Elsevier Ltd., 3rd Edition, 2006.

2. Allen Mottershed, Electronic Devices and Circuits, PHI, 18th reprint, 2006.

Reference books:

1. Robert. L. Boylestadand L. Nashelsky, Electronic Devices and circuit Theory, Pearson Education, 9th edition, 2005.
2. David A Bell, Electronic Devices and Circuits, PHI, 5th edition, 2007.
3. Millman & Halkias, Electronics Devices and Circuits, Mc Graw Hill, 2007.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1202**
TITLE OF THE COURSE	**:**	**PHYSICS**
L : T : P : S/P : C	**:**	**3 : 1 : 0 : 0 : 4**

Course Aim and Summary

The course '**Engineering Physics',** aims at introducing principles of physics to understand the working and behaviour of engineering systems. In the beginning, the course emphasises upon the principles of Mechanics, Quantum mechanics and subsequently deals with semiconductors, devices like diode, Zener diode, LED, photodiode and BJT. The course also covers topics like crystalline solids and their characterization; Static and electromagnetic theory, lasers, Nano science and technology. During the course virtual lab and physical tools/models will be used to demonstrate the behaviour of different engineering systems.

Course Objectives

The Objectives of the Course are:

- To introduce the basic concepts of Mechanics and Quantum mechanics which are essential in understanding and solving problems in engineering.
- To review different types of Lasers and their applications in Science and Engineering.
- To understand Band structure of solids, Semiconductors and FD-distribution and their applications.
- To Explain semiconductor devices like Diode, Zener diode, LED, Photodiode and Semiconductor BJT.
- To learn how to find Lattice parameters of different crystalline solids by using X-ray diffraction methods
- To explain Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillators-Energy decay in damped oscillations and Quality factor
- To understand Divergence and curl of electrostatic field; Laplace's and Poisson's equations, Biot-Savart law, Divergence and curl of static magnetic field and Maxwell's equations
- To explain Principle and working of an optical fiber, Different types of Optical fibers., Point to point Optical communication system and Applications of an Optical fiber.
- To introduce Polar and non-polar dielectrics, dielectric constant, electronic, ionic and orientation polarization mechanisms.
- To explain Lorentz field in cubic materials, Clausius-Mossotti equation, Ferro, Piezo and Pyro electric materials and their applications in engineering.

- To learn how to fabricate Nano materials by using Top-down and Bottom –up approach
- To review Nano science and technology and its practical applications in science and engineering.

Course Outcomes (CO's):

On completion of the Course the Students are able to :

- **Describe** the concepts of Mechanics, Quantum mechanics and select for solving problems in engineering.
- **Summarize** theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering
- **Illustrate** Semiconductors , Semiconductor devices like diode, Zener diode, Photo diode, LED and BJT and its applications
- **Classify** Lattice parameters of different crystalline solids by using X-ray diffraction methods and Simple harmonic , Damped harmonic oscillators
- **Interpret** Maxwell's equations and Different types of Optical fibers and its applications
- **Discuss** polarization mechanisms and fabrication of nano materials by using Top-down and Bottom –up approach's

Course Content

Module 1

Mechanics: Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Newton's laws of motion in describing particle motion: Frames of references, inertial frame and non-inertial frames; examples.

Quantum Mechanics: Foundations of quantum theory, Wave function and its properties, One dimensional time independent Schrodinger wave equation, Eigenvalues and Eigen functions, Uncertainty principle, Applications: one dimensional motion of an electron in a potential-well.

Module 2

Semiconductors: Band Structure, Band gaps: electrochemical and electronic. Particle distributions: Fermi-Dirac. Density of electrons-derivation and expression for density of holes in intrinsic semiconductors, Expression for Fermi level.

Device Physics: Principle and working of diode, Zener diode, LED, photodiode, solar cell. Transistors: BJT and FET, Device fabrication techniques-Photolithography and Metallization.

Module 3

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, X-ray diffraction, Bragg's law, Powder method.

Oscillations: Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, power absorbed by the oscillator.

Module 4

Electromagnetics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations, Biot-Savart law, Divergence and curl of static magnetic field; vector potential, Maxwell's equations-Expression for speed of light.

Electrostatics in dielectric medium: Static dielectric constant, electronic, ionic and orientation polarizations, Internal or local fields in solid, solving simple electrostatics problems in presence of dielectrics, Lorentz field in cubic materials, Clausius-Mossotti equation, Ferroelectric materials and applications.

Module 5

Nanoscience and technology: Scaling laws in miniaturization (electrical and thermal systems), Size dependent properties of materials, Top-down and Bottom-up approach-Ball milling, self-assembly, Scanning probe Microscopy-Introduction [3 hours]

Optics and Lasers: Interference of light, Young's double slit experiment, Newton's rings, Diffraction from a single slit and circular aperture, diffraction gratings and their resolving power, amplification of light by population inversion, different types of lasers: gas lasers and solid state lasers, applications of lasers in science, medicine and engineering. [5 hours]

Text Books:

1. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.
2. Ajoy Ghatak, Optics (2012), Tata McGraw Hill, New Delhi
3. K. Thyagarajan, A.K. Ghatak (1981), Lasers: Theory & Applications, Plenum Press, New York.
4. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer, Verlag
5. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi.
6. Shatendra Sharma, Jyotsna Sharma (2019) Engineering Physics, Pearson, New Delhi.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1203**
TITLE OF THE COURSE	**:**	**BASIC ELECTRICAL ENGINEERING**
L : T : P : S/P : C	**:**	**3 : 0 : 0 : 0 : 3**

Course Aim and Summary

The course 'Basic Electrical Engineering' aims at introducing basic electric and magnetic circuits and their fundamental laws. The course deals with circuit terminology, DC, AC fundamentals, working of various electrical machines, wiring systems and transformers. The course also emphasises on protective devices and precautionary measures of electric shock. Through this course, students will be trained to analyse and solve practical electrical engineering problems.

Course Objectives

The objectives of the Course are:

- To impart basic knowledge of electrical quantities such as current, voltage, power and energy
- To distinguish between passive and active electrical components
- To explain the general structure ofelectrical power system
- To define basic laws of electric circuit and to solve related problems
- To understand basics of earthing, protective devices and wiring
- To introduce concepts, analogies and laws of magnetic circuits
- To introduce AC fundamentals and define various parameters
- To analyse AC circuits
- To explain the necessity and advantages of three phase supply
- To understand the difference between star and delta connections and solve related problems
- To learn the working principle, construction and characteristics of various DC machines
- To study the construction, principle of operationand types of transformers
- To understand the working of induction motors, concept of rotating magnetic field and significance of slip

Course Outcomes

After undergoing this course students will be able to:

- **State** and prove various laws of electric circuits and magnetism
- **Solve** numerical problems on laws of electric circuits and magnetism, single phase and three phase AC circuits, DC machines and transformers
- **Analyse** the behaviour of AC circuits
- **Explain** the types of earthling, wiring and protective devices

- **Explain** the principle of working of DC and AC machines generators, transformers and induction motor.

Course Content

Introduction to Electrical Engineering

Introduction to Electrical Engineering: General structure of electrical power systems, Electric current, ohm's law, Resistance, Inductance and capacitance parameter, Kirchoff's laws, node voltage and mesh current methods, Series and parallel combinations, current division, voltage division rule, Electrical power and energy. Related Numerical problems. Domestic Wiring:-Earthing-significance and types, two way & three way control of lamps, basic protective devices like MCB's and Fuses.

Magnetic Circuits

Faradays laws of electromagnetic induction, Lenz's law, Magnetic circuit- concept and analogies, Force on a current carrying conductor placed in a magnetic field, Dynamically induced emf, Fleming's rules and its applications. Self and mutual inductance, Related Numerical Problems.

Alternating Quantities

Average and effective values of periodic functions, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, instantaneous and average power, power factor, power in complex notation, response of series, parallel and series – parallel circuits. Related numerical problems.

Necessity and advantages of Three phase supply, delta and Y – connections, line and phase quantities, solution of balanced three phase circuits, phasor diagram, Three phase three wire and four wire circuits.

DC Machines

Construction, Working principle and analysis of DC motor and generator, EMF and Torque equations, Connections and working of DC generators and motors- series and shunt, back emf, Related numerical problems.

Transformers

Principle of operation, Construction, Equivalent circuit, EMF equation, ratings, losses, Efficiency and voltage regulation, Related simple problems.

Induction motors: brief idea about construction, concept of rotating magnetic field. Slip and its significance, Ratings and applications, Problems on slip calculation

2.1 **Text Book and References**

Text Books:

1. M. Maria Louis (2014), Elements of Electrical Engineering, 5thedition, PHI Publications, New Delhi.

2. D.P.Kothari and I.J. Nagrath (2010), Basic Electrical Engineering,3rd Edition, TataMcGraw Hill, New Delhi.

References

1. RajendraPrasad (2014), Fundamentals of Electrical Engineering, PHI Publications, 3rdEdittion, New Delhi.
2. Hughes E (2002), Electrical Technology,8th Edition, Longman , United Kingdom
3. http://www.nptel.iitm.ac.in

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1204**
TITLE OF THE COURSE	**:**	**BIOLOGICAL SCIENCES**
L : T : P : S/P : C	**:**	**2 : 0 : 0 : 0 : 2**

Course Objectives

1. To familiarize the student with the structure and function of important components of biological systems and cellular processes.
2. Biological systems and processes will be analyzed from an engineering perspective, with an emphasis on how these can be re-designed for industrial processes and commercial products.

Course outcomes

1. Student understands biological systems
2. Student gets the engineering aspects from biological systems

Course Content

Biology in the 21st Century: The new world in the post genome era. Past, present and future of our society, industry and life style: impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry.

Career opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology.

Quantitative views of modern biology. Importance of illustrations and building quantitative/ qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse.

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity.

Systems biology and illustrative examples of applications of Engineering in Biology.

Text Books:

1. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell, Garland Science Publishers. 2008. 1st edition.

2. J. B. Reece, L. A. Urry, M. L. Cain, S. A. Wasserman, P.V.Minorsky, and R.B.Jackson. Campbell Biology, Benjamin Cummings publishers. 2010. 9th edition.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1205**
TITLE OF THE COURSE	**:**	**TECHNICAL COMMUNICATION**
L : T : P : S/P : C	**:**	**2 : 0 : 3: 0 : 3.5**

Course Aim and Summary

The course 'Technical Communication Skills' aims at enhancing Communication skills of the students in dimensions of - Listening, Speaking, Reading, Writing, Grammar and Vocabulary. The course introduces Communication and types of Communication and deals in detail the listening, referencing, report writing and group discussions. The course covers team, team building skills and effective leadership skills. The course also deals with resume writing, covering letter, job application and e-mail etiquettes. The practical course is designed to acquire correct pronunciation and to enable students to get rid of stage fear and become a good orator.

Course Objectives

The objectives of the Course are:

- To improve students lexical, grammatical competence
- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To Develop professional communication skills
- To create interest among the students about a topic by exploring thoughts and ideas
- To enable students with good use of tenses
- To learn the use of body language and improve verbal message
- To equip with Types of Teams and Leadership styles -to develop managing skills in corporate world.
- To Acquire skills for placement

Course Outcomes

After undergoing this course students will be able to:

- **Explain** communication and types of Communication: Managerial, Corporate, Technical & Organizational Communication. Distinguish Listening and hearing. Demonstrate various aspects of speaking. Discuss Word formation and types.
- **Write** a report, essay. Minutes of Meeting. Evaluate current issues and debate
- **Use** Leadership skills and Team building. Solve Tense exercise.

- **Write** a job application and CV.
- **Discuss** E-Mail etiquettes.
- **Discuss** topic and speak on the spot. Interpret data

Course Content

(THEORY: 1-5, PRACTICALS: 6-10)

1. **Communication; Types of Communication**:
   Managerial, Corporate, Technical & Organizational Communication.
   Listening: Types & its Importance. Difference between hearing & listening.
   Speaking: Different aspects of Effective Speaking
   Word Formation and Types of Word Formation**,** Word Family.

2. **Referencing Skills**:
   Academic Writing: Definition & Tips for writing
   Report Writing: Importance. Steps for Report Writing.
   Group Discussion: Definition, How GD helps in Student Life & Corporate Life.
   Minutes of Meeting: Importance; Steps for writing MOM in Organizations.

3. **TEAM & TEAM BUILDING**:
   Definition, Importance, Types of Team; Team Building & Team Dynamics.
   Leadership: Styles of Leadership; Characteristics of a good leader, Influence of different forces on leadership.
4. **JOB Application**
   Covering Letter; Resume/CV Writing; Difference between Job Application & Resume.
5. **E-mail Etiquettes:**
   Definition, Rules for e-mail etiquettes, Business E-mail etiquettes, Tips for perfecting e-mail etiquettes.

6. **ICE Breaking activity and JAM sessions**
7. **Situational Dialogues/ Role Play (**Greetings, enquiring, complaining**)**
8. **Tenses and Subject Verb Concord**
9. **Extempore, Public Speaking, Debates.**
10. **Data Interpretation.**

References:

1. Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019) Technical Communication, Cengage Learning, New Delhi

2. Other Resources: Language Lab

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1202**
TITLE OF THE COURSE	**:**	**ENGINEERING MATHEMATICS – II**
L : T : P : S/P : C	**:**	**3 : 1 : 0: 0 : 4**

Course Aim and Summary

The course '**Engineering Mathematics-II**' aims at introducing applied mathematics to solve engineering problems. The course introduces complex variables along with argand diagram, second order homogenous and non-homogenous linear differential equations with constant and variable coefficients. The course also introduces Laplace transforms and Fourier transforms through Fourier integral in connection with Fourier series.

Course Objectives

The objectives of the Course are:

- To provide students with sound foundation in applied mathematics to solve real life problems in industry
- To understand complex numbers in Argand plane
- To represent a complex numbers in polar form
- To introduce complex functions with limits, continuity, differentiation etc
- To find nth root of a complex number for optimizing engineering phenomenon
- To study analytic functions with Cauchy-Riemann equations
- To solve homogenous second and higher order linear differential equations with constant coefficients
- To solve non-homogenous second and higher order linear differential equations with constant coefficients
- To solve homogenous second order linear differential equations with variable coefficients
- To calculate Laplace transforms and inverses applied to engineering problems such as circuit analysis and control
- To apply Laplace transforms to solution of differential and integral equations
- To study Fourier series expansion of the functions applied in the analysis of current flow, sound waves, image analysis etc.
- To understand the Fourier series to represent a periodic functions
- To study Fourier transform through Fourier integral

Course Outcomes

After undergoing this course students will be able to:

- **Illustrate** complex numbers in Argand plane and explain properties of complex functions
- **Solve** homogenous and non-homogenous second and higher order linear differential equations with constant and variable coefficients
- **Apply** Laplace transforms and its inverse to solve differential and integral equations
- **Study** Fourier series expansion of the functions applied to various engineering problems
- **Explain** Fourier transform and its inverse
- **Apply** Fourier transform and its inverse for solving engineering problems

Course Content

COMPLEX VARIABLES

Complex function, Limits, Continuity, differentiability, Analytic Functions, CR Equations, Properties of Analytic functions.

DIFFERENTIAL EQUATIONS

Second and higher order linear ODE with constant coefficients, General solution to the homogeneous equations, Method of variation of parameters, Method of undetermined coefficients, Cauchy-Euler and Legendre's linear equations, Power series solution for second order linear ODE.

LAPLACE TRANSFORMS

Basic concepts, Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theoerem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differential equations**.**

FOURIER SERIES

Fourier Series, Dirichlet'sconditions , Euler's Formulae, Fourier series of discontinuous functions, Even and odd functions, Change of interval, Parseval's theorem, Complex form of Fourier series.

FOURIER TRANSFORMS

Fourier transform and Fourier's integral theorem, Fourier cosine integral, Fourier sine integral, Basic properties of Fourier transform.

TEXT BOOKS

1. Erwin Kreyzsig (2015), Advanced Engineering Mathematics, 10th edition, Wiley, India.

REFERENCE BOOKS

1. TynMyint-U and LokenathDebnath (2011), Linear partial differential equations for scientists and engineers, Fourth edition, Birkhauser Boston.

2. R.N.Bracewell (2000) , The Fourier transform and its applications, Third Edition, Mc Graw Hill, Boston.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1171**
TITLE OF THE COURSE	**:**	**ENGINEERING CHEMISTRY LABORATORY**
L : T : P : S/P : C	**:**	**0 : 0 : 3 : 0 : 1.5**

Course Summary

The '**Laboratory course in Engineering Chemistry'** aims at training students on conduction of experiments in the laboratory and developing reports on experiments conducted. The laboratory work includes: Estimation of metals using potentiometric and volumetric methods, determination of viscosity and Surface tension, determination of total hardness of water, chemical oxygen demand, experiment on Thin layer chromatography and synthesis of a drug molecule.

Course Objectives

The objectives of the Course are:

- To estimate the hardness of water, calcium in calcium oxide using volumetric analysis
- To determine the viscosity and surface tension of a liquid
- To understand the principles of Thin layer chromatography
- To determine the saponification value of an oil
- To Synthesize a drug molecules
- To estimate the chemical oxygen demand of industrial waste water using volumetric analysis
- To use conductometry experiments for determining the cell constant of a cell
- To understand the concepts of thermodynamics, electrochemistry and water chemistry

Course Outcomes

After undergoing this course students will be able to:

- **Estimate** the strength of FAS, strength of components in a mixture of strong and weak acid
- **Predict** the molar mass of a compound using the principle of Depression in Freezing point
- **Measure** molecular/system properties such as, surface tension, viscosity etc
- **Synthesize** a drug molecule
- **Separate** an organic mixture using Thin Layer Chromatography
- **Estimate** the total hardness of water, calcium oxide in cement, chemical oxygen demand, saponification value of an oil

Course Content

1. Potentiometric estimation of FAS using standard Potassium Dichromate solution

2. Determination of cell constant of a conductivity cell and conductometric estimation of amount of Hydrochloric acid and Acetic acid in a given acid mixture using standard Sodium hydroxide solution
3. Determination of the Molar Mass of a Compound by Freezing Point Depression
4. Determination of surface tension & viscosity coefficient of the given liquids
5. Synthesis of ethyl p-aminobenzoate (benzocaine) from ethyl p-aminobenzoic acid
6. Separation of ortho and para nitro aniline by thin layer chromatography
7. Determination of total hardness of a sample of water using disodium salt of EDTA
8. Determination of Calcium oxide (CaO) in the given sample of cement by rapid EDTA method
9. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water samples
10. Determination of the saponification value of an oil

Text Book and References

Text Book/s:

1. Chemistry Laboratory Manual/Record (2019) – compiled by Dr. V.Srinivasa Murthy and Dr.Sreenivasa Rao Amaraneni, Department of Chemistry, Dayananda Sagar Univeristy, Bangalore

Reference Book:

A.I. Vogel , A.R. Tatchell (1989), Vogel's Textbook of Practical Organic Chemistry, 5th edition. Prentice Hall, New Jersey

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1172**
TITLE OF THE COURSE	**:**	**COMPUTER PROGRAMMING & PROBLEM SOLVING LABORATORY**
L : T : P : S/P : C	**:**	**0 : 0 : 4 : 0 : 2**

Course Aim and Summary

The course '**Computer Programming and Problem Solving Lab**' aims at training students in writing computer programs with C language and executing. The course deals with formulating algorithms, translating them into working C programs for the given problem statements. During the course, students will be taught to design algorithms, write, execute and debug programs.

Course Objectives

The objectives of the Course are:

- To introduce concept of a computer and the working environment
- To give an introduction of the compiler used
- To introduce basic C programming
- To introduce simple computational problems using arithmetic expressions
- To introduce programs involving control statements such as if, else if ladder, nested if
- To introduce programs involving iterative statements such as for, while, do while
- To introduce programs on one dimensional and two dimensional arrays
- To introduce programs on strings and functions
- To introduce programs on pointers
- To introduce programs on structures and unions
- To introduce programs on the concepts of files

Course Outcomes

After undergoing this course, students will be able to:

- **Design** algorithms and flowcharts
- **Write,** execute and debug simple programs
- **Identify** an approach to solve problems using control flow, decision making, iterative statements
- **Demonstrate** the working of one and two dimensional arrays
- **Solve** problems using concepts of strings arrays, functions, pointers
- **Illustrate** the use of structures and files

Course Content

Execution of basic commands and simple programs
A. Design an algorithm and write a C program that takes three coefficients (a, b, and c) of a Quadratic equation (ax2+bx+c=0) as input and compute all possible roots. Implement a C program for the developed algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages B. Design an algorithm and write a C program to generate equilateral triangle/pyramid pattern till n rows.
A. Design an algorithm and write a C program to find largest of 3 numbers. B. Design an algorithm and write a C program to enter N elements in an array and sort it in ascending order using bubble sort.
A. Design an algorithm and write a C program to display the grades based on the range of marks obtained by the student using C language. B. Design an algorithm and write a C program to find the key element and its position in one dimensional array using binary search.
A. Design an algorithm and write a C program to find the reverse of an integer number and check whether it is PALINDROME or NOT. B. Design an algorithm and write a C program to perform matrix multiplication
A. Design an algorithm and write a C program to read an integer number and check whether it is an Armstrong number or not. B. Design an algorithm and write a C program to check whether a matrix is symmetric or not.
A. Design an algorithm and write a C program using switch statement to read parking time and print the parking fare for customers who park their vehicle (c or C for car, b or B for bus, t or T for tempo) in parking lot. Parking fare is calculated as per the rates given. B. Design an algorithm and write a C program to perform linear search using function.
A. Design an algorithm and write a C program to display the prime numbers upto N numbers. B. Design an algorithm and write a C program to find nPr and nCr using functions.
A. Design an algorithm and write a C program to find the Fibonacci series B. Design an algorithm and write a C program to copy one string into another string without using built in function.

