DEPARTMENT OF INFORMATION TECHNOLOGY

BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABUS

IIIT SONEPAT

2019-2020

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SONEPAT

HARYANA

Semester-wise Curriculum

Semester-I						
S. No.	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	MAL101	Engineering Mathematics I	3	1	0	4
2.	SAP101	Health, Sports & Safety	0	0	2	1
3.	BEL101	Fundamental of Electrical and Electronics Engineering	2	1	0	3
4.	BSL101	Applied Science	3	0	0	3
5.	CSL101	Computer Programming	3	0	0	3
6.	ECL101	Analog Electronics	3	0	0	3
7.	HUL102	Environmental Studies	2	0	0	2
8.	BEL102	Fundamental of Electrical and Electronics Engineering Lab	0	0	2	1
9.	BSL102	Applied Science Lab	0	0	2	1
10.	CSL103	Computer Programming Lab	0	0	2	1
11.	ECL103	Analog Electronics Lab	0	0	2	1
Total credits			**16**	**2**	**10**	**23**
Total hours			**28**			

Semester-II						
S. No.	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	MAL102	Engineering Mathematics- II	3	1	0	4
2.	ECL102	Digital Electronics	3	0	0	3
3.	CSL102	Data Structure	3	0	0	3
4.	HUL101	Communication Skills	2	0	0	2
5.	CSL104	Web Designing	2	1	0	3
6.	CSL105	Application Programming	3	0	0	3
7.	ECL104	Digital Electronics Lab	0	0	2	1
8.	CSL106	Data Structure Lab	0	0	2	1
9.	HUL103	Communication Skills lab	0	0	2	1
10.	CSL107	Web Designing Lab	0	0	2	1
11.	CSL108	Application Programming Lab	0	0	2	1
Total credits			**16**	**2**	**10**	**23**
Total hours			**28**			

Semester-III						
S. No.	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	ITC301	Discrete Mathematics	3	1	0	4
2.	ITC302	Automata and Formal Languages	3	1	0	4
3.	ITC303	Software Engineering	3	0	0	3
4.	ITC304	Computer Organization	3	1	0	4
5.	ITC305	Digital Systems Design	3	1	0	4
6.	ITC306	Practicum-I	0	0	6	3
7.	ITC307	Software Engineering Lab	0	0	2	1
8.	ITC308	Computer Organization Lab	0	0	2	1
9.	ITC309	Digital Systems Design Lab	0	0	2	1
Total credits			**15**	**04**	**12**	**25**
Total hours			**31**			

Semester-IV						
S. No.	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	ITC401	Object Oriented Programming	3	0	0	3
2.	ITC402	Computer Networks	3	0	0	3
3.	ITC403	Operating System	3	0	0	3
4.	ITC404	Database Management Systems	3	1	0	4
5.	ITC405	Statistical and Numerical Methods	3	1	0	4
6.	ITC406	Practicum-II	0	0	6	3
7.	ITC407	Object Oriented Programming Lab	0	0	2	1
8.	ITC408	Computer Networks Lab	0	0	2	1
9.	ITC409	Operating System Lab	0	0	2	1
10.	ITC410	Database Management Systems Lab	0	0	2	1
Total credits			**15**	**02**	**14**	**24**
Total hours			**31**			

B. TECH. (IT)

SYLLABUS

FIRST SEMESTER

Course Code	**MAL101**
Course Title	**Engineering Mathematics-I**
Number of Credits	**3-1-0-4**
Course Type	**GIR**

Course outcomes:

- To understand the importance of calculus and matrix theory.
- Applications of calculus of several variables.
- Derivation and application of calculus and matrix theorems.

Course content:

Unit I- Matrices: Rank of Matrix, consistency of a system of equations. Linear dependence and independence. Linear and orthogonal transformations. Eigen values and Eigen vectors. Cayley Hamilton's theorem. Reductions of diagonal form, Hermitian and skew hermitian matrices, quadratic forms.

Unit II -Differential Calculus : Calculus of functions of single variable: Limit, Continuity and differentiability. Mean value theorems: Rolle's theorem. Lagrange's Theorem. Cauchy's theorem. Taylor's theorem with remainders, indeterminate forms, curvature, curve tracing.

Unit III- Calculus of functions of several variables: Limit, Continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation. Tangent plane and normal line.

Unit IV- Euler's theorem on homogeneous functions, total differentiation, chain rules, Jacobian,
Taylor's formula, Maxima and minima Lagrange's Method of Undetermined multipliers.

Unit V- Integral calculus: Fundamental theorem of Integral calculus, mean value theorems, evaluation of definite integrals. Applications in Area, Length. Volumes and surface of solids of revolutions, Improper integrals: Beta Gamma functions.

Books:

1) Text:

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons.
2. Piskunov, N., Differential and Integral Calculus, Mir publishers Moscow (vol.1, Vol.2)

2) References:

1. Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, Addison Wesley Longman.
2. Michael D. Greenberg, Advanced Engineering Mathematics, Pearson Education Pvt. Ltd.
3. Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, Narosa Publishers.

Course Code	**SAP101**
Course Title	**Health, Sports & Safety**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

Course outcomes:

- To provide physical fitness and good health.
- Create awareness among the students about their health status by conducting various tests and measurements and suggest them suitable remedial physical fitness program so that they can improve physical and physiological health status.
- To improve productivity, foster social harmony, inculcate sense of discipline and dedication in general life, develop the spirit of team work, through various sports activities.