A. Design an algorithm and write a C program to read data from the keyboard; write it in a file called DATA.txt. Again read the same data from the file and display it on the screen. B. Design an algorithm and write a C program to swap two numbers using pointers.
A. Design an algorithm and write a C program to read n numbers and find the maximum element and minimum element among all the elements using selection sort. B. Design an algorithm and write a C program to maintain a record of n student details using an array of structures with fields (Roll number, Name, Dept, Marks, and Grade). Assume appropriate data type for each field. Print the details of the student, given the student roll no as input

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1173**
TITLE OF THE COURSE	**:**	**WORKSHOP PRACTICE**
L : T : P : S/P : C	**:**	**1 : 0 : 3 : 0 : 2.5**

Course Aim & Summary

This course aims at developing skills by using workshop tools, equipment's and materials to create various physical models. The course deals with basic manufacturing processes like fitting, sheet metal work, welding, soldering, machining, carpentry, casting and smithy useful for industries.

Course Objectives

The objectives of the course are:

- To impart knowledge and skills to use tools, machines, equipment, and measuring instruments
- To cultivate safety aspects in handling of tools and equipments
- To provide hands-on training on fitting, sheet metal, carpentry, casting , smithy, machining operations
- To provide hands-on training on soldering and welding processes

Course Outcomes

After undergoing this course students will be able to:

- **Construct** different types of fitting models.
- **Construct** various types of sheet metal models.
- **Demonstrate** different lathe operations and produce models.
- **Construct** welding and sheet metal joints and soldering practice
- **Construct** different types of carpentry models.
- **Demonstrate** the casting and smithy processes

Course Contents

Fitting & Sheet metal shop

Study of fitting tools; Preparation of one fitting model involving rectangular/triangular or semi-circular/dovetail combination joints. Sheet metal: Study of sheet metal tools and operations, preparation of one model & Soldering practice.

Machine shop

Preparation of one model on lathe involving plain turning, facing, taper turning, step turning, and knurling

Welding shop

Study of the joining process (Arc welding & Gas welding); carry out welding exercises of

Butt joint, Lap joint, T joint and L-joint.

Carpentry
Study of tools and Operations and carpentry joints; Simple exercise using jack plain; To prepare half lap corner joint, mortise and ten-on joints; Simple exercise on woodworking lathe (Demonstration Only).

Casting
Introduction to casting tools, process of preparation of sand molds. Demonstration of one casting process using non-ferrous metal. Die Casting – Demonstration only

Forging
Introduction to forging tools and operations; smithy practice; Demonstration of construction of square & hexagonal bolts.

Note: *Includes theory and practice

Suggested Text/Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002. Delhi
2. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008. Delhi
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998. Delhi
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017. Noida

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1271**
TITLE OF THE COURSE	**:**	**ENGINEERING GRAPHICS & DESIGN**
L : T : P : S/P : C	**:**	**1 : 0 : 4 : 0 : 3**

Course Aim & Summary

The course aims at introducing engineering graphics as a language of engineers for universal communication. This course covers orthographic projections of points, lines, planes and solids. It also deals with development of surfaces and isometric projections of planes and solids. Students solve problems using manual sketching and professional CAD software for modelling and assembly of simple engineering components from various engineering domains. They work in teams to develop conceptual designs for an identified need.

Course Objectives

The objectives of the Course are:

- To create awareness and emphasize the need for Engineering Graphics
- To follow basic drawing standards and conventions
- To Introduce free hand sketching as a tool for technical Communication
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To understand the concepts of orthographic and isometric projections
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly
- To work in a team for creating conceptual design of products

Course Outcomes

After undergoing this course students will be able to:

- **Explain** usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings
- **Construct** points, lines, planes and solids using orthographic projections principles
- **Construct** geometries of planes and solids using isometric projection principles
- **Prepare** the lateral surfaces of the given solid by applying the basic concepts
- **Construct** lateral surfaces of solids using geometry development principles
- **Create** associative models at the component and assembly levels for product design

Course Content

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1:

Introduction to Engineering Drawing & Computer Graphics

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Selection size and scale, conventions, Co-ordinate system and reference planes, ISO and ANSI standards for coordinate dimensioning and tolerances. Setting up of units and drawing limits. Conic sections including the rectangular hyperbola, cycloid, epicycloid, hypocycloid and involute.

Layout of the software, standard tool bar/menus and description, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, create, edit and use customized layers, changing line lengths through modifying existing lines (extend/lengthen), Dimensioning guidelines, tolerance techniques, drawing annotation.

Module 2: Orthographic Projections (First Angle Projection Only)

Principles of Orthographic Projections, Projections of points in all the four quadrants, Projection of straight lines, inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method.

Projections of plane surfaces– polygonal and circular surfaces, planes in different positions (change of position method only).

Module 3: Projections of Regular Solids

Projections of right regular pentagon, tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions (change of position method only).

Module 4: Sections and Development of Lateral Surfaces of Solids

Definition, Section planes, Sectional views, apparent shapes and True shapes of Sections of right regular solids of prisms, pyramids, cylinders and cones resting with base on HP. Development of lateral surfaces of above solids.

Module 5: Isometric Projection

Principles of Isometric projection, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and combination of solids, Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 6: Demonstration of a simple team design project

Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating associative models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil fixtures -windows, doors, bath, sink, shower, etc. Applying colour coding to the components.

Text Book and References

1. Gopalakrishna, K. R. (2005) Engineering Graphics, 32nd edition, Subash Publishers Bangalore, India
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House, Gujarat, India
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education, New Delhi.
4. DSU Text book, Wiley-India Publications, Bangalore

References

1. Luzzader, Warren. J and Duff John M., (2005) ,Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Basant Agarwal and Agarwal C.M., (2008), Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19EN1272**
TITLE OF THE COURSE	**:**	**ENGINEERING PHYSICS LABORATORY**
L : T : P : S/P : C	**:**	**0 : 0 : 3 : 0 : 1.5**

Course Aim and Summary

The course 'Engineering Physics laboratory' aims at training students for conducting physics experiments in laboratory and report writing on the experiments conducted. The course includes experiments like Newton's rings and diffraction grating to expose the students to the basic principles of optics. The course also involves experiments for studying the characteristics of semiconductor devices like Zener diode, LED and transistor. In addition, it also has experiments to study the material properties like resistivity, band gap energy and dielectric property. The course also exposes the students to the working principle of LCR circuit and its characterization. The fundamentals of mechanics are introduced through an experiment on calculation of moment of inertia of a torsional pendulum.

Course Objectives

The objectives of the Course are:

- Understand the importance of Physics in the practical applications
- Able to calculate all the relevant physical parameters and represent any characteristic variation graphically
- Gaining hands-on expertise in working with various semiconductor devices
- Understanding the relation between dielectric constant of a dielectric and the charging-discharging of a capacitor
- Understanding the optical principles of diffraction and interference
- Understand the concepts of quanta of energy and correlate it with the working principle of a light emitting diode
- Understanding the concept of frequency response, bandwidth and quality factor in electrical circuits
- Understand the concept of moment of inertia and estimate it for a rigid body

Course Outcomes

After undergoing this course students will be able to:

- **Illustrate** the various characteristics of semiconductor materials and different semiconductor devices
- **Demonstrate** the optical principles of diffraction and interference
- **Estimation** of moment of inertia for a rigid body
- **Demonstrate** the frequency response curve for a LCR circuit
- **Illustrate** the characteristics of a dielectric material
- **Interpret** the variation of physical parameters graphically and derive conclusions

Course Content

I-V characteristics of a Zener Diode

I–V Characteristics of a Zener diode in forward and reverse bias condition

Four probe technique

Measurement of resistivity of a semiconductor using Four probe technique

Newton's Rings

Measurement of radius of curvature of a plano-convex lens using Newton's Rings

Dielectric constant

Determination of dielectric constant of a dielectric material

Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

Band gap energy

Determination of energy gap of an intrinsic semiconductor

Diffraction grating

Determination of wavelength of a laser light using diffraction grating

Planck's constant

Measurement of Planck's constant using LED

LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit

Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration

Text Book and References

Text Book/s:

1. Engineering Physics Laboratory manual, DSU

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19AU0009**
TITLE OF THE COURSE	**:**	**ENVIRONMENTAL SCIENCES**
L : T : P : S/P : C	**:**	**2 : 0 : 0 : 0 : 0**

Course Aim & Summary

This course aims at creating awareness regarding preservation of environment for providing safe and healthy atmosphere. This course deals with concepts of ecosystem, renewable and non-renewable energy resources, environmental pollution, laws and regulations governing the environment.

Course Objectives

The objectives of the Course are:

- To explain the importance of this course
- To understand the concepts of ecosystem, energy and non-renewable energy resources
- To learn water quality aspects requirement and water safety plans
- To explain solid waste and sewage management
- To create awareness of noise, air & land pollution and their effects on environment
- To learn environmental laws and regulations
- To Understand Montreal and Kyoto protocols

Course Outcomes

After undergoing this course students will be able to:

- **Discuss** impacts on eco-system, balanced ecosystem Environmental Impact Assessment(EIA) tool used in project evaluation and sustainable development
- **Explain** renewable and non-renewable resources and material cycles (carbon cycle, nitrogen cycle and sulphur cycle)
- **Describe** the practices carried out for effective solid waste management and regulating the potable water quality
- **Predict** reasons for catastrophic impacts on the environment like climate change and global warming
- **State** the role of government, laws and regulation enforcements for protecting environment

Course Content

Environment and components of environment eco-system

Types & Structure of Ecosystem, Balanced ecosystem, Human Activities, Food, Shelter, and Economic and Social Security. Impacts of Agriculture and Housing

Impacts of Industry, Mining and Transportation, Environmental Impact assessment, Sustainable Development.

Natural resources and energy
Different types of energy, Conventional sources and Non-Conventional sources of energy, Solar energy, Hydro electric energy Resources Mineral resources, Forest Wealth Material Cycles, Carbon Cycle, Nitrogen Cycle and Sulphur Cycle.

Water, Solid waste and sewage management
Sources of water and quality issues, water quality indices, water safety plans, water supply systems, water demand-industrial and agricultural water demand. Sewage-domestic and storm water, quality of sewage, sewage flow variations, solid waste management-municipal solid waste management, composition and various chemical and physical parameters of municipal solid waste (MSW), MSW Management-collection, transport, treatment, E-Waste Management and Biomedical Waste Management, Sources, Characteristics and Disposal methods.

Environmental Pollution
Pollution: Noise, Air, Automobile and Land Pollution, Definition, Effects, Global Warming, Acid rain and Ozone layer depletion, controlling measures, Public Health Aspects, Global Environmental Issues, Population Growth, Urbanization, Land Management.

Environmental Acts and Regulations
Environmental Acts and Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs), Environmental Education and Montreal and Kyoto Protocols, wildlife conflicts in Indian context.

Text Book and References

Text Books:

1. Benny Joseph, "Environmental Studies" (2005), Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies" (2009), Wiley India Private Ltd., New Delhi.

References:

1. R Rajagopalan, "Environmental Studies – From Crisis to Cure" (2005) Oxford University Press, New Delhi.
2. P.Aarne Vesilind, Susan M.Morgan, Thomson, "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
3. R J Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19AU0005**
TITLE OF THE COURSE	**:**	**DESIGN THINKING & INNOVATION**
L : T : P : S/P : C	**:**	**1 : 0 : 2 : 0 : 0**

Course Aim & Summary

This course is an experience into Design thinking, innovation and rapid prototype methods; it gives an overview of design thinking tools to help students in understanding design thinking as a problem solving approach. Ideas are developed through these processes and then applied to a basic approach to understand their value in the market place.

Course Objectives

The objectives of the Course are:
Students will be able to:

- Define Creativity and Innovation
- Discuss key concepts and principles that guide innovative practices
- Examine approaches to innovation practiced by various organizations
- Explain the fundamental principles that guide design thinking
- Explain design thinking practices and their applications

Course Outcomes

After undergoing this course students will be able to:

- Apply the design thinking principles and process
- Recognize the significance of innovation
- Discuss both individual and contextual factors that are linked to creativity
- Discuss the need for and significance of adopting a design thinking mind set
- Develop many creative ideas through design criteria & brainstorming sessions.
- Know the importance of approaching innovation projects with concept development
- Develop rapid prototypes to bring their ideas into reality as quickly as possible with assumptions and testing

Course Content

Module-1

Why Design Thinking & the Design Process- Introduction to design process, key concepts, terminology, product & process design.

Module-2

Scoping, The Design Brief and Visualization -Clarify the scope of a project, questions to explore, target products & innovations, establishing the importance of pictures and storytelling in the overall process.

Module-3

Establishing Design Criteria and Brainstorming -Developing an expression of the

ideal end state of a project, generate many fresh alternatives to the status quo.

Module-4

Concept Development- Choosing the best ideas, assembling them into detailed solutions, evaluation, consistent format for summarizing and communicating new concepts.

Module-5

Assumptions, Testing and Prototyping- Tool for surfacing key assumptions, attractiveness of a new concept, data to assess, create visual manifestations of concepts, prototype of new product.

Text Book References

1. Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia University Press, 2011)
2. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, The Designing for Growth Field Book: A Step-by-Step Project Guide (Columbia University Press, 2014)

References

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (Harper Business, 2009)
2. Bruce Hannington and Bella Martin, Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions (Rockport Publishers, 2012)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)
4. https://www.interaction-design.org/literature/article/designthinking-get-a-quick-overview-of-the-history, Carnegie-Mellon University- The Basics of User Experience Design.
   https://hbr.org/2018/03/better-brainstorming

SEMESTER/YEAR	**:**	**I YEAR**
COURSE CODE	**:**	**19AU0021**
TITLE OF THE COURSE	**:**	**KANNADA KALI – II**
L : T : P : S/P : C	**:**	**2 : 0 : 0 : 0 : 0**

Course Learning Objectives:

Learners are Non – Kannadigas, so this course will make them,

· To Read and understand the simple words in Kannada language
· To learn Vyavaharika Kannada (Kannada for Communication)
· will create a some interest on Kannada Language and Literature

Lesson 1 : Introducing each other – 1. Personal Pronouns, Possessive forms, Interrogative words.
Lesson 2 : Introducing each other – 2. Personal Pronouns, Possessive forms, Yes/No Type Interrogation
Lesson 3 : About Ramanaya. Possessive forms of nons, dubitive question, Relative nouns
Lesson 4 : Enquiring about a room for rent. Qualitative and quantitative adjectives.
Lesson 5 : Enquiring about the college. Predicative forms, locative case.
Lesson 6 : In a hotel Dative case defective verbs.
Lesson 7 : Vegetable market. Numeral, plurals.
Lesson 8 : Planning for a picnic. Imperative, Permissive, hortative.
Lesson 9 : Conversation between Doctor and the patient. Verb- iru, negation – illa, non – past tense.
Lesson 10: Doctors advise to Patient. Potential forms, no – past continuous.
Lesson 11: Discussing about a film. Past tense, negation.
Lesson 12: About Brindavan Garden. Past tense negation.
Lesson 13: About routine activities of a student. Verbal Participle, reflexive form, negation.
Lesson 14: Telephone conversation. Past and present perfect past continuous and their negation.
Lesson 15: About Halebid, Belur. Relative participle, negation.
Lesson 16: Discussing about examination and future plan. Simple conditional and negative
Lesson 17: Karnataka (Lesson for reading)
Lesson 18: Kannada Bhaashe (Lesson for reading)
Lesson 19: Mana taruva Sangati alla (Lesson for reading)
Lesson 20: bEku bEDagaLu (lesson for reading)

1. Kannada Kali (ಕನ್ನಡ ಕಲಿ) – ಲಿಂಗದೇವರು ಹಳೆಮನೆ, A Text Book to Learn Kannada by Non – Kannadigas who come to study Diploma, Engineering and Health Sciences in Karnataka, ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. Spoken Kannada – ಮಾತಾಡುವ ಕನ್ನಡ, ಪ್ರಕಟಣೆ – ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ ಬೆಂಗಳೂರು.
3. Kannada Kirana - ಕನ್ನಡ ಕಿರಣ, ಪ್ರಕಟಣೆ – ಬೆಂಗಳೂರು ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಅಪ್ ಲಾಂಗ್ವೇಜಸ್, ಬೆಂಗಳೂರು .

SEMESTER/YEAR : I SEM / I YEAR
COURSE CODE : 19AU0025
TITLE OF THE COURSE : KANNADA MANASU – II
L : T : P : S/P : C : 2 : 0 : 0 : 0 : 0

COURSE OBJECTIVES:

1. To equip the native Kannada speaking students with advanced skills in Kannada communication and understanding
2. To enrich the students with creative writing

COURSE OUTCOMES:

1. Students will have better speaking and writing communication skills in Kannada

ಕನ್ನಡ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಒಲವು ಮತ್ತು ಆಸಕ್ತಿಯನ್ನು ಬೆಳೆಸುವುದು

1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ
2. ವಿವಿಧ ರೀತಿಯ ಅರ್ಜಿ ನಮೂನೆಗಳು
3. ಪತ್ರ ವ್ಯವಹಾರ – ಸರ್ಕಾರಿ ಅರೆಸರ್ಕಾರಿ ಪತ್ರಗಳು – ಆಹ್ವಾನ ಪತ್ರಿಕೆ, ಜಾಹೀರಾತು, ಪತ್ರಿಕಾ ಪ್ರಕಟಣೆ ಇತ್ಯಾದಿ ಪತ್ರಗಳು
4. ಭಾಷೆ ಮತ್ತು ಬರಹ – ಡಾ. ಎಂ ಚಿದಾನಂದ ಮೂರ್ತಿ ರವರ ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲ ತತ್ವಗಳು ಪುಸ್ತಕದಿಂದ
5. ಭಾಷಾಭ್ಯಾಸ – ತತ್ಸಮ ತದ್ಭವ, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ವಿರುದ್ಧಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥ ಪದಗಳು, ನುಡಿಗಟ್ಟುಗಳು, ಅನುಕರಣಾವ್ಯಯಗಳು (ದ್ವಿರುಕ್ತಿ) ಮತ್ತು ಜೋಡು ನುಡಿಗಳು, ಕನ್ನಡದ ದೇಶ್ಯ ಪದಗಳು, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು.
6. ಭಾಷಾ ರಚನೆ – ವಾಕ್ಯ ಪದ್ಧತಿ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಪತ್ರ ಲೇಖನ, ವರದಿ ಲೇಖನ, ಪ್ರಬಂಧ ಲೇಖನ.
7. ಶ್ರಾವಣ (ಕವನ) – ದ ರಾ ಬೇಂದ್ರೆ
8. ಡಾ. ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ (ವ್ಯಕ್ತಿ ಚಿತ್ರ) – ಎ ಎಸ್ ಮೂರ್ತಿರಾವ್
9. ದೋಣಿ ಹರಿಗೋಲುಗಳಲ್ಲಿ (ಪ್ರವಾಸ ಕಥನ) – ಶಿವರಾಮ ಕಾರಂತ
10. ಅಣ್ಣಪ್ಪನ ರೇಷ್ಮೆ ಕಾಯಿಲೆ (ಪ್ರಬಂಧ) – ಕುವೆಂಪು
11. ನಮ್ಮ ಎಮ್ಮೆಗೆ ಮಾತು ತಿಳಿಯುವುದೆ? (ವಿನೋದ) – ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
12. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು (ವಿಜ್ಞಾನ ಲೇಖನ) – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
13. ಬೆಡ್ ನಂಬರ್ ಏಳು (ಕತೆ) – ತ್ರಿವೇಣಿ
14. ರೊಟ್ಟಿ ಮತ್ತು ಕೋವಿ (ಕವನ) – ಸು ರಂ ಎಕ್ಕುಂಡಿ
15. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು (ಅಂಕಣ ಬರಹ) – ಪಿ ಲಂಕೇಶ್

16. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ (ಪರಿಸರ ಲೇಖನ) – ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
17. ಗಾಂಧಿ (ಕತೆ) – ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
18. ಬೆಲ್ಚಿಯ ಹಾಡು (ಕವನ) – ಸಿದ್ಧಲಿಂಗಯ್ಯ
19. ಎಲ್ಲ ಹುಡುಗಿಯರ ಕನಸು (ಕವನ) – ಸವಿತಾ ನಾಗಭೂಷಣ
20. ನೀರು (ಕತೆ) – ಬಸವರಾಜ ಕುಕ್ಕರಹಳ್ಳಿ
21. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿಯ ಒಂದು ಚಿತ್ರಣ (ಪರಿಚಯ ಲೇಖನ) – ರಹಮತ್ ತರೀಕೆರೆ
22. ವೃತ್ತಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ (ತಂತ್ರಜ್ಞಾನ ಬರಹ) – ಎಸ್ ಸುಂದರ್
23. ಕೊಣಪೇಗೌಡ (ಕಾವ್ಯ) – ಜಾನಪದ

ಪಠ್ಯಪುಸ್ತಕಗಳು

1. ಕನ್ನಡ ಮನಸು – ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ತರಗತಿ ಕನ್ನಡ ಪಠ್ಯ. ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಕ್ನಸಡ – ಆಡಳಿತ ಕನ್ನಡ (ಪತ್ರಿಕೆ – 1, ಬ್ಲಾಕ್ 4) ಪ್ರಕಟಣೆ: ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
3. ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಟ್ಟದ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಉತ್ತಮ ಪುಸ್ತಕಗಳು.

SEMESTER/YEAR : I SEM / I YEAR
COURSE CODE : 19AU0004
TITLE OF THE COURSE : CONSTITUTION OF INDIA & PROFESSIONAL ETHICS
L : T : P : S/P : C : 2 : 0 : 0 : 0 : 0

Course objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.

Course outcomes

At the end of the course student will be able

- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Muncipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Sailent features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.
Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.
Union Executives – President, Prime Minister Parliament Supreme Court of India. State Executives – Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th&91st Amendments.

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions.

Powers and functions of Municipalities, Panchyats and Co – Operative Societies.

Text Books:

1. Brij Kishore Sharma,"Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

DAYANANDA SAGAR UNIVERSITY

SHAVIGE MALLESHWARA HILLS, KUMARASWAMY LAYOUT

BENGALURU–560 111, KARNATAKA.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS

FOR

BACHELOR OF TECHNOLOGY (B.Tech.) – 2019

COMPUTER SCIENCE & ENGINEERING

(CSE)

(WITH EFFECT FROM 2019-20)

SCHEME - B.TECH – 2019-20 ONWARDS

III SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS2301	ENGINEERING MATHEMATICS – III – CSE & CST	CR	04	--	--	--	04	*	***
2	103	19CS2302	COMPUTATIONAL THINKING WITH PYTHON	CR	02	--	02	--	03	*	***
3	103	19CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	03	--	02	--	04	*	***
4	103	19CS2304	DATA STRUCTURES AND APPLICATIONS	CR	03	--	02	--	04	I	19EN1103
5	103	19ENC004	FUNDAMENTALS OF ENGINEERING ECONOMICS	CR	03	--	--	--	03	*	***
6	103	19CS2305	ANALOG ELECTRONICS	CR	02	--	02	--	03	*	***
					17	**--**	**08**	**--**	**21**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

SCHEME - B.TECH – 2019-20 ONWARDS

IV SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS2401	DISCRETE MATHEMATICAL STRUCTURES	CR	03	01	--	--	04	*	***
2	103	19CS2402	PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION	CR	03	01	02	--	05	III	19CS2303
3	103	19CS2403	DESIGN & ANALYSIS OF ALGORITHMS	CR	03	01	02	--	05	III	19CS2304
4	103	19CS2404	SIGNALS SYSTEMS	CR	03	--	02	--	04	*	***
5	103	19CS2405	WEB TECHNOLOGIES	CR	02	--	--	--	02	*	***
6	103	19CS2406	SPECIAL TOPICS – I	CR	01	--	02		02	*	***
7	103	19CS2407	MANAGEMENT SCIENCES	CR	02	--	--	--	02	*	***
					17	**03**	**08**	**--**	**24**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,

SCHEME - B.TECH – 2019-20 ONWARDS

V SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS3501	FINITE AUTOMATA AND FORMAL LANGUAGES	CR	03	01	02	--	05	IV	19CS2401
2	103	19CS3502	OPERATING SYSTEMS	CR	03	01	02	--	05	*	***
3	103	19CS3503	OBJECT ORIENTED DESIGN AND PROGRAMMING WITH JAVA	CR	03	--	04	--	05	*	***
4	103	19CS3504	DATABASE MANAGEMENT SYSTEMS	CR	03	--	02	--	04	*	***
5	103	19CS35XX	PROFESSIONAL ELECTIVE – I	CR	AS INDICATED IN PROGRAM ELECTIVE LIST				03	AS INDICATED IN PROGRAM ELECTIVE LIST	
6	103	19CS3505	MINOR PROJECT	CR	--	--	--	04	02	*	***
					14	**02**	**12**	**04**	**24**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

PROFESSIONAL ELECTIVE – I

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	19CS3511	CYBERSECURITY	03	-	-	-	03	*	***
2	19CS3512	CLOUD COMPUTING	02	-	02	-	03	*	***
3	19CS3513	VLSI DESIGN AND VERIFICATION	03	-	-	-	03	III	19CS2303
4	19CS3514	RANDOMIZED AND APPROXIMATE ALGORITHMS	03	-	-	-	03	IV	19CS2403
5	19CS3515	DEEP LEARNING	02	-	02	-	03	III	19CS2301
6	19CS3516	INTERNET OF THINGS	03	-	-	-	03	*	***
7	19CS3517	DIGITAL IMAGE PROCESSING	02	-	02	-	03	II	19EN1201

SCHEME - B.TECH – 2019-20 ONWARDS

VI SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS3601	COMPILER DESIGN AND SYSTEMS SOFTWARE	CR	03	01	02	--	05	V	19CS3501
2	103	19CS3602	COMPUTER NETWORKS	CR	03	--	02	--	04	*	***
3	103	19CS3603	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	CR	03	--	02	--	04	*	***
4	103	19CS36XX	PROFESSIONAL ELECTIVE – II	CR	AS INDICATED IN PROGRAM ELECTIVE LIST				03	AS INDICATED IN PROGRAM ELECTIVE LIST	
5	103	19CS36XX	PROFESSIONAL ELECTIVE –III	CR					03		
6	103	19OEXXXX	OPEN ELECTIVE - I	CR	03	--	--	--	03	*	***
7	103	19CS3604	SPECIAL TOPICS – II	CR	01	--	02	--	02	*	***
					17	**01**	**12**	**--**	**24**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

PROFESSIONAL ELECTIVE – II & III

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	19CS3611	MACHINE LEARNING FOR HEALTHCARE	02	-	02	-	03	V	19CS3515
2	19CS3612	UG RESEARCH PROJECT-I/PRODUCT DEVELOPMENT FOUNDATION-I	-	-	-	06	03	*	***
3	19CS3613	DATA SCIENCE	02	-	02	-	03	III	19CS2301 & 19CS2302
4	19CS3614	MOBILE COMPUTING AND APPS DEVELOPMENT	02	-	02	-	03	V	19CS3503
5	19CS3615	COMPUTER ARCHITECTURE	03	-	-	-	03	IV	19CS2402
6	19CS3616	COMPUTATIONAL GEOMETRY	03	-	-	-	03	III	19CS2304
7	19CS3617	SOFT COMPUTING	03	-	-	-	03	IV	19CS2403
8	19CS3618	INTRODUCTION TO BLOCK CHAIN AND DISTRIBUTED LEDGER	02	-	02	-	03	*	***

SCHEME - B.TECH – 2019-20 ONWARDS

VII SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS47XX	PROFESSIONAL ELECTIVE – IV	CR	AS INDICATED IN PROGRAM ELECTIVE LIST				03	AS INDICATED IN PROGRAM ELECTIVE LIST	
2	103	19CS47XX	PROFESSIONAL ELECTIVE – V/MOOCS	CR					03		
3	103	19OEXXXX	OPEN ELECTIVE - II	CR	03	--	--	--	03	*	***
4	103	19CS4701	CYBER CRIMES, SECURITY POLICIES AND LAW	CR	02	--	--	--	02	*	***
5	103	19CS4702	MAJOR PROJECT STAGE - 1	CR			--	04	02	*	***
					15	**02**	**-**	**04**	**19**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,

PROFESSIONAL ELECTIVE – IV & V

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	19CS4711	MULTI CORE ARCHITECTURE	03	-	-	-	03	IV	19CS2402
2	19CS4712	PATTERN RECOGNITION	02	-	02	-	03	V	19CS3517
3	19CS4713	WIRELESS NETWORKS	03	-	-	-	03	VI	19CS3602
4	19CS4714	SEQUENCE NETWORKS AND GAN	02	-	02	-	03	V	19CS3515
5	19CS4715	CRYPTOGRAPHY	02	-	02	-	03	I	19EN1101
6	19CS4716	MOOC	-	-	-	-	03	*	***
7	19CS4717	UG RESEARCH PROJECT-II/PRODUCT DEVELOPMENT FOUNDATION-II	-	-	-	06	03	VI	19CS3612

SCHEME - B.TECH – 2019-20 ONWARDS

VIII SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	19CS48XX	PROFESSIONAL ELECTIVE-VI (BLENDED LEANING)	CR	AS INDICATED IN PROGRAM ELECTIVE LIST				03	AS INDICATED IN PROGRAM ELECTIVE LIST	
2	103	19CS4801	MAJOR PROJECT STAGE-2	CR	--	--	--	18	09	*	***
					02	**-**	**02**	**18**	**12**		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits,

PROFESSIONAL ELECTIVE – IV & V

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	19CS4811	IMAGE & VIDEO ANALYTICS ON THE EDGE	02	-	02	-	03	*	***
2	19CS4812	MOOC WITH BLENDED LEARNING	-	-	-	-	03	*	***
3	19CS4813	COMPUTER VISION	02	-	02	-	03	V	19CS3517
4	19CS4814	PARALLEL COMPUTING	03	-	-	-	03	IV	19CS2402
5	19CS4815	SOCIAL NETWORKS AND ANALYTICS	02	-	02	-	03	IV	19CS2401
6	19CS4816	HUMAN COMPUTER INTERFACE	03	-	-	-	03	V	19CS3503

OPEN ELECTIVES LIST - B.TECH PROGRAMME – 2019 20 Batch

(Updated as on 13.07.2021)

SL.No	COURSE CODE	COURSE TITLE	OFFERING DEPARTMENT
1	19OE0001	ARTIFICIAL INTELLIGENCE	CSE
2	19OE0002	DATA STRUCTURES & ALGORITHMS	CSE
3	19OE0003	WEB TECHNOLOGIES	CSE
4	19OE0004	SOCIAL NETWORKS & ANALYTICS	CSE
5	19OE0005	MANAGEMENT INFORMATION SYSTEM	CSE
6	19OE0006	FUNDAMENTALS OF CLOUD COMPUTING	CSE
7	19OE0007	MACHINE LEARNING WITH PYTHON	CSE
8	19OE0008	BUSINESS INTELLIGENCE	CSE
9	19OE0009	EVOLUTION OF TELECOM	ECE
10	19OE0010	SENSORS AND TRANSDUCERS	ECE
11	19OE0011	DIGITAL SYSTEM DESIGN	ECE
12	19OE0012	SENSORS, NETWORKS AND PROTOCOLS	ECE
13	19OE0013	IMAGE PROCESSING AND COMPUTER VISION	ECE
14	19OE0014	AUTOMOTIVE EMBEDDED SYSTEMS	ECE
15	19OE0015	AUTOMOBILE ENGINEERING	MECH
16	19OE0016	RAPID MANUFACTURING TECHNOLOGIES	MECH
17	19OE0017	ROBOTICS ENGINEERING	MECH
18	19OE0018	PRODUCT DESIGN & MANUFACTURING	MECH
19	19OE0019	RENEWABLE ENERGY SOURCES	MECH
20	19OE0020	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)	MECH
21	19OE0021	PRODUCT ENGINEERING AND ENTREPRENEURSHIP	CST
22	19OE0022	SMALL BUSINESS LAUNCH	CST
23	19OE0023	INTRODUCTION TO AEROSPACE ENGINEERING	ASE
24	19OE0024	AIRCRAFT SYSTEMS AND INSTRUMENTATION	ASE

SEMESTER/YEAR	**:**	**III SEM/II YEAR**
COURSE CODE	**:**	**19CS2301**
TITLE OF THE COURSE	**:**	**ENGINEERING MATHEMATICS – III – CSE & CST**
L: T: P: S/P : C	**:**	**4 : 0 : 0 : 0 : 4**

MODULE 1: INTEGRATION IN THE COMPLEX PLANE

Complex Integrals, Cauchy-Goursat Theorem, Independence of Path, Cauchy's Integral Formulas and Their Consequences, Cauchy's Two Integral Formulas, Some Consequences of the Integral Formulas, Applications. **[10 hours]**

MODULE 2: SEQUENCES AND SERIES

Sequences and Series, Taylor Series, Laurent Series, Zeros and Poles, Residues and Residue Theorem, Some Consequences of the Residue Theorem, Evaluation of Real Trigonometric Integrals, Evaluation of Real Improper Integrals, Applications. **[10 hours]**

MODULE 3: INTRODUCTION TO PROBABILITY THEORY

Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. **[12 hours]**

MODULE 4: CONTINUOUS PROBABILITY DISTRIBUTIONS AND BIVARIATE DISTRIBUTIONS

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. **[8hours]**

MODULE 5: BASIC STATISTICS

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation. Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. **[12 hours]**

Textbooks:

1. A First course in complex analysis with applications, Dennis Zill and Patrick Shanahan, Jones and Bartlett publishers.

2. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition

3. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 11th Edition

Reference Books:

1. Complex Variables and applications, Brown and Churchill, Mc Graw Hill Education, Eighth Edition.

2. Probability, Statistics and Statistics with Reliability, Queuing, and Computer Science Applications, Kishore Trivedi, Prentice Hall, 2nd Edition

3. Probability and Random Processes, S. Miller and Childers, Elsevier Inc.,Second Edition

SEMESTER/YEAR	**:**	**III SEM/II YEAR**
COURSE CODE	**:**	**19CS2302**
TITLE OF THE COURSE	**:**	**COMPUTATIONAL THINKING WITH PYTHON**
L: T: P: S/P : C	**:**	**2 : 0 : 2 : 0 : 3**

Course Objectives:

The objectives of the Course are:

1. To understand basic concepts of computational thinking.
2. To introduce python programming for problem solving.
3. To introduce different debugging and unit testing tools.
4. To solve real world problems using python data structures.
5. Learn to handle files and exception handling in python.
6. To explore Python's object-oriented features.
7. To build Web services and Networked programs in python.
8. To train students to design an application as part of the course mini- project using computational thinking with python.

Course Outcomes

After undergoing this course, students will be able to:

- Understand basic concepts of computational thinking.
- Outline basic python programming for problem solving.
- Apply computational thinking to solve real world programs using python.
- Build python programs using core data structures like
- list, dictionaries and tuples
- Implement object oriented concepts using python
- Design applications related to web services and network Programming.

Course Content

Module 1: Introduction to Computational Thinking and Python:

Introduction to computational thinking: Stages of Computational thinking, Design using Flowcharts**,** Implementation, Testing

Python Basics: Values, expressions and statements, Conditional execution, Functions Iterations

Module 2: Python Environment and Data Structures

Python Environment: Usage of Debugging and Unit Testing tools in python, Introduction to Github, Executing the python programs using Jupyter notebooks,

Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries

Module 3: **Python Files and Exception Handling**

Files: File types, modes, File functions, File attributes, File positions, Looping over file,. **Exception Handling**: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions.

Module 4: Python Objects

Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.

Module 5: Applications of Python

Applications: Networked Programs, Using web services

Text Book and References

Text Books:

1. " Python for Everybody-Exploring Data Using Python 3", Dr. Charles R. Severance, Shroff Publishers; First edition (10 October 2017)
2. "Introduction to Computing & Problem Solving with Python",Jeeva Jose,P.Sojan Lal, Khanna Book Publishing; First edition (2019).

Reference Books:

1. "Computer Science Using Python: A Computational Problem- Solving Focus", Charles Dierbach, Introduction John Wiley, 2012.
2. "Introduction to Computation and Programming Using Python", John V Guttag, Prentice Hall of India, 2015.
3. "How to think like a Computer Scientist, Learning with Python", Allen Downey, Jeffrey Elkner and Chris Meyers, Green Tea Press, 2014.
4. "Learning to Program with Python", Richard L. Halterman, 2011.

SEMESTER/YEAR	**:**	**III SEM/II YEAR**
COURSE CODE	**:**	**19CS2303**
TITLE OF THE COURSE	**:**	**DIGITAL ELECTRONICS & LOGIC DESIGN**
L: T: P: S/P : C	**:**	**3 : 0 : 2 : 0 : 4**

Course Objectives

The objectives of the Course are:

- To understand various number systems and conversion from one to other number systems
- To understand the difference between analog and digital signals
- To cite the basic characteristics of TTL and CMOS logic families
- To familiar with basic logic gates and their truth tables
- To introduce basic postulates of Boolean algebra
- To manipulate expressions into POS or SOP form.
- To introduce the methods for simplifying Boolean expressions like K-Map and Quine Mclusky
- To understand the concept of don't care conditions and how they can be used to further optimize the logical functions
- To design simple combinational circuits such as multiplexers, decoders, encoders
- To understand the differences between combinational and sequential Logic circuits
- To familiar with basic sequential logic component-SR Latch
- To understand the basics of various types of memories.
- To present the working of various Flip- Flops (T flip-flop, D flip-flop, R-S flip-flop, JK flip-flop)
- To design combinational circuits using programmable logic devices.
- To design sequential circuits such as different types of Counters, Shift Registers

2.1 Course Outcomes

After undergoing this course, students will be able to:

- Demonstrate the knowledge of binary number systems, logic families, boolean algebra and logic gates
- Analyze different methods used for simplification of Boolean expressions.
- Design combinational logic circuits using combinational logic elements
- Design combinational circuits using Programmable Logic Devices
- Analyze sequential logic elements in the design of synchronous and asynchronous systems
- Design sequential systems composed of standard sequential modules, such as counters and registers

Course Content

Module 1: NUMBER SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES:

Review of number systems-Binary, Octal, Hexadecimal. Introduction to Analog and Digital signals. TTL and CMOS technology, TTL and CMOS Parameters.

Truth table of Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic, Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation.

SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS:

Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions.

Practical:

1. Study and verification of Basic gates with Truth Tables
2. Simplification of expressions using Karnaugh Maps and realizing circuits using Basic Gates
3. Realize binary to gray code converter and vice versa

Module 2: **SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS:**

Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.

DESIGN OF COMBINATIONAL LOGIC CIRCUITS:

Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Encoders, Priority encoders, Magnitude comparator – BCD converter, Parity Generators and Checkers.

Practicals:

1. Simplify the given expression using tabular method and to realize circuits using Multiplexers.
2. Design and implementation parallel adder and subtractor
3. Design and implementation of comparators
4. Design various combinational logic circuits like encoders, decoders

Module 3: **PROGRAMMABLE LOGIC**:

Memories: RAM, ROM, SRAM, DRAM, Addressing schemes, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.

SEQUENTIAL CIRCUITS:

Introduction to Sequential Circuits. Combinational v/s Sequential circuits. Asynchronous v/s Synchronous circuits. State table and state diagram

Module 4: **SEQUENTIAL CIRCUITS (continued)**:

State assignment – Memory elements and their excitation functions –T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements – Design of synchronous sequential circuits like Sequence Detectors and binary counters.

Module 5: **APPLICATION OF SEQUENTIAL CIRCUITS**:

Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register, Applications of Shift Registers, Asynchronous and Synchronous Counters, Changing the Counter Modulus, Decade Counters, Presettable Counters, Counter Design.

Practicals:

1. Design and implementation of shift register
2. Design and implementation synchronous counters
3. Design and implementation ring counter and Johnson counter
4. Study of 7490 BCD counter
5. Design and implementation of asynchronous counters

Textbooks and References

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, Pearson Education, 2018
2. Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

References:

1. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
2. Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning, 2014
3. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

SEMESTER/YEAR	**:**	**III SEM/II YEAR**
COURSE CODE	**:**	**19CS2304**
TITLE OF THE COURSE	**:**	**DATA STRUCTURES AND APPLICATIONS**
L: T: P: S/P : C	**:**	**3 : 0 : 2 : 0 : 4**

Course Objectives

The objectives of the course are

- To introduce the concept of data structure and its applications
- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To introduce non-primitive data structures
- To analyse the complexity of a data structure
- To introduce static and dynamic memory allocation using C language
- To explain linear data structures – stack, queue, linked list
- To explain non-linear data structures – trees and graphs
- To train students to design an application as part of the course mini- project using their choice of data structure using C language.

Course Outcomes

After completing this course, students will be able to

- Outline basic C program design for data structures
- Implement stack & queue data structure and their applications
- Apply concepts of dynamic memory allocation to real-time problems
- Implement tree data structure and its applications
- Implement graph data structure and its applications
- Outline the concepts of file structures

Course Content

Module -1 Introduction to Data structures

Definition, Types, Algorithm Design, C Pointers, C Structure, Array Definition, Representation of Linear Array in Memory, Array Operations (Insertion, Deletion, Search and Traversal), Single Dimensional Arrays, Two Dimensional Arrays, Function Associated with Arrays, Arrays as Parameters, Recursive Functions. 11 Hours

Module-2 Introduction to Stack and Queue

Stack: Definition, Array Representation of Stack, Operations Associated with Stacks- Push & Pop, Applications of Stack: Recursion, Polish expressions, Conversion of Infix to Postfix, Infix to Prefix, Postfix Expression Evaluation, Tower of Hanoi.

Queue: Definition, Representation of Queues, Operations of Queues- QInsert, QDelete, Priority Queues, Circular Queue. 11 Hours

Module-3 Dynamic Data Structure

Linked List: Types, Introduction to Singly Linked lists: Representation of Linked Lists in Memory,

Traversing, Searching, Insertion & Deletion from Linked List. Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal). Applications: Polynomial Representation & Basic Operations, Stack & Queue Implementation using Linked Lists.

11 Hours

Module-4 Trees & Graphs

Trees: Basic Terminology, Binary Trees and their Representation, Complete Binary Trees, Binary Search Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal), Application: Expression Evaluation.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential Representation of Graphs, Adjacency Matrices, Graph Transversal, Connected Components and Spanning Trees. 12 Hours

Module-5 File Structures: Physical storage media, File Organization, Linked Organization of File, Inverted File, Organization Records into Blocks, Sequential Blocks, Indexing & Hashing, Multilevel Indexing, Tree Index, Random File, Primary Indices, Secondary Indices. 11 Hours

Laboratory Experiments

1. To perform arithmetic operations on tables
2. To search element(s) in a multidimensional array
3. To implement stack and queue using array & linked list
4. To implement graph & binary tree traversal techniques
5. To evaluate infix/prefix/postfix expressions

Open-Ended Experiments

6. A man in an automobile searches for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?

7. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.

8. Mini-Project on applying suitable data structure to a given real-world problem

Textbooks & References:

Textbooks

1. A M Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

Reference Books

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER/YEAR	**:**	**III SEM/II YEAR**
COURSE CODE	**:**	**19ENC004**
TITLE OF THE COURSE	**:**	**FUNDAMENTALS OF ENGINEERING ECONOMICS**
L: T: P: S/P : C	**:**	**3 : 0 : 0 : 0 : 3**

Course Objectives

The objectives of the Course are:

- To familiarize the prospective engineers with elementary
- To give an introduction to market/firm structure.
- To understand tools that they are likely to find useful in their profession
- To introduce various economic concepts such as microeconomics and macroeconomics
- To explain monetary and fiscal policy and Banking system.
- To introduce inventory analysis, cash control and cash flow
- To develop budgets and break even points
- To introduce the concept of linear programming
- To introduce the Indian economy.

Course Outcomes

After undergoing this course, students will be able to:

- Outline basic concepts of Principles of Economics
- Understand basic concepts of micro and macro economics
- Outline aggregate models and financial system
- Demonstrate Fiscal and Monetary tools
- Solve the problems of Investment analysis
- Outline concepts of Indian Economy

Course Content

Module 1:

Basic Principles and Methodology of Economics. Demand/Supply–elasticity Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. 8 Hours

Module 2:

Aggregate demand and Supply(IS/LM).Price Indices (WPI/CPI),Interest rates ,Direct and Indirect Taxes, Public Sector Economics–Welfare, Externalities, Labour Market-Components of Monetary and Financial System, Central Bank–Monetary Aggregates; Commercial Banks& their functions; Capital and Debt Markets. 8 Hours

Module 3

Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve - Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control–Techniques, Types of Costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. 8 Hours

Module 4

Investment Analysis– NPV, ROI, IRR, Payback Period, Depreciation, Time value of money-Business Forecasting–Elementary techniques. Statements – Cash flow, Financial. Case - Study Method.

9 Hours

Module 5

Indian economy Brief overview of post-independence period–plans. Post reform Growth, Structure of productive activity. Issues of Inclusion–Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private - Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

9 Hours

Text Book and References

Text Book:

1. Mankiw Gregory N.(2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta, Managerial Economics, Tata MGH, 2004

References:

1. Misra, S.K. and Puri, *Indian Economy,* Himalaya, 2009
2. Pareek Saroj, *Text book of Business Economics,* Sunrise Publishers, 2003

SEMESTER/YEAR	**:**	**IV SEM/II YEAR**
COURSE CODE	**:**	**19CS2401**
TITLE OF THE COURSE	**:**	**DISCRETE MATHEMATICAL STRUCTURES**
L: T: P: S/P : C	**:**	**3 : 1 : 0 : 0 : 4**

Course Objectives

The objectives of the Course are:

- Solve problems using relations and generating functions.
- Understand and Construct mathematical arguments
- Use propositional and predicate logic in knowledge representation and program verification.
- Develop recursive algorithms based on mathematical induction.
- Know essential concepts in graph theory and related algorithms.
- Apply knowledge of discrete mathematics in Elementary Number Theory and problem solving.

Course Outcomes

After undergoing this course student will be able to:

- Classify functions, basic set theory relations
- Demonstrate the correctness of an argument using propositional and predicate logic , laws and truth tables
- Solve Algebraic Structures like groups, rings, domains
- Compare and differentiate graphs in different geometries related to edges.
- Apply mathematical induction, counting principles, recursion, elementary number theory
- Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem

Course Content

Module 1: Relations , Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality,
Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion
principle

Module 2 : Logic and Propositional Calculus: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications , Introduction to Predicate Calculus

Module 3: Graph Theory: Introduction, data structures, graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, the bridges of Konigsberg,

traversable multi-graphs, labelled and weighted graphs, complete, regular and bipartite graphs.

Module 4: Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations.

Module 5: Algebraic Structures : Introduction, operations, semi-groups, groups, subgroups, normal subgroups, isomorphism and homomorphism, rings, integral domains and fields, polynomials over a field.

Text Book and References

Text books:

- S. Lipschutz and M. L Lipson, Discrete Mathematics, Schaum's outline, 3rd Edition, McGraw Hill Higher Education, 2006.
- C L Liu, Elements of Discrete Mathematics, 2nd Edition, Tata McGraw Hill, 2000.

Reference books:

- K. Rosen. *Discrete Mathematics and Its Applications (4th edition).* McGraw-Hill. 1999
- Ronald R Graham, D. E. Knuth, and Oren Patashnik, Concrete Mathematics, 2nd Edition, Addision- Wesley Publishing Company, 1994

SEMESTER/YEAR	**:**	**IV SEM/II YEAR**
COURSE CODE	**:**	**19CS2402**
TITLE OF THE COURSE	**:**	**PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION**
L: T: P: S/P : C	**:**	**3 : 1 : 2 : 0 : 5**

Course Objectives

The objectives of the Course are:

- To introduce the architecture of 8086
- To understand the importance and function of each pin of 8086 Microprocessor
- To familiarize with the architecture of 8086 microprocessor and its operation
- To understand the various addressing modes required for assembly language Programming and to calculate the physical address.
- To learn the 8086 instruction set and write 8086 Assembly level programs
- To understand the importance of different peripheral devices and their interfacing to 8086
- Understand the concepts of Hardwired control and micro programmed control.
- To explain the current state of art in memory system design
- Discuss the concept of memory organization.
- Summarize the types of memory.
- Learn about various I/O devices and the I/O interface.
- Learn the different types of serial communication techniques.
- To understand DMA technique
- To provide the knowledge on Instruction Level Parallelism
- To understand the concepts of pipelining techniques.

Course Outcomes

After undergoing this course, students will be able to:

- Identify the basic building blocks of 8086 microprocessor and use the addressing modes for executing programs efficiently
- Develop 8086 assembly language programs using modern assembler tools
- Design interfacing of IO devices to 8086
- Design data part and control part of a processor
- Design different memory blocks
- Understand pipeline Processing

Course Content

Module-1

Introduction to Microprocessor & its Architecture:

Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, Memory paging, 8086 pin diagram, Internal Architecture of 8086,Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Instruction formats

8hrs

Module-2

Programming 8086 and its Interfacing with I/O devices

Assembler directives, Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Assembly language programming with 8086, macros, procedures.

8255 - Programmable Peripheral Interface; Features, Pin diagram, block diagram, 8255 programming, DC/Stepper motor interfacing, Keyboard and display interfacing. **9hrs**

Module- 3

Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions.

Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation;

Data Part Design: Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path, Control Part Design: Control unit design; Hardwired and Micro programmed Control unit.

Discussions about RISC versus CISC architectures. **10hrs**

Module-4

Memory Technology: Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map, Auxiliary Memory, Associative Memory, Cache Memory and organization.

I/O subsystems: Input-Output devices such as Disk, CD-ROM, and Printer etc.; interfacing with IO devices, Isolated versus Memory Mapped I/O

Synchronous and Asynchronous data transfer: Strobe pulse and Handshaking

Modes of data transfer: Programmed I/O, Interrupt-initiated I/O and Direct memory access (DMA)

10hrs

Module - 5

Pipeline Processing, Instruction and Arithmetic Pipeline, Pipeline hazards and their resolution, Parallel Processing Systems, Multi-core Architectures 5**hrs**

Text Book and References

Text Book:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009
2. Douglas V Hall, "MICROPROCESSORS AND INTERFACING, PROGRAMMING AND HARDWARE" TMH, 2006.
3. Mano, Morris M. Computer system architecture. Dorling Kindesley Pearson, 2005.

References:

1. Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture,

programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
4. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization , McGraw-Hill series 2002
5. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
6. Vincent P. Heuring and Harry F. Jordan , Computer Systems Design and Architecture (2nd Edition), Dec, 2003
7. David Patterson and John Hennessey , Computer Organization and Design, Elsevier. 2008
8. Comer, Douglas. Essentials of computer architecture. Chapman and Hall/CRC, 2017.
9. Hord, R. Michael. Parallel supercomputing in MIMD architectures. CRC press, 2018.
10. Tanenbaum, Andrew S. Structured computer organization. Pearson Education India, 2016.

SEMESTER/YEAR : IV SEM/II YEAR
COURSE CODE : 19CS2403
TITLE OF THE COURSE : DESIGN & ANALYSIS OF ALGORITHMS
L: T: P: S/P : C : 3 : 1 : 2 : 0 : 5

Course Objectives

The objectives of the Course are:

1. Understand the Algorithm criteria
2. Ability to analyze time and space complexity
3. Analyze the asymptotic performance of algorithms.
4. Write rigorous correctness proofs for algorithms.
5. Understand the limitations of Algorithm power
6. Become familiar with the different algorithm design techniques.
7. Demonstrate a familiarity with major algorithms and data structures.
8. To apply Substitution method, Recursion tree method and Master's method for solving the recurrence relations
9. Understand the Divide and conquer design strategy
10. To Analyze the Time complexities of Divide and conquer Applications
11. To understand the Greedy Technique
12. To apply Greedy technique to Optimal storage on tapes- Minimum cost spanning tree, Knapsack problem, Single Source Shortest Path Algorithm.
13. To learn the Dynamic programming techniques
14. To understand the difference between dynamic programming and divide and conquer
15. To understand the concepts of Dynamic Programming Applications
16. To critically analyze the efficiency of alternative algorithmic solutions for the same problem
17. To understand the Graph searching and Traversal methods
18. To learn about Strongly connected components, Graph matching, Network flow Algorithm
19. To understand the Back tracking concept
20. To demonstrate the N queen's problem
21. To understand the LC Branch and bound techniques
22. To apply LCBB for solving 0/1 Knapsack and TSP problem
23. Apply important algorithmic design paradigms and methods of analysis.
24. To understand the complexity measures
25. To compare the Polynomial vs Non-Polynomial time complexity
26. To understand the P, NP-hard and NP-Complete classes
27. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes

After undergoing this course, students will be able to:

- Outline the overview of Data structures and Algorithms
- Understand the different Algorithmic Design strategies
- Apply the Design principles and concepts to Algorithmic design
- Describe the DAA paradigms and when an Algorithmic Design situation calls for it.
- Analyze the efficiency of Algorithms using Time and Space complexity theory
- Implement an existing algorithms to improve the run time efficiency

Course Content

Module 1 : INTRODUCTION

Notion of an Algorithm, Concept of algorithmic efficiency, Algorithm performance Analysis- Insertion sort, Linear search. Asymptotic Notations, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method, Master's method.

Module 2 : DIVIDE AND CONQUER

Structure of divide-and-conquer algorithms: Analysis of divide and conquer run time Recurrence relations: Examples-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication

GREEDY METHOD

General method – Optimal storage on tapes- Minimum cost spanning tree, Knapsack problem, Single Source Shortest Path Algorithm.

Module 3 : DYNAMIC PROGRAMMING

Overview, difference between dynamic programming and divide and conquer-Applications: All pair shortest path in graph, Matrix chain multiplication, Travelling salesman Problem, Longest Common subsequence, 0/1 knapsack problem, Optimal binary search tree.

Module 4 : GRAPH SEARCHING AND TRAVERSAL

Strongly connected components, Graph matching, Network flow Algorithm

BACK TRACKING

Overview, N-queen's problem, sum of subset and Graph coloring.

BRANCH AND BOUND

LC Searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Travelling Salesman Problem

Module 5 : COPING WITH THE LIMITATIONS OF ALGORITHMIC POWER

Complexity measures, Polynomial vs Non-Polynomial time complexity, P, NP-hard and NP-Complete classes, Cook's theorem, Standard NP-complete problems and Reduction techniques.

Text Book and References

Text Books:

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015
2. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012

Reference Books:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, " Fundamentals of Computer Algorithms," Galgotia Publication, 2015
2. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley
3. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", Pearson Education, 2009
4. D. E. Knuth, " The Art of Computer Programming , Volume 3" 2nd Edition, Addison Wesley, 2014
5. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

SEMESTER/YEAR	**:**	**IV SEM/IIYEAR**
COURSE CODE	**:**	**19CS2404**
TITLE OF THE COURSE	**:**	**SIGNALS & SYSTEMS**
L: T: P: S/P : C	**:**	**3 : 0 : 2 : 0 : 4**

Course Objectives

The objectives of the Course are:

- Understand Continuous and Discrete Signals and Systems
- How to apply Fourier series, Laplace Transforms, Z transforms for signal processing/representation
- Time Invariant System and Convolution its application to Image Processing
- To give the students' knowledge about the most important issues in sampling and
- reconstruction

Course Outcomes

After undergoing this course, students will be able to:

- Understand Various signals in CTS and DTS
- How to Apply Convolution to Image Processing
- How to use Fourier series for Periodic signal and Fourier Transform and Laplace Transform for Non Periodic signals
- Application of convolution.
- Conversion of Signals from Time domain to Frequency Domain
- How to Convert Analog signals to Digital and Usage of Analog Filters (Lowpass, Highpass, Bandpass)

Module 1: Introduction to Signals and Systems (08 Hours)

Introduction to Signals and Systems, Continuous-Time and Discrete-Time Signals, Signal Properties, Representation of System, Continuous & Discrete-Time Mathematical Models of Systems, Properties of System, Relation between signals and systems.

Module 2: Behavior of continuous and discrete-time LTI systems (07 Hours)

Introduction, Discrete-Time LTI Systems: The Convolution Sum, Continuous-Time LTI Systems: The Convolution Integral, Properties of Linear Time-Invariant Systems, Causal LTI Systems Described by Differential and Difference Equations, Singularity Functions.

Module 3: Laplace Transformation (Theory and Matlab implementation) **(07 Hours)**
Introduction to Laplace Transform, Applications of Laplace Transform, Step functions in Laplace Transform, Properties of Laplace Transform: Linearity, Scaling in Time, Time Shift, "Frequency" or S-Plane Shift, Multiplication by T^n, Integration & Differentiation. Impulse Response, Discrete Time Signals: Sequences, Basic Sequences and Operations, Sinusoidal Sequences, Discrete-Time Systems, Linear Systems, Time-Invariant System, Periodic and Aperiodic Time Sinusoids.

Module 4: Fourier and z- Transforms (Theory and Matlab implementation) (12 Hours)

Introduction to Fourier Series, Fast Fourier-Transformation (FFT) and Discrete Fourier Transform (DFT), Image Transforms, Fourier Series Theorem, Continuous Fourier Transform, Convolution in the frequency domain, Introduction and applications of histograms, Frequency Domain Analysis using Fourier Transform, Filters: Low Pass Filter, High-Pass Filter.
Z-Transformation: Introduction to Z-Transformation, Relationship to Fourier Transform, Region of Convergence, Special Functions, Convolution, Unit Step, Poles & Zeros, Convergence of Finite Sequences, Inverse Z-Transform, Properties of Z-Transform, The Z-Transform for discrete time signals and systems

Module 5: Sampling and Reconstruction (10 Hours)

Introduction, Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, The Effect of Under-sampling: Aliasing, Discrete-Time Processing of Continuous-Time Signals, Sampling of Discrete-Time Signals.

Text/Reference Books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

SEMESTER/YEAR	**:**	**IV SEM/II YEAR**
COURSE CODE	**:**	**19CS2405**
TITLE OF THE COURSE	**:**	**WEB TECHNOLOGIES**
L: T: P: S/P : C	**:**	**2 : 0 : 2 : 0 :3**

Course Objectives

- Understand the major areas and challenges of web programming.
- To create websites using HTML5, CSS3, JavaScript
- To create dynamic, interactive web pages using JavaScript
- Understand client-side JavaScript libraries and frameworks
- Understand server-side scripting language
- Use the techniques for creating data-driven websites using modern web technologies

Course Outcomes

After undergoing this course, students will be able to:

- Know the fundamentals of web application architecture and front end technologies like HTML5 and CSS3
- Use JavaScript for client-side scripting and add dynamic content to pages.
- Use of XML and JSON for data transfer between client and server
- Use of Nodejs for server side programming
- Use React for web development

Course Content

Module 1 WWW, HTML5 and CSS3 (9 Hours)

INTRODUCTION TO WWW: Overview of HTTP, HTTP request – response

Markup Language (HTML5): Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – HTML Forms.

CSS3: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; Background images, Conflict Resolution, CSS3 features: Box Shadow, Opacity, Rounded corners, Attribute selector.

Module 2 JAVASCRIPT (9 Hours)

Overview of Javascript; Object orientation and Javascript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input. Control statements; Arrays; Functions; Constructor; Pattern matching using regular expressions; DOM Events, Introduction to asynchronous javascript-examples and applications, Introduction to callbacks-understanding callbacks with an example

Introduction to Progressive web apps

Module – 3 XML and JSON (08 Hours)

XML: Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets; XML processors;

JSON: JSON syntax, data types, JSON vs XML,JSON parse, JSON file as database

Module –4 Node JS (08 Hours)

Introduction to Node JS, Setup Dev Environment, Node JS Modules, Node Package Manger, File System, Debugging Node JS Application, Events, Express.JS, Database Connectivity, MVC Architecture In Node Js Applications.

Module –5 React (08 Hours)

React -- Overview, Environment Setup, JSX, React -- Components, React -- State, Properties Overview, Properties Validation, Component API, Component life cycle, Forms, Events, Refs and Keys. Progressive Web Apps with React

Text Books:

1. Programming the World Wide Web – Robert W. Sebesta, 7th Edition, Pearson Education, 2008.
2. Beginning JSON, BEN SMITH, 2015
3. Kirupa Chinnathambi, "Learning React", 1 Edition, Addison-Wesley Professional
4. Ethan Brown, First Edition, "Web Development with Node and Express", O'Reilly Media

Reference Books:

1. Internet & World Wide Web How to H program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
2. Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006.
3. The Web Warrior Guide to Web Programming – Xue Bai et al, Thomson, 2003.
4. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
5. Mike Mcgrath, "PHP & MySQL in easy Steps", Tata McGraw Hill, 2012.

SEMESTER/YEAR	**:**	**IV SEM/II YEAR**
COURSE CODE	**:**	**19CS2407**
TITLE OF THE COURSE	**:**	**MANAGEMENT SCIENCES**
L: T: P: S/P : C	**:**	**2 : 0 : 0 : 0 :2**

Course Objectives

The objectives of the Course are:

- Acquire knowledge about the fundamental concepts of organization and management
- Make decision strategies, planning process, tools and techniques
- Inculcate the traits needed to be an effective leader and familiarize with the organizational structures and design
- Gain valuable insights into strategic process, formulation and implementation
- Utilize the intricacies involved in cultural and ethical issues of people
- Utilize the dimensions of the planning-organizing-leading-controlling (P-O-L-C) framework
- Gain knowledge of Micro and Small Enterprises (with the help of case studies) and Know the Institutional Support

Course Outcomes

After undergoing this course, students will be able to:

- Observe and evaluate the various influencing factors on the current practice of organization and management
- Use the techniques and tools of planning and make prudent decisions
- Identify how organizations adapt to uncertain environment, identify techniques managers use to influence and control the internal environment
- Apply and execute management goals and Managing Projects
- Manage people and deal with cultural and ethical issues
- Understand and use the knowledge of Micro and Small Enterprises (with the help of case studies) and know the Institutional Support for setting up Micro and Small Enterprises

Course Content

Module 1: Organization

The Individual and the Organization, Management, Primary Functions of Management, Role of management in organisation, Advantages of Managing People Well, Types of Managers, Role of managers, management Thought, Management Roles, Environmental Factors, Internal and External Factors 6 hrs

Module 2: Organisational control

Control in the Business Setting, Motivation, Importance of Employee Motivation, Leadership, Effective Leader, Organising, Purpose of Organization, organisational design, Common Organizational Structures, Factors Impacting Organizational Design, and Contingencies

5 hrs

Module – 3: Project Management

Preparation of project - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for

project report, Enterprise Resource Planning: Meaning and Importance- Enterprise Resource Planning and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation

7 hrs

Module 4: People Management

Importance of people, attracting a Quality Workforce, Recruiting process, Employee Diversity, Conflict Management, Organisational Culture, Influences on Organizational Culture, Initiating and Fostering Cultural Change, Putting It Together: Culture and Diversity, Ethics, Cultural Issues.

6 hrs

Module – 5 Micro and Small Enterprises

Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath), case study (N R Narayana Murthy & Infosys),

Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR. 6 hrs

Text Book

1. Schermerhorn, J.R., Introduction to Management, 13th ed., Wiley; 2017
2. P. C. Tripathi, P. N. Reddy; Principles of Management , Tata McGraw Hill, 4th / 6th Edition, 2010.
3. Harold Koontz, Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 10th ed., Tata McGraw -Hill Education, 2015
5. Poornima M Charantimath, Entrepreneurship Development -Small Business Enterprises – Pearson Education – 2006

Reference Book:

1. Samuel C. Certo, Tervis Certo, Modern management: concepts and skills, 12th ed., Pearson, 2012
2. Charles W. L. Hill, Steven Mcshane, Principles of Management McGraw Hill Education, 2017
3. Stephen Robbins, Mary Coulter, Fundamentals of Management, 9th ed., Pearson Education, 2016

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3501**					
TITLE OF THE COURSE	**FINITE AUTOMATA AND FORMAL LANGUAGES**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**1**	**2**	**-**	**50**	**5**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV/II	19CS2401	DISCRETE MATHEMATICAL STRUCTURES

COURSE OBJECTIVES :

- To learn general theory of automata, properties of regular sets and regular expressions.
- To understand basics of formal languages.
- To know push-down automata, context- free languages, Turing machines.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the concept of Automata	L1
CO2	Explain the concept of Regular Expression, languages and abstract machines to recognize them	L2
CO3	Know the generalized computation model and different types Computation	L2

COURSE CONTENT:	
MODULE 1	**9Hrs**
Introduction to Finite Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon – transitions.	
MODULE 2	**12Hrs**
Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions. applications of regular expressions such as Grep, and Lex etc.. Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata .	

MODULE 3	**10Hrs**
Context – free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata,	
MODULE 4	**9Hrs**
Properties of Context – Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc	
MODULE 5	**10Hrs**
Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing Machines and Computers. Chomsky hierarchy	

TEXT BOOKS :

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008.
2. J.E. Hopcroft , R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education , New Delhi 2008

REFERENCES :

1. K.L.P. Misra and N. Chandrashekaran. Theory of Computer Science-Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007

2. C. Martin - Introduction to Languages and the Theory of Computation 2ndEdn, TMH, New Delhi, 2000.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3502**					
TITLE OF THE COURSE	**Operating Systems + Lab**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**1**	**2**	**-**	**50**	**5**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	***	***	***

COURSE OBJECTIVES:

- To impart fundamental understanding of the purpose, structure, functions of Operating system
- To introduce the notion of a process -- a program in execution, which forms the basis of all computation.
- To introduce CPU scheduling, which is the basis for multi programmed operating systems
- To understand different approaches to memory management.
- To present a number of different methods for preventing or avoiding deadlocks in a computer system.
- To explores various techniques of allocating memory to processes.
- To discuss file system including access methods, file locking, and directory structures.
- To describe the details of implementing local file systems and directory structures
- To discuss the goals and principles of protection in a modern computer system.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the basic structure and functionality of Operating System.	L2
CO2	Analyse the performance of scheduling algorithms for the given problems.	L4
CO3	Apply the deadlock handling mechanisms to solve the given problem.	L3
CO4	Apply suitable techniques for management of different Resources	L3
CO5	Understand the structure and organization of the file system.	L2

CO6	Understand the principles of protection and security Mechanisms	L2

COURSE CONTENT:	
MODULE 1	**9Hrs**
Operating System Overview Goals of an OS, What Operating Systems Do, Basic functions, Computing environments, classes of Operating-System; Batch, Multiprogramming, Time sharing, Real time, Distributed systems, Operating-System Operations, Virtualization, Operating-System Services, System Calls, Types of System Calls, Operating-System Design and Implementation, Operating-System Structure, System Boot, Case studies; Architecture of Unix, The kernel of Linux, Architecture of windows	
MODULE 2	**12Hrs**
Process Management Process Concept, Process Scheduling, Process synchronization; The critical section problem, Peterson's solution; Synchronization hardware, Mutex locks, Semaphores, Classical problems of synchronization; Monitors, Inter process Communication; Shared-Memory Systems, Message-Passing Systems, Threads Overview, Multithreading models – Pthreads.	

MODULE 3	**10Hrs**
Deadlocks, Memory Management :System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock Memory management strategies: Contiguous Memory Allocation, Segmentation, Paging, Demand Paging, Page-Replacement algorithms	
MODULE 4	**9Hrs**
File System & Implementation: File concept, Access methods, Directory structure, File-System Mounting, Protection, Directory Implementation, Allocation Methods, Free-Space Management, Disk Structure, Disk Scheduling	
MODULE 5: Security and Protection	**10Hrs**
Goals of security and protection, security and protection threats, security attacks; Trojan horses, Viruses and Worms, Encryption, Encryption techniques, Authentication and Password Security, Protection Structures, capability based computer systems, Security and Protection in Windows	

TEXT BOOKS :

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 9th Edition, John Wiley
2. Operating systems- A Concept based Approach-D.M.Dhamdhere, 2nd Edition, TMH.

REFERENCES :

1. William Stallings. "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2013.
2. Andrew S. Tanenbaum. "Modern Operating Systems", Addison Wesley, Fourth Edition, 2014.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3503**					
TITLE OF THE COURSE	**Object Oriented Design and Programming with Java**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**4**	**-**	**42**	**5**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the basic concepts of object-oriented design techniques.
- Understand the fundamentals of object-oriented programming with Java.
- Draw UML diagrams for the software system.
- Impart basics of multi-threading and database connectivity.
- Develop GUI using event handling techniques in Java.

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Apply the concepts of object-oriented programming in software design process.	**L3**
CO2	Develop Java programs using Java libraries and construct to solve real-time problems.	**L3**
CO3	**Understand, develop and apply various object-oriented features using Java to solve computational problems**	**L2**
CO4	Implement exception handling and JDBC connectivity in Java.	**L3**
CO5	Build an event-oriented GUI (graphical user interface).	**L6**

COURSE CONTENT:

MODULE 1	**09 Hrs**

An Overview of Object-Oriented Systems Development: Introduction; Two Orthogonal Views of the Software; Object-Oriented Systems Development Methodology; Why an Object-Oriented? Overview of the Unified Approach. **Object Basics**: Introduction; An Object-Oriented Philosophy; Objects; Objects are Grouped in Classes; **Attributes**: Object State and Properties; Object behaviour and Methods; Object Respond to Messages; Encapsulation and Information Hiding; **Class Hierarchy:** Inheritance; Multiple Inheritance; **Polymorphism**; Object Relationships and Associations: Consumer-Producer Association; Aggregation and Object Containment; **Case Study** - A Payroll Program; **Object-Oriented Systems Development Life Cycle**: Introduction; Software Development Process; Building High-Quality Software; Object-Oriented Systems Development: A Use Case Driven Approach; Reusability.

MODULE 2	**08 Hrs**

Unified Modelling Language :Introduction; Static and Dynamic models; Why Modeling? Introduction to the UML; UML Diagrams; UML Class Diagram; Use-Case Diagram. **Introduction to Java**: Java's Magic: The Bytecode; JVM; Object-Oriented Programming; Simple Java programs; Two Control Statements; Lexical Issues; **Data Types; Variables, Arrays and String constructors**; **Operators; Control Statements; Introducing Classes:** Class Fundamentals; objects; methods; constructors; this Keyword; Garbage Collection; finalize() method; Parameter Passing; Overloading; Access Control Keywords. Inheritance basics; method overriding; abstract classes; Packages and interfaces. Exception handling fundamentals; multiple catch; nested try statements.

MODULE 3	**09 Hrs**

Multi-Threaded Programming :Multi-Threaded Programming: Java Thread Model; The main Thread; Creating a thread and multiple threads; Extending threads; Implementing Runnable; Synchronization; Inter Thread Communication; producer consumer problem. **Input/Output**: I/O Basic; Reading console input Writing Console output.

MODULE 4	**08 Hrs**

Event and GUI Programming:Introducing Swing; The Origins of Swing; Swing Is Built on the AWT; Two Key Swing Features; The MVC Connection; Components and Containers; The Swing Packages; A Simple Swing Application; Event Handling; JLabel; JTextField; JButton

MODULE 5	**08 Hrs**

Database Access:

The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet.

TEXT BOOK:

1. Bahrami A.; Object Oriented Systems Development using the Unified Modeling Language; McGraw Hill; 1999.
2. Schildt; Herbert. Java The Complete Reference; 8th Edition. US: McGraw-Hill Osborne Media; 2011.
3. Jim Keogh; J2EE: The Complete Reference; McGraw Hill Education in 2002.

REFERENCES:

1. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.

2.Y. Daniel Liang, Introduction to Java Programming, 7th edition, Pearson, 2013.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3504**					
TITLE OF THE COURSE	**DATABASE MANAGEMENT SYSTEMS + Lab**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**2**	**-**	**42**	**4**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Demonstrate the basic elements of a relational database management system	L2
CO2	Identify the data models for relevant problems	L2
CO3	Apply normalization for the development of application software's	L3
CO4	Use Structured Query Language (SQL) for database manipulation.	L3
CO5	Understand transactions and their properties (ACID)	L2
CO6	Design and develop a large database with optimal query processing	L6

COURSE CONTENT:	
MODULE 1	**8Hrs**
Introduction: Purpose of Database System-–Views of data–data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes, relationships, relationship types, E/R diagram notation, examples.	

MODULE 2	**9 Hrs**
Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses.	
MODULE 3	**10 Hrs**
Database Design: Dependencies and Normal forms, dependency theory – functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF	
MODULE 4	**9 Hrs**
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	
MODULE 5	**9 Hrs**
Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL	

TEXT BOOK:

1. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 5thEd, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8thed, Pearson Education, 2006.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addision Wesley, 2007
2. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003
3. S. K. Singh, "Database Systems Concepts, Design and Applications", First Edition, Pearson Education, 2006

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3511**					
TITLE OF THE COURSE	**CYBERSECURITY**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the basic concepts of cyber security, how it has evolved, and some key techniques used today.
- Have 1st depth view of Perimeter Security, Authentication and Access management, Cryptography, Malware, Secure Programming etc
- Explore the subject through prescribed book, case studies, hands on experience, extra readings for alternate view or real time application

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Explain the basic concepts of confidentiality, availability and integrity in Information Assurance, Including Defence technologies for Perimeter security, Authentication, Access Control.	**L2**
CO2	Develop solutions for security problems, balancing business concerns, technical issues and security.	**L3**
CO3	Understand about Intruders and Intruder Detection mechanisms, Types of Malicious software	**L2**
CO4	**Determine appropriate mechanisms for protecting the network.**	**L4**
CO5	**Write Safe programs for some common vulnerability.**	**L3**

COURSE CONTENT:	
MODULE 1	**7 Hrs**
Overview and Basics of Crypto and its Applications : Overview : Computer Security Concepts, Requirements, Design Principles, Trends, Strategy Cryptographic Tools: Confidentiality with symmetric encryption, Message Authentication &	

Hash Functions, Digital Signatures, Certificates, Random Numbers Reading Discussion (Optional) : Why crypto systems fail - Ross Anderson	
MODULE 2	**8 Hrs**
User Authentication and Access Control: User Authentication: Principles, Password-based, token based, Biometric, Remote User authentication, Security Issues, Oauth (reference wikipedia) Access Control: Principles, Access Rights, Discretionary Access Control, Unix File Access Control, Role Based Access Control, Attribute based Reading Discussion (Optional) : The Quest to Replace Passwords: A Framework for Comparative Evaluation of Web Authentication Schemes.	
MODULE 3	**9Hrs**
Malwares: Malicious Software: Types of Malware, Viruses & Counter Measures, Worms, Bots, Different types of Payloads, Rootkits , Countermeasures Reading Discussion (Optional) : Measuring Pay-per-Install: The Commoditization of Malware Distribution by J. Caballero, C. Grier, C. Kreibich, V. Paxson (gives a feel of security market)	
MODULE 4	**9 Hrs**
Network Security: Firewall and Intrusion Prevention systems: Firewalls, Types of Firewalls, Intrusion Prevention, Unified Threat management Intrusion Detection: Intruders, Intrusion Detection, Analysis, Host based, Network based Reading Discussion (Optional) : Next generation firewalls by Gartner, Palo Alto	
MODULE 5	**9 Hrs**
Internet Security Protocol: Internet Security Protocols and standards: SSL, TLS, HTTPS.	

TEXT BOOK:

1. Computer Security- Principles and Practice, William Stalling, Laurie Brown 4th Edition, Pearson

REFERENCES:

1. James Graham, Richard Howard, Ryan Olson- Cyber Security Essentials CRC Press
2. James A. Lewis, security: turning national solutions into international cooperation
3. Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin, security: The Essential Body of Knowledge
4. John Rittinghouse, PhD, William M. Hancock, PhD, security Operations Handbook

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3512**					
TITLE OF THE COURSE	**CLOUD COMPUTING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand various basic concepts related to cloud computing technologies
- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Understand the applications of Cloud Computing
- Get exposure to Microsoft Azure, Google Cloud Platform, Amazon Web Services

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	**Define Cloud computing and characteristics**	**L1**
CO2	Describe benefits and drawbacks of Cloud computing	**L2**
CO3	Explain various types of virtualization and capacity planning metrics	**L2**
CO4	Discuss various types of cloud services	**L2**
CO5	Discuss Cloud Security and various challenges	**L2**

COURSE CONTENT:	
MODULE 1	**8Hrs**
INTRODUCTION **:Basics of cloud computing, Cloud Computing Models (Paas, Saas, Iaas), Understanding Public Clouds, Private Clouds, Community Cloud and Hybrid Clouds, Cloud Computing Benefits and risks, Cloud Computing Challenges, Cloud Computing Architecture and Virtualization. Introduction to Google App Engine.**	
MODULE 2	**8Hrs**
CLOUD Technologies **:Overview of Cloud Computing techniques (Grid Computing, Cloud Computing, Utility Computing, Fog Computing, Edge computing). Introduction to Cloud security.**	

MODULE 3	**9Hrs**
CLOUD VIRTUALIZATION TECHNOLOGY **:Introduction, why virtualization, virtualization benefits, application virtualization, virtual machine, desktop virtualization, server virtualization, storage virtualization, Network virtualization implementing virtualization, Hypervisor.**	
MODULE 4	**9Hrs**
ACCESSING THE CLOUD AND MIGRATING TO THE CLOUD **:Accessing the Cloud: Cloud Web access technologies (SOAP,REST),Platforms, web applications framework, web hosting service, web APIs, web browsers.** **Migrating to the Cloud: Broad approaches to migrating into the cloud, the seven-step model of migration into a cloud.**	
MODULE 5	**8Hrs**
CLOUD APPLICATIONS **: Cloud Platforms in Industry: Amazon Web Services, Google Cloud Platform, Microsoft Azure. Cloud Applications: Scientific Applications (Healthcare: ECG Analysis in the Cloud) and Business and Consumer Applications (Social Networking, Smart Grids)**	

TEXT BOOK:

Module 1 & 5**:**

1. **Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education**

Module 2:

2. **Cloud Computing, Dr. Kumar Saurabh, Wiley Publications, 2012**
3. **Guide to Cloud Computing, Richard hill, Springer Publications, 2013**

Module 3:

4. **Cloud Computing A Practical Approach, Anthony T Velte et.al, MC Graw Hill publications, 2014**
5. **Cloud Computing Principles and Paradigms, Rajkumar Buyya et.al, Wiley Publications, 2015**

Module 4:

6. **Cloud Computing Technologies and Strategies of the Ubiquitous data center, Brain J.S et.al, CRC Press, 2014**

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3513**					
TITLE OF THE COURSE	**VLSI DESIGN & VERIFICATION**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	III/II	19CS2303	Digital Electronics and logic Design

COURSE OBJECTIVES:

- Study VLSI design methodology and need of CAD tools
- Study of algorithms used in design-automation tools.
- Study of algorithms used in automation tools for verification and testing

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	**Define problems of complexity, productivity, verification and optimization, and learn currently available and emerging solutions**	**L1**
CO2	Define problems of complexity, productivity, verification and optimization, and learn currently available and emerging solutions	**L1**
CO3	Gain insight into CAD, and develop ability to read the professional CAD literature.	**L2**

COURSE CONTENT:	
MODULE 1	**8Hrs**
Introduction :Introduction to Digital VLSI Design Flow, High Level Design Representation, Transformations for High Level Synthesis	
MODULE 2	**9Hrs**
Scheduling, Allocation and Binding: Introduction to HLS(High Level Synthesis): Scheduling, Allocation and Binding Problem, Scheduling Algorithms, Binding and Allocation Algorithms.	

MODULE 3	**9Hrs**
Logic Optimization and Synthesis: Two level Boolean Logic Synthesis, Heuristic Minimization of Two-Level Circuits, Finite State Machine Synthesis, and Multilevel Implementation	
MODULE 4	**7Hrs**
Verification: Binary Decision Diagram: Binary Decision Diagram: Introduction and construction, Ordered Binary Decision Diagram, Operations on Ordered Binary Decision Diagram	
MODULE 5	**9Hrs**
Temporal Logic and Introduction to Digital Testing: Introduction and Basic Operations on Temporal Logic, Syntax and Semantics of CLT, Equivalence between CTL Formulas , Introduction to Digital VLSI testing	

TEXT BOOK:

1. Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits", Tata McGraw-Hill, 1st edition, 2003.
2. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, "High-Level Synthesis: Introduction to Chip and System Design, Springer", 1st edition, 1992.
3. Sabih H. Gerez, "Algorithms for VLSI Design Automation",1st edition,1998

REFERENCES:

1. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.
2. M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems, Cambridge University Press, 2nd Edition, 2004.
3. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3514**					
TITLE OF THE COURSE	**RANDOMIZED & APPROXIMATE ALGORITHMS**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV/II	19CS2403	Design and analysis of Algorithms

COURSE OBJECTIVES:

- **To introduce the concept of randomized algorithms**
- **To apply the concepts of probabilistic analysis of algorithms**

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	**Apply basics of probability theory in the analysis of algorithms**	**L3**
CO2	**Comprehend randomized algorithms and its advantages to traditional algorithm**	**L4**
CO3	**Design and implement randomized techniques in solving real world problems**	**L3**

COURSE CONTENT:	
MODULE 1	**8Hrs**
Elements of probability theory, Verification of polynomial identities, matrix multiplication. Las Vegas and Monte Carlo algorithms, Random Variables and Expectations	
MODULE 2	**9 Hrs**
Jensen's Inequality, Bernoulli and Binomial RV, Conditional Expectation, Geometric distribution, Coupon collector's problem.	
MODULE 3	**9 hrs**
Game Tree evaluation, The Minimax Principle, Randomness and Non Uniformity, Markov's Inequality, Variance and Moments of a RV, Chebyshev's inequality.	

MODULE 4	**7Hrs**
Randomized Quick Sort, Coupon Collector's problem and Randomized Median Finding.	
MODULE 5	**9 Hrs**
Sum of Poisson Trials, Coin flips, Set balancing, Packet Routing in Sparse Networks, Bucket Sort, Hashing, Hamiltonian Cycles in Random Graphs, Finding a large cut, Maximum satisfiability, Graphs with large girth.	

TEXT BOOK:

1. **M. Mitzenmacher and E. Upfal, "Probability and computing: Randomized algorithms and Probabilistic analysis", Cambridge, 2005**
2. **D. Dubhashi and A. Panconesi, "Concentration of measure for the analysis of randomized algorithms", Cambridge, 2009.**
3. **R. Motwani and P. Raghavan, "Randomized Algorithms", Cambridge Press, 1995.**

REFERENCES:

1. **J. Hromkovic, "Design and analysis of randomized algorithms", Springer Verlag, 2005.**
2. **K. Mulmuley, "Computational Geometry, an introduction through randomized algorithms", Prentice Hall, 1994.**

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3515**					
TITLE OF THE COURSE	**DEEP LEARNING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	III	19CS2301	ENGINEERING MATHEMATICS – III

COURSE OBJECTIVES:

- **To understand the basic building blocks and general principles that allows one to design Deep learning algorithms**
- **To become familiar with specific, widely used Deep learning networks**
- **To introduce building blocks of Convolution neural network architecture**
- **To learn to use deep learning tools and framework for solving real-life problems**

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	**Build various deep learning models**	**L6**
CO2	**Identify and Apply the deep learning algorithms which are more appropriate for various types of learning tasks in various domains**	**L3**
CO3	**Implement deep learning algorithms and solve real-world problems deep learning tools and framework**	**L3**

COURSE CONTENT:	
MODULE 1	**5 Hrs**
Mathematical background for Deep learning- Data Manipulation and Data Preprocessing, Linear Algebra, Calculus, Probability	
MODULE 2	**7 Hrs**
Introduction to Machine learning - Types of Machine Learning problems, Linear	

Regression-Basic elements of linear regression, Vectorization for Speed, From Linear Regression to Deep Networks, Softmax Regression	
MODULE 3	**5 hrs**
Multilayer Perceptrons-hidden layers, activation functions, Model Selection, underfitting, overfitting, weight decay, dropout	
MODULE 4	**6 Hrs**
Forward Propagation, Backward Propagation, and Computational Graphs Layers and Blocks, shallow neural network, deep neural network, Optimization for training Deep Models.	
MODULE 5	**5 Hrs**
Foundations of Convolutional Neural Networks- Convolution operation, Convolutional Layers, Object Edge Detection in Images, Padding and Stride, Multiple Input and Multiple Output Channels, 1 × 1 Convolutional Layer, Pooling, Convolutional Neural Networks (LeNet)	

TEXT BOOK:

1. **Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, "Dive into Deep Learning", Amazon Science, 2020**
2. **Ethem Alpaydin, "Introduction to Machine Learning", PHI, 2005**

REFERENCES:

1. **Tom Mitchell, Machine Learning, McGraw-Hill, 1997**
2. **Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016**
3. **François Chollet, "Deep Learning Python", Manning Publications, 2018**
4. **Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", O'Reilly Media; 1 edition (April 9, 2017)**
5. **Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly Media; 1 edition (August 19, 2017)**

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	19CS3516					
TITLE OF THE COURSE	**INTERNET OF THINGS**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- **To learn the building blocks of Internet of Things (IoTs) and their characteristics.**
- **To introduces the students to the programming aspects of Internet of Things with a view towards rapid prototyping of IoT applications.**
- **To learn Reference architectures for different levels of IoT applications.**
- **To learn IoT data analytics and Tools for IoT.**

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Identify a suitable IOT data analytics and a tool for IOT	**L4**
CO2	Understand how the general Internet as well as Internet of Things work	**L2**

COURSE CONTENT:	
MODULE 1	**8 Hrs**
Introduction Introduction: Concepts behind the Internet of Things. - The IoT paradigm Smart objects - Bits and atoms - Goal orientation - Convergence of technologies. Introduction to Internet of Things Introduction, Definition & Characteristics of IoT, Physical Design of IoT , Things in IoT , IoT Protocols . IoT Levels & Deployment Templates.	
MODULE 2	**7 Hrs**
Domain Specific IOTs :Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry. IoT and M2M- Introduction , M2M , Difference	

between IoT and M2M , SDN and NFV for IoT, Software Defined Networking , Network Function Virtualization	
MODULE 3:	**9 Hrs**
IOT SYSTEM MANAGEMENT WITH NETCONF: Need for IoT Systems Management, Simple Network Management Protocol(SNMP), Limitations of SNMP, Network Operator Requirements, NETCONF 83 4.5 YANG , IoT Systems Management with NETCONF-YANG , NETOPEER	
MODULE 4	**9 Hrs**
DEVELOPING INTERNET OF THINGS :IoT Platforms Design Methodology , Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, DATA ANALYTICS FOR IOT -Introduction , Apache Hadoop ,MapReduce Programming Model , Using Apache Storm for Real-time Data Analysis ,REST-based approach ,WebSocket-based approach , Structural Health Monitoring Case Study	
MODULE 5	**9 Hrs**
Tools for IoT Introduction :Chef, Setting up Chef , Chef Case Studies, Multi-tier Application Deployment ,Hadoop Cluster , Storm Cluster, Puppet, Puppet Case Study - Multi-tier Deployment, NETCONF - YANG Case Studies ,Steps for IoT device Management with NETCONF-YANG , Managing Smart Irrigation IoT System with NETCONF-YANG , Managing Home Intrusion Detection IoT System with NETCONF-YANG ,IoT Code Generator	

TEXT BOOK:

1. Arshdeep Bahga and Vijay Madisetti , Internet of Things - A Hands-On Approach, VPT; 1 edition (August 9, 2014)

REFERENCES:

1. Ian G Smith, The Internet of Things 2012 New Horizons, IERC - Internet of Things European Research Cluster, 2012.
2. IEEE 802.3 Working Group, http://www.ieee802.org/3, Retrieved 2014. Paul Deitel, C How to Program, 7th Edition, Deitel How to Series.
3. M. Wang, G. Zhang, C. Zhang, J. Zhang, C. Li, An IoT-based Appliance Control System for Smart Homes, ICICIP 2013.
4.] H. Zhang, J. Guo, X. Xie, R. Bie, Y, Sun, Environmental Effect Removal Based Structural Health Monitoring in the Internet of Things, International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**19CS3517**					
TITLE OF THE COURSE	**DIGITAL IMAGE PROCESSING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	II/I	19EN1201	ENGINEERING MATHEMATICS-II

COURSE OBJECTIVES:

- Develop an overview of the field of image processing.
- Understand the fundamental algorithms and how to implement them.
- Prepare to read the current image processing research literature.
- Gain experience in applying image processing algorithms to real problems.

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Understand image formation and Analysis	**L2**
CO2	Understand various applications of image processing in industry, medicine, and defense.	**L2**
CO3	Apply the signal processing algorithms and techniques in image enhancement and image restoration.	**L3**
CO4	**Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems**	**L3**

COURSE CONTENT:	
MODULE 1	**5Hrs**
Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.	

MODULE 2:	**6Hrs**
Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	
MODULE 3	**6 Hrs**
Image Enhancement in the Spatial Domain: Some Basic Gray Level, Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic, Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	
MODULE 4	**6 Hrs**
Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters , Homomorphic Filtering.	
MODULE 5	**5Hrs**
Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.	

TEXT BOOK:

1. Rafel C Gonzalez and Richard E. Woods, “Digital Image Processing”, 3rd Edition, Pearson Education, 2003.
2. A K Jain, Digital Image Processing

REFERENCES:

1. Scott.E.Umbaugh, “Computer Vision and Image Processing”, Prentice Hall, 1997.
2. A. K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 2004.
3. Z. Li and M.S. Drew, “Fundamentals of Multimedia”, Pearson, 2004.
4. S.Jayaraman, S.Esakkirajan, T. Veerakumar, “Digital Image Processing”, Tata McGraw Hill, 2004.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3601**					
TITLE OF THE COURSE	**Compiler Design and System Software**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**1**	**2**	**-**	**52**	**5**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS3501	Finite Automata and Formal Languages

COURSE OBJECTIVES:

- To discuss the techniques of scanning, parsing & semantic elaboration well enough to build or modify front end.
- To expose the critical issues in modern compilers & provide them with the background to tackle those problems.

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Understand the major phases of compilation and to understand the knowledge of Lex tool & YAAC tool	**L2**
CO2	**Develop the parsers and experiment the knowledge of different parsers design without automated tools**	**L3**
CO3	**Construct the intermediate code representations and generation**	**L3**
CO4	Convert source code for a novel language into machine code for a novel computer	**L3**
CO5	Apply for various optimization techniques for dataflow analysis	**L3**

COURSE CONTENT:	
MODULE 1	**10Hrs**
Introduction to System Software, Machine Architecture of SIC and SIC/XE. **ASSEMBLERS:** Basic assembler functions: A simple assembler, Assembler algorithm and data structures, Machine dependent assembler features: Instruction formats and addressing modes – Program relocation, Machine independent assembler features: Literals, Symbol-defining statements, Expressions, Program blocks, Control Sections and Program Linking.	

MODULE 2	9 Hrs
LOADERS AND LINKERS Basic loader functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Machine dependent loader features :Relocation, Program Linking ,Algorithm and Data Structures for Linking Loader, Machine-independent loader features: Automatic Library Search, Loader Options, Loader design options :Linkage Editors, Dynamic Linking	
MODULE 3	**11 Hrs**
COMPILERS: Introduction: Language Processors, Structure of compiler, The science of building a compiler, Applications of compiler technology. **LEXICAL AND SYNTAX ANALYSIS:** Role of lexical Analyser, Specification of Tokens, Lexical Analyzer generator Lex. **SYNTAX ANALYSIS I:** Role of Parser, Syntax error handling, Error recovery strategies, Writing a grammar: Lexical vs Syntactic Analysis, Eliminating ambiguity, Left recursion, Left factoring.	
MODULE 4:	**12 hrs**
SYNTAX ANALYSIS II-:Top down parsing: Recursive Descent Parsing, First and follow, LL (1), –Bottom up parsing:Shift Reduce Parsing ,Introduction to LR parsing Simple LR: Why LR Parsers, Items and LR0 Automaton, The LR Parsing Algorithm, Constructing SLR Parsing Tables. **SYNTAX-DIRECTED TRANSLATION:** Syntax-Directed Definitions: Inherited and Synthesized Attributes, Evaluation orders for SDDs: Dependency graphs, Ordering the evaluation of Attributes, S-Attributed Definition, L-Attributed Definition, Application: Construction of Syntax Trees.	
MODULE 5	**10 Hrs**
INTERMEDIATE CODE GENERATION: Three Address Code: Addresses and Instructions, Quadruples, Triples, Static Single Assignment form**.** **CODE GENERATION**: Issues in the design of code generator, Basic Blocks, Optimization of Basic Blocks, The Code Generation Algorithm, Peephole optimization**.** **MACHINE INDEPENDENT OPTIMIZATION:** The Principal Sources of Optimization	

TEXT BOOK:

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

REFERENCES:

1. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
2. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
3. D.M.Dhamdhere, Systems Programming and operating systems, Second Revised edition, Tata McGraw Hill.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3602**					
TITLE OF THE COURSE	**COMPUTER NETWORKS**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**2**	**-**	**42**	**4**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy** Level
CO1	Understand and explore the basics of Computer Networks and Various Protocols.	**L2**
CO2	Administrate a network and flow of information	**L2**
CO3	Understand the concepts of network security, mobile, and ad hoc network	**L2**

COURSE CONTENT:	
MODULE 1	**9Hrs**
Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model. **Physical Layer:** Introduction to Guided transmission media and wireless transmission media. Transmission mode, Classification of networks. Parallel & Serial Transmissions, Analog & Digital Signals, Periodic & Aperiodic Signals, Encoding Schemes. RS-233C Protocol. **Data Link Layer** - Design issues, CRC codes, Elementary Data Link Layer Protocols, stop and wait, sliding window, go-back-N protocols.	
MODULE 2	**9 Hrs**
Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges,	

spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways. LLC, WiFi, Bluetooth Protocols.	
MODULE 3	**8 Hrs**
Network Layer: Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control, Classful IP addresses(A,B,C,D) ,QoS, Details of IP Packet	
MODULE 4	**9 Hrs**
The Internet Transport Protocols: Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.	
MODULE 5	**7 Hrs**
Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH, SNMP. Socket Programming using TCP and UDP. **Introduction to Internet of Things**, Introduction to Sensors, Actuator, Transducers, Gateway, IOT Architecture, Introduction to Node MCU and Arduino. Overview of Edge, Fog and Cloud computing and application of IOT in Home Automation	

TEXT BOOK:

1. Behrouz A. Forouzan, Data Communications and Networking -, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

REFERENCES:

1. Computer Networking- A top down approach- James F Kurose and Keith W Ross,6th Edition, Pearson Education.
2. W. Tomasi, "Advanced Electronic Communication Systems", 2000
3. James Martin, "Telecommunications & the Computer", 3rd Edition, PHI. 2001
4. P. C. Gupta, "Data Communications, PHI, 2001.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3603**					
TITLE OF THE COURSE	**Software Engineering and Project Management**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**2**	**-**	**42**	**4**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- This course is introduced to give the students necessary knowledge.
- Understanding and Design aspects in Software Engineering
- To understand the Software Project Planning and Evaluation techniques

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand software development life cycle models, process models, and various design engineering techniques.	L2
CO2	Understand the importance of testing and use different types of testing techniques.	L3
CO3	Understand Project Management principles while developing software.	L2

COURSE CONTENT:	
MODULE 1	**9Hrs**
Introduction to Software Engineering: FAQs about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties, Organizations, people and computer systems; Legacy systems, the evolving role of software, Changing Nature of Software, Software myths. **A Generic view of process:** Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Software Cost Estimation: Productivity; Estimation techniques	

MODULE 2	7Hrs
Process models: A simple safety- critical system; System dependability; Availability and reliability, the waterfall model, Incremental process models, Evolutionary process models, The Unified process. Comparison of different models with case studies, Agile Development: Agile Tech, Extreme Programming, and other Agile Process Models: Scrum Methodology	
MODULE 3	**9Hrs**
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioural models, Data models, Object models, structured methods.	
MODULE 4	**9Hrs**
Testing Strategies: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. A strategic approach to software testing, System testing, the art of Debugging; Component testing; Test case design; Test automation - Selenium, Test strategies for conventional software: Black-Box and White-Box testing, Validation tests, System testing.	
MODULE 5	**8Hrs**
Software Project Management Introduction to Software Project Management – all life cycle activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	

TEXT BOOKS :

1. Software Engineering, by Ian Sommerville Eighth edition, International Computer Science Series.
2. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition.

REFERENCES :

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. SoftwareEngineering-K.K.Agarwal&YogeshSingh,NewAgeInternationalPublishers
3. Software Engineering, an Engineering approach-JamesF. Peters, WitoldPedrycz, John Wiley.
4. Systems Analysis and Design –Shelly Cashman Rosenblatt, Thomson Publications.
5. Software Engineering principles and practice-Waman Jawadekar,The McGraw-Hill Companies

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3611**					
TITLE OF THE COURSE	**Machine Learning for Healthcare**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	V/III	19CS3515	Deep Learning

COURSE OBJECTIVES :

- To introduce the students to healthcare domain and to make them understand and practice to use machine learning techniques to data in the healthcare domain

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Identify different problems in the healthcare industry that need solution.	L4
CO2	Understand and be able to choose appropriate Machine learning technique that is suitable to solve the identified problem.	L2
CO3	Build a framework of the solution	L6

COURSE CONTENT:	
MODULE 1	**6Hrs**
Knowing Healthcare Industry: Overview of Healthcare & Life science Industry, Introduction to healthcare informatics, Medical Standards and Coding Types, Global Healthcare Challenges and Trends; Past-Present-Future of AI&ML in Healthcare	
MODULE 2	**6Hrs**
Advanced Analytics in Health Care : Overview of clinical care, Clinical Data, Data Types; Risk Stratification; Survival Modelling; Disease progression Modelling, Causal Inference, Re-enforcement learning in healthcare applications	
MODULE 3	**6Hrs**
Medical Image Diagnostics and NLP for healthcare: Medical Image modalities and management; ML applications in medical Ology space (cardiology, ophthalmology, dermatology, pathology, oncology, haematology, odontology, osteology, pulmonology); NLP for Healthcare: Payer Analytics – Insurance	

MODULE 4	6Hrs
Precision Medicine, Automating clinical workflow, Regulation of AI/ML, challenge in deploying ML model	
MODULE 5	**4Hrs**
Public Health – Government, Provider Analytics, Care management System, Wearable devices and Medical Bots, Pharma R&D and Life Science	

TEXT BOOKS :

1. SumeetDua, U. RajendraAcharya, PrernaDua (Editors), Machine Learning in Healthcare Informatics,Intelligent Systems Reference Library 56, Springer,
2. Sergio Consoli • Diego ReforgiatoRecupero • Milan Petkovic (Editors), Data Science for Healthcare Methodologies and Applications

REFERENCES :

1. Thomas M. Deserno, Fundamentals of Bio-Medical Image processing, Biological and Medical Physics, Biomedical Engineering, Springer, ISBN 978-3-642-15816-2, 2011
2. Recent journal publications/white papers from companies
3. Other Video links

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**UG Research Project-I/Product Development Foundation- I**					
TITLE OF THE COURSE	**19CS3612**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	-	6	-	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To identify key research questions within a field to carry out research in a team
- To identify and summarize the literature review of the relevant field
- To demonstrate relevant referencing and inculcate new skills in various aspects of academic writing
- To demonstrate the knowledge and understanding of writing the publication/report
- To showcase the strong evidence on the clarity of the argument, understanding of the selected domain area and presentation of its technical information
- To detail description of the process of carrying out the independent research in written document along with results and conclusions with reference to the existing literature
- To analyze and synthesize the new research findings

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy Level**
CO1	**Draft of the Publication or Demonstration of the Proof-of-concept product, Draft of patent application**	**L6**

COURSE CONTENT:

The research topic proposed by both the guide and the student team should be approved by the department chairman to proceed further. A degree of industrial input and involvement will be encouraged, and can be facilitated through existing academic-industrial collaborations or by addressing specific topics that are of interest to industrial partners.

All projects will be closely supervised by the Project Guide with ongoing feedback and guidance at all stages of the project from the conception to completion.

The following criteria will be checked by the department chairman to approve for the

research proposal:

a. Department staff as course guide

1. Ability to provide research direction to the student in the chosen field of interest
2. Ability to design an appropriate research strategy and methodology to carry out the research by student
3. Ability to provide and evaluate the strong literature review document for the chosen research topic
4. Ability to train students on research paper / technical writing skills
5. Conduct reviews in regular time period and submit the evaluation to department chairman

b. Student Team

1. To be dedicated and committed to work on a new research topic by learning new technical skills
2. To have fair knowledge on what is product development or research topic
3. To have constant interaction with allocated guide by providing weekly updates
4. To be committed to complete the project and submitting the technical paper within the stipulated time framed by the university

Evaluation:

There will be CIA evaluation as well as the Semester end evaluation of the work done. It will be done by a committee of senior researchers of the Department.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3613**					
TITLE OF THE COURSE	**DATA SCIENCE**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	III	19CS2301	Engineering Mathematics – III
2	III	19CS2302	Computational Thinking with Python

COURSE OBJECTIVES :

- To use statistical and computational techniques to Discover, Analyze, Visualize and Present Data

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Apply statistical techniques to preprocess data and perform exploratory data analysis.	L3
CO2	Understand and be able to use appropriate statistical and machine learning modeling techniques for data analysis and modeling	L2
CO3	Use data visualization techniques for exploratory data analysis and communicating the results	L3
CO4	Evaluate and improve performance of Models	L5
CO5	Use appropriate python libraries for data preprocessing, analysis, modeling and visualization	L3

COURSE CONTENT:	
MODULE 1	**6Hrs**
Overview of the Data Science process. Statistical thinking in the age of big data – Population and Samples, Measures of central tendencies, variability, hypothesis testing, correlation, statistical models and inference. Basic Python constructs and data structures, Jupyter Notebooks	
MODULE 2	**6Hrs**
Data Preprocessing: Data Cleaning - Missing values, Noisy data, Data cleaning process,	

Data Reduction: Principal Components Analysis, Data Transformation: Strategies Overview, Data Transformation by normalization, Discretization by binning. Introduction to Pandas for Data Wrangling.	
MODULE 3	**6Hrs**
Exploratory Data Analysis and Data Visualization with Python: Introduction, Scatter Plots, Histogram, Box Plots, Violin Plot, Heat Map, waffle charts, word clouds, attractive regression plots. Visualizing geospatial data using Folium. choropleth maps. Case Study: Let my dataset change your mindset by Dr HansGosling.	
MODULE 4	**5 Hrs**
Basic Machine Learning Algorithms – Linear Regression, k-nearest neighbors, k- means, decision trees, naïveBayes	
MODULE 5	**5 Hrs**
Model Evaluation**: Confusion Matrix, Evaluation Measures. Comparing Classifiers based on cost-benefit and ROC curves. Improving Classifier accuracy: Ensemble Methods, Bagging and Boosting. Capstone Project**	

TEXT BOOKS :

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'reilly Publications,2014
2. Jiawei Han, MichelineKember and Jian Pei, Data Mining Concepts and Techniques, 3rd edition, Elsevier,2012

REFERENCES :

1. Jake VanderPlas, Python Data Science Handbook – Essential tools for working with data, O'Reilly,2016
2. Data Science and Big Data Analytics, Wiley Publications,2015
3. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd edition).,Springer,2008

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3614**					
TITLE OF THE COURSE	**MOBILE COMPUTING AND APPS DEVELOPMENT**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS3503	Object Oriented Design and Programming with Java

COURSE OBJECTIVES :

- To understand the basic concepts of mobile computing
- To learn the setup of Android development environment
- To illustrate the interaction of app with the user interface and handling various activities
- To identify the options for saving the persistent application data
- To gain knowledge about different mobile platforms and application development

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Create, test and debug Android application by setting up the Android development environment	L6
CO2	Implement adaptive and responsive user interfaces that work across various devices	L3
CO3	Demonstrate the techniques involved to store, share and retrieve data in Android applications	L2
CO4	Acquire technical competency and skills in developing applications using Android and cross-platform	L2

COURSE CONTENT:	
MODULE 1	**6Hrs**
INTRODUCTION TO MOBILE COMPUTING Introduction to mobile computing, Architecture of mobile network, Generations of mobile communication, mobile operating systems, Application of mobile communication, Challenges of mobile communication.	
MODULE 2	**6Hrs**
Introduction, trends, platforms, Android Development Setup like, Android Studio, Eclipse,	

Android SDK, tools. Emulator setup. App behaviour on the Android Runtime (ART). Platform Architecture. Application framework and basic App Components resources. Hello World program in Android Studio	
MODULE 3	**6Hrs**
MOBILE APP DEVELOPMENT USING ANDROID: **Android user Interface – Layouts (Linear, Absolute, Table, Relative, Frame and Scroll), values, asset XML representation, generate R.Java file, Android manifest file. Activities, Intent and UI Design - activities life-cycle. Android Components – layouts, fragments, basic views (Button, Edit Text, Check box, Toggle Button, Radio Button), list views, picker views, adapter views, Spinner views, Menu, Action Bar and Managing data using SQLite database (Database create, Read, Update and delete).**	
MODULE 4	**6Hrs**
MESSAGING AND LOCATION BASED SERVICES Sending SMS and mail, Google Maps – Displaying Google Maps in Andriod application, Networking – How to connect to Web using HTTP, Publishing Android Applications – how to prepare application for deployment, exporting application as an APK file and signing it with new certificate, how to distribute new android application and publish android application on market place	
MODULE 5	**4Hrs**
DATA PERSISTENCE AND GOOGLE APIS FOR ANDROID: Introduction of Google APIs for Android. SQLite Databases. CROSS-PLATFORM APP DEVELOPMENT - Introduction to Cross platform App Development - Difference to native apps, Pros and cons, Development tools.	

TEXT BOOKS :

1. **Mobile Cloud Computing by Debashis De, CRC Press, Taylor & Francis Group**
2. **Head First Android Development by Jonathan Simon O'reilly Publications**

REFERENCES :

1. **Learning Android by Marko Gargenta O'reilly Publications**
2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
3. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
4. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014
5. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3615**					
TITLE OF THE COURSE	**COMPUTER ARCHITECTURE**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV/II	19CS2402	Principles of Microprocessors & Computer Organization

COURSE OBJECTIVES :

- **To understand the micro-architectural design of processors**
- **Learn about the various techniques used to obtain performance improvement**
- **Learn Power savings in current**

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the principles of computer design and classify instructions set architecture	L2
CO2	Describe the operations of performance such as pipelines, dynamic scheduling branch predictions, caches	L2
CO3	**Describe the modern architecture such as RISC, Scalar, VLIW Multi core and multi CPU systems**	L2
CO4	**Describes instruction and thread level parallelism**	L2
CO5	**Develop the applications for high performance computing systems**	L3

COURSE CONTENT:	
MODULE 1	**8Hrs**
FUNDAMENTALS OF COMPUTER DESIGN: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.	
MODULE 2	**7Hrs**
PIPELINING: Introduction; Pipeline hazards; Implementation of pipeline; what makes	

pipelining hard to implement? ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation.	
MODULE 3	**9Hrs**
INSTRUCTION –LEVEL PARALLELISM – 2: Exploiting ILP using multiple issues and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example	
MODULE 4	**9Hrs**
MULTIPROCESSORS AND THREAD –LEVEL PARALLELISM: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency.	
MODULE 5	**9Hrs**
HARDWARE AND SOFTWARE FOR VLIW AND EPIC: Introduction: Exploiting Instruction- Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.	

TEXT BOOKS :

1. Computer Architecture, A Quantitative Approach – John L. Hennessey and David A. Patterson 4th Edition, Elsevier, 2007

REFERENCES :

1. Advanced Computer Architecture Parallelism, Scalability-Kai Hwang: Programmability, Tata McGrawhill, 2003.
2. Parallel Computer Architecture, A Hardware / Software Approach – David E. Culler, Jaswinder Pal Singh, Anoop Gupta:, Morgan Kaufman, 1999.
3. Computer Organization and Architecture: Designing for performance, W. Stallings, 4th Ed. PHI, 1996.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3616**					
TITLE OF THE COURSE	**COMPUTATIONAL GEOMETRY**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	III	19CS2304	Data Structures and Applications

COURSE OBJECTIVES :

- **To understand problems in Computational Geometry and solve them using Randomized Algorithms**

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the theory behind computational geometry	L2
CO2	Design and implement randomized techniques in solving real world problems specifically for Computational Geometry	L3

COURSE CONTENT:	
MODULE 1	**9Hrs**
Review of Randomized Quick Sort, Introduction to Computational Geometry: Range queries, Arrangements, Trapezoidal decompositions, Convex Polytopes, Voronoi Diagrams, Early deterministic algorithms: planar convex hulls, planar Voronoi diagrams.	
MODULE 2	**8Hrs**
Deterministic vs. Randomized algorithms, Incremental algorithms: Trapezoidal decompositions, Convexpolytopes, Voronoi diagrams.	
MODULE 3	**9Hrs**
Dynamic algorithms: Trapezoidal decompositions, Voronoi diagrams, Dynamic Shuffling, Random Sampling: Top down sampling, Bottom up sampling, Dynamic sampling, more dynamic algorithms	
MODULE 4	**7Hrs**

Randomized approximation schemes, The DNF counting problem, Approximating the Permanent, Volume Estimation.	
MODULE 5	**9Hrs**
Delaunay Triangulations Triangulations of Planar Point Sets, The Delaunay Triangulation, Properties of the Delaunay Triangulation, A randomized incremental algorithm for computing the Delaunay Triangulation , Interval Trees, Priority Search Trees, Segment Trees, Interval Trees, Priority Search Trees, Segment Trees	

TEXT BOOKS :

1. K. Mulmuley, "Computational Geometry, an introduction through randomized algorithms", Printice Hall, 1994.

REFERENCES :

1. R. Motwani and P. Raghavan, "Randomized Algorithms", Cambridge Press, 1995
2. J. Hromkovic, "Design and analysis of randomized algorithms", Springer Verlag, 2005.
3. M. Mitzenmacher and E. Upfal, "Probability and computing: Randomized algorithms and Probabilistic analysis", Cambridge, 2005

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3617**					
TITLE OF THE COURSE	**SOFT COMPUTING**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV	19CS2403	Design & Analysis of Algorithms

COURSE OBJECTIVES :

- **Learn the various soft computing frame works.**
- **Be familiar with design of various neural networks.**
- **Learn genetic programming.**
- **Be exposed to hybrid systems.**

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	**Explain the principal components of soft computing that include Artificial Neural Networks & Genetic Algorithms**	L2
CO2	Apply a suitable method of Soft Computing to solve a particular problem.	L3

COURSE CONTENT:	
MODULE 1	**9Hrs**
Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing. Learning problems: Designing a Learning System, Issues in Machine Learning: The Concept Learning Task- General-to-specific ordering of hypotheses. Overview of Neural Networks: Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.	
MODULE 2	**8Hrs**
NEURAL NETWORKS: Issues in Decision tree learning; - Artificial Neural Networks (ANN), ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm.	
MODULE 3	**9Hrs**

NEURAL NETWORKS(continued..): Back propagation Algorithm- Convergence, Estimating Hypotheses Accuracy, Basics of sampling Theory. Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory	
MODULE 4	**9Hrs**
GENETIC ALGORITHM: Basic concept of Genetic algorithm and detail algorithmic steps- adjustment of free Parameters- Solution of typical control problems using genetic algorithm. Genetic Programming– multilevel optimization – real life problem- advances in GA for solving optimization problems	
MODULE 5	**7Hrs**
SOFT COMPUTING TECHNIQUES & APPLICATIONS: Learning first order rules- sequential covering algorithms. A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.	

TEXT BOOKS :

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES :

1. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
2. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
3. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**19CS3618**					
TITLE OF THE COURSE	**Introduction to Blockchain and distributed ledger**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Learn the underlying principles and techniques associated with block chain technologies.
- Understand and describe how blockchain works
- Familiarize with Ethereum, smart contracts and related technologies, and solidity language.
- Understand several types of blockchain use cases.

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the basic concepts and technology used for blockchain	L2
CO2	Explore the usage of merkle tree, cryptography and mining in Blockchain	L2
CO3	Use smart contract in real world applications.	L3
CO4	Implement Ethereum block chain contract.	L3
CO5	Apply hyperledger platform to implement the Block chain Application	L3
CO6	Apply the learning of solidity and de-centralized apps on Ethereum.	L3

COURSE CONTENT:	
MODULE 1	**6Hrs**
Introduction to Blockchain Distributed systems, P2P network Architecture of Blockchain, Generic elements of a blockchain: How blockchain works, Benefits, features, and limitations of blockchain How blockchain accumulates blocks, types of blockchain, Distributed ledger, Consensus	

mechanisms-Proof of work, Proof of Stake, Proof of Authority, CAP theorem, Decentralization, Disintermediation, Ecosystem - Storage, Communication and Computation, Dapps	
MODULE 2	**6Hrs**
Cryptography and Smart Contracts Symmetric cryptography (DES, AES), Asymmetric cryptography, Public and Private keys, Algorithms - RSA, Hash functions, SHA, SHA-256, ECDSA Smart contracts - Benefits of Smart contracts, Solidity programming-Types, Literals, Enums, Function types, Reference types, mappings, Global variables, Control structures (Events, Inheritance, Libraries, Functions), Compile, verify and Deploy.	
MODULE 3	**6Hrs**
Ethereum Blockchain The Ethereum network, Components of the Ethereum ecosystem, Ethereum Virtual Machine – Execution Environment, Opcodes and their meaning, Structure of a Block, Genesis Block, Merkle tree, Geth, Transactions, Transaction receipts, Nonce, Gas - gasPrice, gasLimit, Ether, Mining, Wallets, Ethereum network (main net, test net)	
MODULE 4	**6Hrs**
Ethereum development Ropsten test net, Mist, Metamask, Infura, Web3.0 - POST requests, HTML &Javascript frontend, Web3J -Java frontend, Creating Blockchain network and peering, Truffle - build contract, migrate and deploy, Ganache CLI Case studies: Smart Home Solution using Smart Contract (https://anbunathanramaiah.medium.com/smart-home-solution-using-smart-contract-7eb7cd3407d3)	
MODULE 5	**5Hrs**
Hyperledger Projects under Hyperledger, Hyperledger reference architecture, Hyperledger design principles, Hyperledger Fabric, HyperledgerSawtooth Case studies: Blockchain in Health Care, Blockchain in IoT	

TEXT BOOKS :

1. Imran Bashir, “Mastering Blockchain”, Third Edition, Published by Packt Publishing Ltd, 2020
2. Max Hooper, David Metcalf, VikramDhillon, “Blockchain Enabled Applications: Understand the Blockchain Ecosystem and How to Make it Work for You”, Published byApress, 2017

REFERENCES :

1. RiteshModi” Solidity Programming Essentials, First Edition, Published by Packt Publishing Ltd, April 2018
2. Blockchain for Dummies, Manav Gupta, IBM Limited Edition, John Wiley & Sons, Inc. 2017
3. Mohinuddin Ahmed, Abu S S M BarkatUllah, AI-Sakib Kahn Pathan “Security Anayltics for IoT”, CRC Press, 2020

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4711**					
TITLE OF THE COURSE	**MULTICORE ARCHITECTURE**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	IV	19CS2402	Principles of Microprocessors & Computer Organization

COURSE OBJECTIVES :

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the multi-core architectures and issues involved in writing code for the multi-core architectures	L2
CO2	Develop software for these architectures and the program optimization techniques	L3
CO3	Build techniques in compilers & OpenMP and parallel programming libraries	L3

COURSE CONTENT:	
MODULE 1	**9Hrs**
Introduction to parallel computers: Instruction Level Parallelism (ILP) vs. Thread Level Parallelism (TLP); performance issues: brief introduction to cache hierarchy and communication latency. Shared memory multiprocessors: general architecture and the problem of cache coherence; synchronization primitives: atomic primitives; locks: TTS, tickets, array; barriers: central and tree; performance implications in shared memory programs.	
MODULE 2	**9Hrs**
Chip multiprocessors: why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI;memory consistency models: SC; chip multiprocessor case studies: Intel Montecito and dual core Pentium 4, IBM power4, Sun Niagara.	

MODULE 3	9Hrs
Introduction to program optimization: overview of parallelism, shared memory programming; introduction to OpenMP; data flow analysis, pointer analysis, alias analysis, data dependence analysis, solving data dependence equations (integer linear programming problem); loop optimizations; memory hierarchy issues in code optimization.	
MODULE 4	**8Hrs**
Operating system issues for multiprocessing: need for pre-emptive OS, scheduling techniques in multi core architectures, interprocess communication in multi core architecture, shared memory: sharing issues and synchronization, sharing memory and other structures.	
MODULE 5	**7Hrs**
Sharing I/O devices, distributed semaphores, monitors spin locks, implementation techniques for multi-cores; case studies from applications: digital signal processing, image processing, speech processing.	

TEXT BOOKS :

1. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan Kaufmann publishers.
2. D. E. Culler, J. P. Singh, with A. Gupta. Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann publishers.

REFERENCES :

1. Allen and Kennedy. Optimizing Compilers for Modern Architectures.Morgan Kaufmann publishers.
2. S. Tanenbaum. Distributed Operating Systems.Prentice Hall.
3. Coulouris, Dollimore, and Kindberg. Distributed Systems Concept and Design. Addison-Wesley publishers.

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4712**					
TITLE OF THE COURSE	**PATTERN RECOGNITION**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS3517	Digital Image Processing

COURSE OBJECTIVES :

- Numerous examples from machine vision, speech recognition and movement recognition have been discussed as applications.
- Unsupervised classification or clustering techniques have also been addressed in this course.
- Analytical aspects have been adequately stressed so that on completion of the course the students can apply the concepts learnt in real life problems.

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Identify feature extraction techniques and representation of patterns in feature space.	L2
CO2	Use statistical, nonparametric and neural network techniques for pattern recognition.	L3
CO3	Use techniques for recognition of time varying patterns.	L3

COURSE CONTENT:	
MODULE 1	**6Hrs**
INTRODUCTION AND STATISTICAL PATTERN RECOGNITION **Introduction:** Feature extraction and Pattern Representation, Concept of Supervised and Unsupervised Classification, Introduction to Application Areas. Statistical Pattern Recognition: Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary, Normal Density, Discriminant Function for Discrete Features, Parameter Estimation.	
MODULE 2	**6Hrs**

DIMENSIONALITY PROBLEM AND NONPARAMETRICPATTERN CLASSIFICATION

Dimensionality Problem: Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis. Nonparametric Pattern Classification: Density Estimation, Nearest Neighbour Rule, Fuzzy Classification

MODULE 3	**6Hrs**

LINEAR DISCRIMINANT FUNCTIONS

Linear Discriminant Functions: Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure Kesler's Construction

MODULE 4	**5Hrs**

NEURAL NETWORK CLASSIFIER AND TIME VARYING PATTERN RECOGNITION

Neural Network Classifier: Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network

Time Varying Pattern Recognition: First Order Hidden Markov Model, Evaluation, Decoding, Learning

MODULE 5	**5Hrs**

UNSUPERVISED CLASSIFICATION

Unsupervised Classification: Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique, Iterative Optimization

TEXT BOOKS :

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley & Sons, 2001
2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

REFERENCES :

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4713**					
TITLE OF THE COURSE	**WIRELESS NETWORKS**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**-**	**-**	**-**	**42**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	VI	19CS3602	Computer Networks

COURSE OBJECTIVES :

- Understand the architecture and applications of current and next generation wireless networks
- Get a basic introduction to the key concepts and techniques underlying modern physical layer wireless and mobile communications
- Learn how to design and analyze various medium access and resource allocation techniques
- Learn how to design and analyze network layer routing protocols, along with key component mechanisms
- Learn to design and analyze transport layer protocols

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the fundamentals of wireless network and their functionalities.	L2
CO2	Compare and contrast multiple division techniques, mobile communication systems.	L4
CO3	Classify network protocols, ad hoc and sensor networks, wireless MANs, LANs and PANs	L4
CO4	Understand the architectures of various access technologies such as 5G technologies.	L2

COURSE CONTENT:	
MODULE 1	**7Hrs**
Introduction, Fundamentals of cellular systems, mobile ad-hoc and sensor networks, wireless PAN/LAN/MAN. Overview of probability theory, traffic theory, queuing theory, and discrete event driven simulations.	
MODULE 2	**9Hrs**

Mobile radio propagation, multi-path propagation, path loss, slow fading, fast fading. Channel coding and Error Control Techniques. Cellular concept, frequency reuse, cell splitting, cell sectoring. Multiple radio access protocols, CSMA, CSMA/CD, CSMA/CA and standards.	
MODULE 3	**9Hrs**
Multiple division techniques: FDMA, TDMA, CDMA, OFDM, SDMA. Static and dynamic channel allocation techniques. Mobile Communication Systems: Registration, Roaming, Multicasting, Security and Privacy.	
MODULE 4	**9Hrs**
Ad-hoc networks, routing in MANETs. Wireless sensor networks, MAC protocols for wireless sensor networks, routing in sensor networks. Wireless PAN (Bluetooth), Wireless LAN (Wi-Fi), Wireless MAN (WiMAX)	
MODULE 5	**8Hrs**
Introduction – 5G vision – 5G features and challenges – Applications of 5G – 5G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.	

TEXT BOOKS :

1. Dharma PrakashAgrawal and Qing-An Zeng, Introduction to Wireless and Mobile Systems, Tomson, 2010, 3rd edition
2. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.

REFERENCES :

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE
   for Mobile Broadband”, Second Edition, Academic Press, 2008
2. Vijay K. Grag and Joseph E. Wilkes, Wireless and Personal Communications Systems, 1996.
3. Christian Huitema, Routing in the Internet, Prentice Hall, 1995.
4. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Pearson Education, 2007

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4714**					
TITLE OF THE COURSE	**Sequence Networks and GAN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS35XX	Deep learning

COURSE OBJECTIVES :

- Provide technical details about sequence networks
- Learn the fundamentals of Generative Adversarial Networks.

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Design and implement efficient algorithms using Deep networks and GANs.	L3
CO2	Train and build models to develop real world Machine learning based applications and products.	L3

COURSE CONTENT:	
MODULE 1	**6Hrs**
Introduction to Deep Learning:Evolution**,** Sigmoid activation, ReLU, ELU, Stochastic Gradient Descent**,** Learning rate tuning, Regularization, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) and Long Short Term Memory (LSTM) Networks, Discriminative versus Generative models.	
MODULE 2	**5Hrs**
Techniques to improve Neural Networks: Deep Neural Networks (DNN) Optimization and Regularization and Automated Machine Learning (AutoML), Unsupervised pre-training, transfer learning, and domain adaptation.	
MODULE 3	**6Hrs**
Fundamentals of Generative Adversarial Networks (GANs):Unsupervised learning with GAN, Neural architecture search, network compression, graph neural networks. Automating human tasks with deep neural networks.	
MODULE 4	**6Hrs**

The purpose of GAN, An analogy from the real world, Building blocks of GAN. Implementation of GAN, Applications of GAN, Challenges of GAN Models, Setting up failure and bad initialization, Mode collapse, Problems with counting, Problems with perceptive.	
MODULE 5	**5Hrs**
Improved training approaches and tips for GAN, Feature matching, One sided label smoothing, normalizing the inputs, optimizer and noise, Batch norm, Avoiding sparse gradients with ReLU, MaxPool	

TEXT BOOKS :

1. Kuntal Ganguly, (2017), Learning Generative Adversarial Networks, Packt Publishing
2. Good fellow,I., Bengio.,Y., and Courville,A., (2016), Deep Learning, The MIT Press.

REFERENCES :

1. Charniak, E. (2019), Introduction to deep learning, The MIT Press.

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4715**					
TITLE OF THE COURSE	**CRYPTOGRAPHY**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**56**	**3**

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	I	19EN1101	Engineering Mathematics-I

COURSE OBJECTIVES :

- Understand OSI security architecture and classical encryption techniques. Acquire fundamental knowledge on the concepts of finite fields and number theory
- To understand the various cryptographic concepts and algorithms
- To understand the underlying mathematical structures of cryptographic algorithm
- To get an overview of the various applications of the cryptographic algorithms and implement them in mini project.

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the theories and concepts of Cryptography	L2
CO2	Understand the Cryptographic Techniques	L2
CO3	Design the Cryptographic Algorithms	L6
CO4	Apply Cryptographic Algorithms in real world problems	L3

COURSE CONTENT:	
MODULE 1	**5Hrs**
Introduction &Number Theory ` Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography). Finite fields and number theory: Overview of Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm. Finite fields- Polynomial Arithmetic –Prime numbers, Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms.	
MODULE 2	**5Hrs**

Cryptographic Protocols
Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols – Advanced Protocols – Zero Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography -Oblivious Transfer - Oblivious Signatures – Esoteric Protocols.

MODULE 3	**6Hrs**

Cryptographic Techniques
Key Length - Key Management - Electronic Codebook Mode - Block Replay - Cipher Block Chaining Mode – Stream Ciphers - Self-Synchronizing Stream Ciphers - Cipher-Feedback Mode - Synchronous Stream Ciphers – Output Feedback Mode - Counter Mode - Choosing a Cipher Mode - Interleaving - Block Ciphers versus Stream Ciphers -Choosing an Algorithm - Public-Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels -Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding and Encryption - Detecting Encryption – Hiding and Destroying Information.

MODULE 4	**6Hrs**

Cryptographic Algorithms

Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation – Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer - Madryga - NewDES - GOST – 3 Way – Crab– RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

MODULE 5	**6Hrs**

Cryptographic Algorithms Design and Applications
Symmetric Algorithms (Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Cipher Design - N-Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - One- Way Hash Functions Using Symmetric Block Algorithms)
Asymmetric Algorithms Using Public-Key Algorithms -Message Authentication Codes. RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes – Ongchnorr - Shamir - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol – IBM Secret-Key Management Protocol – Kerberos
Case study: IBM Common Cryptographic Architecture.

TEXT BOOKS :

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, John Wiley &Sons,Inc, 2nd Edition, 2007.
2. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, 2013

REFERENCES :

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata McGraw Hill, 2007.
2. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms and Protocols”, Wiley Publications, 2003.
3. Charles Pfleeger, “Security in Computing”, 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication in PublicWorld”, PHI 2002.
6. Bruce Schneier and Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech
   India Pvt Ltd, 2003.
7. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of
   India, 2002.
8. AtulKahate, Cryptography and Network Security, Tata McGrew Hill, 2003.
9. Wenbo Mao, Modern Cryptography Theory and Practice, Pearson Education, 2004.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**UG Research Project -II/Product Development Foundation-II**					
TITLE OF THE COURSE	**19CS4717**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	-	6	-	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	VI	19CS3612	UG Research Project-I/Product Development Foundation-I

COURSE OBJECTIVES:

- To identify key research questions within a field to carry out research in a team
- To identify and summarize the literature review of the relevant field
- To demonstrate relevant referencing and inculcate new skills in various aspects of academic writing
- To demonstrate the knowledge and understanding of writing the publication/report
- To showcase the strong evidence on the clarity of the argument, understanding of the selected domain area and presentation of its technical information
- To detail description of the process of carrying out the independent research in written document along with results and conclusions with reference to the existing literature
- To analyze and synthesize the new research findings

COURSE OUTCOMES:

CO No.	Outcomes	**Bloom's Taxonomy Level**
CO1	**Draft of the Publication or Demonstration of the Proof-of-concept product, Draft of patent application**	**L6**

COURSE CONTENT:
The research topic proposed by both the guide and the student team should be approved by the department chairman to proceed further. A degree of industrial input and involvement will be encouraged, and can be facilitated through existing academic-industrial collaborations or by addressing specific topics that are of interest to industrial partners. All projects will be closely supervised by the Project Guide with ongoing feedback

and guidance at all stages of the project from the conception to completion.
The following criteria will be checked by the department chairman to approve for the research proposal:

c. Department staff as course guide

6. Ability to provide research direction to the student in the chosen field of interest
7. Ability to design an appropriate research strategy and methodology to carry out the research by student
8. Ability to provide and evaluate the strong literature review document for the chosen research topic
9. Ability to train students on research paper / technical writing skills
10. Conduct reviews in regular time period and submit the evaluation to department chairman

d. Student Team

1. To be dedicated and committed to work on a new research topic by learning new technical skills
2. To have fair knowledge on what is product development or research topic
3. To have constant interaction with allocated guide by providing weekly updates
4. To be committed to complete the project and submitting the technical paper within the stipulated time framed by the university

Evaluation:
There will be CIA evaluation as well as the Semester end evaluation of the work done. It will be done by a committee of senior researchers of the Department.

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**19CS4701**					
TITLE OF THE COURSE	**CYBER CRIMES, SECURITY POLICIES AND LAW**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**--**	**--**	**--**	**30**	**2**

Prerequisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn the information technology laws
- To provide insight into the applicability of laws in the digital environment.
- To understand the provisions of Information Technology laws to facilitate electronic commerce – electronic signatures, data protection, cyber security; penalties & offences under the IT Act, dispute resolution, and other contemporary issues.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Apply the knowledge of the Cyber literacy to become aware of the fundamental rights and duties in their role as Engineers.	L2
CO2	Understanding of ethical and legal aspects of Information Technology Act and their redressal mechanism related Cyber issues.	L2
CO3	Demonstrate an advanced and integrated understanding of the nature and extent of the e-governance, e-commerce principle and to interpret various other Legislation and Act associated with it.	L2
CO4	Critically evaluate the extent and application of the Cyber Laws, the security aspect.	L5

COURSE CONTENT:

MODULE 1	**6Hrs**

INTRODUCTION:

Conceptual and theoretical perspective of cyber law - Computer and Web Technology - Development of Cyber Law – National and International Perspective.
Regulatory Body; ICCAN Regulations.
Need of Information Technology Law; Harmonization and unification of I T Laws;

MODULE 2	**6Hrs**

INFORMATION TECHNOLOGY LAW:
Information Technology Act 2000 (with up to date amendments), Nature and Scope;
Regulatory bodies and dispute settlement Mechanism under the Act;
Privacy issues in the Cyber World; Data Protection Principles; Privacy rights of Data Subjects; Protection of sensitive Data; Regulation of Trans Border Data;
E-governance: Legal recognition of Electronic records and electronic evidence; Digital Signature Certificates; records; Cyber Law issues in E-governance; E-Records; E-Documents; Dispute Resolution under IT Act.

MODULE 3	**6Hrs**

CYBER CRIME AND THE LAW
Introduction, Meaning and Definition of Cyber Crime; Crime on the Net; Cyber Criminals and Victims of Cyber Crime. Online Games.
Cyber Crimes – financial frauds - money laundering, credit card frauds, social crimes – cyber hacking, cyber stalking, Data Theft; Cyber Fraud; pornography, identity theft, Intellectual Property related crimes, cyber terrorism, defamation; spams and virus; online lottery and cheating etc.
Cyber Torts: - Civil and Tortious Liability; Defective Software; Negligence in Creating software; Remedies and Damages:
Damage to computer and computer system – (s.43 read with s.66) – access/facilitates access, data theft, virus attacks, email bombings, denial of service attack, damage to computer source code

MODULE 4	**6Hrs**

E-Commerce
E-Banking; Relationship of Customer and Banker under IT Laws; Legal issues of E-Money; Credit and Debit Cards; E-Fund transferring;

MODULE 5	**6Hrs**

E- Contracts; Trade Marks and Domain Names; and Jurisdiction in Cyber Space
Kinds of Contracts - email, web contracts, Standard form contracts Formation of E-contracts – application of The Contract Act, 1872 and Information and Technology Act, 2005, United Nations Convention on the Use of Electronic Communications in International Contract 2005; Trade Marks and Domain Names, Jurisdiction of Cyber Space

TEXT BOOKS:

1. G Usha – Cyber Privacy & Security
2. Dr. Gupta & Agarwal – Cyber Laws
3. Dr. Pavan Duggal - Cyber Crime and Cyber Law Cyber Law University

REFERENCES:

1. Yatindra Singh: Cyber Laws.
2. Ajit Narayanan and Bennum (ed.): Law, Computer Science and Artificial Intelligence.
3. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
4. Kamath Nandan: Law relating to Computer, Internet and E-Commerce.
5. Arvind Singhal and Everett Rogers: India's Communication Revolution: From Bullock Carts to Cyber Marts.
6. Lawrence Lessing: Code and other Laws of cyberspace.
7. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**19CS4811**					
TITLE OF THE COURSE	**IMAGE AND VIDEO ANALYTICS ON THE EDGE**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**--**	**2**	**--**	**56**	**3**

Prerequisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Apply the mathematical knowledge and understanding of algorithms to problems in image and video processing on edge: from pre-processing, to quantitation, object detection recognition, feature detection matching and motion estimation.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Apply the definitions of the image classification and analysis problem to common problems in computer vision.	L3
CO2	Explain the basics of object recognition and image search, object detection techniques, motion estimation, object tracking in video using convolutional filters.	L2
CO3	Apply convolutional neural networks to image data for object recognition and detection.	L3
CO4	Select different network architectures for the appropriate image and video processing problems.	L4

COURSE CONTENT:	
MODULE 1	**5Hrs**
Introduction: What is computer Vision, a brief history, Image Formation: Geometric primitives and transformation, photometric image formations, The digital camera.	
MODULE 2	**6Hrs**
Introduction to Image Processing:	

Point operators, Linear filtering, Neighbourhood operators: non-linear filtering, bilateral filtering, binary image processing, Fourier transforms, Pyramids and wavelets, Geometric transformations. **Hands-on:** Colour balance, Demosaicing, Photo effects using filters, Histogram equalization, Local histogram equalization, Separable filters, Sharpening, blur, and noise removal, Fourier transform, Pyramids, Wavelet construction and applications, Feature-based morphing, Image denoising	
MODULE 3	**6Hrs**
Object Detection, Recognition: Instance Recognition, Image classification, object detection, semantic segmentation, video understanding, vision and language **Hands-on:** Face detection, Face recognition using Eigen faces, Recognition-based colour balancing, Pedestrian detection, Object detection and localization, Recognition and segmentation.	
MODULE 4	**6Hrs**
Feature Detection and matching: Points and patches, edges and contours, contour tracking, lines and vanishing points, Segmentations **Hands-on:** Interest point descriptor, ROC curve computation, Facial feature tracker, edge detector, contour matching, Snake evolution, region segmentation.	
MODULE 5	**5Hrs**
Motion Estimation: Translation alignment, parametric motion, optical flow, Layered Motion **Hands-on:** Correlation, Optical flow, Automated morphing / frame interpolation, Video denoising, Motion segmentation, Transparent motion and reflection estimation	

TEXT BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 2nd editon, 2021
2. Practical Deep Learning for Cloud, Mobile, and Edge by Anirudh Koul, Siddha Ganju, Meher Kasam

REFERENCES:

1. Yao Wang, JornOstermann and Ya-Qin Zhang, “Video Processing and Communications”, Prentice Hall, 2001.
2. A.MuratTekalp, “Digital Video Processing”, Pearson, 1995 Thierry Bouwmans, FatihPorikli, Benjamin Höferlin and Antoine Vacavant, “Background Modeling and Foreground Detection for Video Surveillance: Traditional and Recent Approaches, Implementations, Benchmarking and Evaluation", CRC Press, Taylor and Francis Group, 2014.

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**19CS4813**					
TITLE OF THE COURSE	**COMPUTER VISION**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**--**	**2**	**--**	**56**	**3**

Perquisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS3517	Digital Image processing

COURSE OBJECTIVES:

- To introduce various topics of computer vision with their applications.
- Combining the analytics with CV which helps in various Video Analytics processing.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the concepts of video analytics in a much easier way using Stereo Vision and Structure from motion features	L2
CO2	Analyze on various real-time application of video analytics	L4

COURSE CONTENT:	
MODULE 1	**5Hrs**
Image Formation Models Introduction to Computer Vision, Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Image representations (continuous and discrete), Edge detection, Image Enhancement, Restoration, Histogram Processing	
MODULE 2	**6Hrs**
Depth estimation, views & Object Recognition Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, RANSAC, 3-D reconstruction framework; Auto-calibration. Hough transforms	

and other simple	
object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition	
MODULE 3	**5Hrs**
Motion Estimation & Analysis Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion, Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.	
MODULE 4	**6Hrs**
Shape Representation and Segmentation Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object detection.	
MODULE 5	**6Hrs**
Multiview Identification: View based model, view correspondence, in identification, Generalization from multiple view. Identifying moving faces, Biological perspectives, Computational Theories of temporal identification, identification using holistic temporal trajectories, Identification by Continuous view transformation.	

TEXT BOOKS:

1. Computer Vision - A modern approach, by David A. Forsyth and Jean Ponce, Pearson, 2nd Edition, 2015
2. Computer Vision: Algorithms and Applications, by Richard Szeliski, Springer-Verlag London Limited 2011.

REFERENCES:

1. Dynamic Vision: From Images to Face Recognition, Imperial College Press, World Scientific Publication Co Ltd, 2000
2. Introductory Techniques for 3D Computer Vision, by EmanueleTrucco and Aalessandro Verri, Publisher: Prentice Hall. 1998
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
5. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**19CS4814**					
TITLE OF THE COURSE	**PARALLEL COMPUTING**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**--**	**--**	**--**	**42**	**3**

Perquisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
1	IV	19CS2402	PM & CO

COURSE OBJECTIVES:

- To understand the architectural, hardware, OS and programming aspects in High Performance Computing
- To understand the distributed memory programming, shared memory programming, and a few parallel applications

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand high performance computing at various levels/layers	L2
CO2	Design and implement parallel solutions to the given problem	L3

COURSE CONTENT:	
MODULE 1	**8Hrs**
Introduction to Computer Systems: Processors, Memory, I/O Devices; Cost, timing, and scale (size) models. Program Execution: Process, Virtual Memory, System Calls, Dynamic Memory Allocation.	
MODULE 2	**9Hrs**
Machine-Level View of a Program: typical RISC instruction set and execution, Pipelining. Performance issues and Techniques, Cost and Frequency Models for I/O, paging, and caching. Temporal and spatial locality.	

MODULE 3	**9Hrs**
Typical Compiler Optimizations: Identifying program bottlenecks – profiling, tracing. Simple high-level language optimizations – locality enhancement, memory disambiguation. Choosing Appropriate Computing Platforms: benchmarking, cost- performance issues.	
MODULE 4	**9Hrs**
Parallel Computing: Introduction to parallel Architectures and Interconnection Networks, communication latencies. Program parallelization: task partitioning and mapping, data distribution, Message passing, synchronization and deadlocks.	
MODULE 5	**7Hrs**
Distributed memory programming using MPI/PVM.Shared memory parallel programming. Multithreading.	

TEXT BOOKS:

1. Dowd, K., High performance Computing, O'Reilly Series,1993.
2. Culler, D., and Singh, J.P., Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann Pub.,1999.

REFERENCES:

1. Gropp, W., Lusk, E., and Skjellum, A., Using MPI: Portable Parallel Programming with the Message-passing Interface, MIT Press,1997.
2. Grama, Gupta, A., Karypis, G., Kumar, V., Introduction to Parallel Computing, Addison Wesley, 2003. ISBN:0-201-64865-2

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**19CS4815**					
TITLE OF THE COURSE	**SOCIAL NETWORKS AND ANALYTICS**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**--**	**2**	**--**	**56**	**3**

Perquisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
1	III	19CS2401	DMS

COURSE OBJECTIVES:

- To understand the Social network concepts and its issues/challenges, various tools of Social network analysis.
- To know about Social network APIs.
- To know about mining and classification techniques of Social networks.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the Social network concepts and its issues/challenges, various tools of Social network analysis.	L2
CO2	Understand about Social network APIs.	L2
CO3	Understand about mining and classification techniques of Social networks.	L2

COURSE CONTENT:	
MODULE 1	**5Hrs**
Introduction Social network concepts – Development of social network and analysis - Online social networks – Social Network Data - Issues and challenges	
MODULE 2	**5Hrs**
Linked-based and structural analysis - Content-based analysis - Static and dynamic analysis Mathematical Representation of social networks	

MODULE 3	**6Hrs**
Social networking systems and API - Statistical Analysis of Social Networks	
Community Detection in Social Networks - Node Classification in Social Networks - Evolution in Dynamic Social Networks	
MODULE 4	**6Hrs**
Social Influence Analysis -Link Prediction in Social Networks -Data Mining in Social Media Text Mining in Social Networks - Social Tagging -Building social services	
MODULE 5	**6Hrs**
UCINET – PAJEK– NETDRAW – StOCNET - SPlus - R – NodeXL- SIENA and RSIENA - Real-world networks (Facebook graph, Twitter networks,) Case Studies	

TEXT BOOKS:

1. Christina Prell, Social Network Analysis: History, Theory and Methodology, SAGE Publications Ltd, Publication Year 2011
2. Stanley Wasserman and Katherine Faust, " Social Network Analysis: Methods and Applications", Cambridge University Press, 1994

REFERENCES:

1. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", 2010
2. Carrington and Scott (eds). The SAGE Handbook on Social Network Analysis SAGE, First Edition 2011

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**19CS4816**					
TITLE OF THE COURSE	**HUMAN COMPUTER INTERFACE**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	**--**	**--**	**--**	**42**	**3**

Perquisite Courses (if any):			
#	Sem/Year	Course Code	Title of the Course
1	V	19CS3503	OOD & Programming with Java

COURSE OBJECTIVES:

- Learn the foundations of Human Computer Interface
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile HCI
- Learn the guidelines for user interface.

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the foundations of Human Computer Interface	L2
CO2	Design the Human Computer Interface	L3

COURSE CONTENT:	
MODULE 1	**8Hrs**
FOUNDATIONS OF HCI The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Historical evolution of HCI; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	

MODULE 2	**9Hrs**
DESIGN & SOFTWARE PROCESS Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	
MODULE 3	**9Hrs**
MODELS AND THEORIES Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models. Keystroke level model (KLM), GOMS, CASE STUDIES. Shneiderman's eight golden rules; Norman's seven principles; Norman's model of interaction; Neilsen's ten heuristics with example of use	
MODULE 4	**9Hrs**
Responsive GUI Design Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	
MODULE 5	**7Hrs**
Conversational Interfaces, IVR, Chatbot, ALEXIA, MONTANA and similar tools. Case Studies.	

TEXT BOOKS:

1. Alan Dix, , Inc, Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (MODULE I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition ,O"Reilly Media Inc., 2009 (MODULE –IV).
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O"Reilly, 2009.(MODULE -V)

REFERENCES:

1. Interaction Design, beyond Human Computer Interaction", by I Jennifer Preece, Yvonne Rogers, Helen Sharp, John Wiley & Sons