Course content:

Development of components of fitness through conditioning exercises:
Strength: (Strength Endurance, Maximum Strength, explosive strength), Endurance: (aerobic endurance, anaerobic endurance, speed endurance and strength endurance), Speed, Co-coordinative ability, Flexibility

Physical Efficiency Test Level : (Testing and Evaluation of Physical Fitness):
Cooper Test 12 minute run or walk test, Sit and reach test, 100 meter run, one minute sit up test, Push up/Bent knee push up test

Teaching and development of sports skills: Cognitive, Perceptual, Motor, Perceptual motor. First Aid training

Intramural phase 1: Identification of sports talent through exposing students to inter- section tournament. Football, Volleyball, throw ball, table tennis & Chess.

Yoga, Meditation and Personal Safety.

List of Lab Assignments / Experiments OR List of Tools on which the lab assignment should be based (If Any)

Physical Efficiency Test(Testing and Evaluation of Physical Fitness): l5OOmeter run, shuttle run, standing broad jump, one minute sit up test, flexibility test
Testing and assessment of selected Physiological parameters through Sports
Medicine Research Lab: Total body fat analysis, Harvard step test, BMI, WHR, Back strength, Leg strength, grip strength, resting pulse rate, and resting respiratory rate. Intramural phase 2: Badminton, Basketball, Cricket, Kho-Kho, etc.
Yoga and Meditation.
Personal Safety Skill Demonstration

Course Code	**BEL101**
Course Title	**Fundamentals of Electrical and Electronics**
Number of Credits	**2-1-0-3**
Course Type	**GIR**

Course outcomes:

- To understand the fundamentals for D.C. & A.C. circuits.
- To understand the magnetic circuits.
- To understand the working of transformers and D.C. machines.
- To understand the fundamentals of semiconductor devices.

Course content:

Unit I- D.C. Circuits and A.C. Fundamentals

Ohm's law, Kirchhoff's laws, Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformations, Thevenin's and Norton's Theorems, star & delta transformations, maximum power transfer theorem and Transients.

Unit II- A.C. Fundamentals

Single phase EMF generation, average and effective values of sinusoids, Solution of series and Parallel Circuits, power and power factor, Resonance in series and parallel circuits, steady state analysis for sinusoidal excitation: Sinusoids, Three phase connections: star and delta.

Unit-III- Magnetic Circuits

Mmf, Magnetizing force, Magnetic flux and flux density, permeability, Reluctance and permeance, B-H curve, Simple magnetic circuits, Hysteresis and eddy current loss.

Unit-IV- Transformers and D.C. machines

Single-phase transformer Construction, principle of operation, EMF equation, phasor diagram on no-load and full-load, losses and efficiency, open and short circuit test, auto transformer.

D.C. generator construction, EMF equation, various types and characteristics of D.C. motor, principle, torque and speed formula, types and their characteristics, Speed control

Unit-V- Semiconductor Diode and BJT

Semiconductor Diode and its V-I characteristics, Rectifier circuit, Various types of diodes, Zener diode, PIN Diode, Light emitting diode, gun diode, Working principle, Transistors in CC, CE, and CB configurations, transistor biasing, V-1 characteristics and load line concept with Quiescent point, Transistor• parameter.

Textbooks:

1. Toro, Del V., Electrical Engineering Fundamentals, Prentice Hall oJ India, 1994.
2. Millman, Jacob and Halkias, Christos C., Integrated Electronics: Analog and Digital Circuits and Systems, Mc Grew Hill,2004
3. Boylestad, Robert L., and Nashelsky, Louis, Electronics Device and Circuit Theory, Ninth Edition, Prentice Hall of India,2005.

Course Code	**BSL101**
Course Title	**Applied Sciences**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- To understand the fundamentals of Quantum Mechanics.
- To understand the structure and properties of materials.
- To know current trends and advances in NEMS and MEMS.

Course content:

Unit I- Quantum Mechanics-I

Dual nature of matter, de-Broglie Hypothesis, phase velocity and group velocity, their relations, wave function & its physical significance, probability density, Schrodinger's wave equation, Eigen values &Eigen functions, applications.

Unit II- Electronic conduction in solids

Drude-Lorentz Theory, Drift velocity, relaxation time, mean collision time, mean free path, Electrical conductivity, Quantum free electron theory, density of energy states, Fermi energy, thermionic emission.

Unit III- Study of materials

Structure of materials, Properties of materials, Transforming materials, Structure and transformation of materials, Electronic properties of materials, Mechanical properties, Engineering applications of materials.

Unit IV- Current trends in Engineering applications

Quantum information & quantum computing, evolution of quantum theory, quantum computer, nanoscale systems and nanotechnology, nanoscience and technology, composite materials, smart materials and structures, nano and micromechanical systems (NEMS and MEMS).

Books:

Text:

1. Resnick, Walker and Halliday, Fundamental of Physics, John Willey and Sons. Inc, 6th Edition, 2005.
2. Streetman B. G., Solid State Electronics, Prentice Hall India (2nd Edition) 1986.
3. Avadhanulu M. N. and P.G. Kshirsagar, A text Book of Engineering Physics, (7th Edition) 2004.
4. Dekker A.J.; Electrical Engineering Materials; Prentice Hall of India Publication, 1992.
5. Kenneth Krane; Modem Physics; (2nd Edition); John Wiley Eastern, 1998.
6. Pillai S. 0., Solid State Physics, New Age International Publishers, 3rd edition, 1999.

Reference:

1. John A. Pelesko, David H. Bernstein, "Modeling MEMS and NEMS" CRC Press, 2002

Course Code	**CSL101**
Course Title	**Computer programming**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- To understand the fundamentals of C- language programming.

Course content:

Unit I- Introduction

Flow charts, data types and storage classes, scope of variables, arithmetic operators, assignment, conditional, arithmetic expressions, enumerated data types, decision making, branching, looping, Switch concept, function and parameter passing, recursive functions, macros.

Unit II- Basic programming algorithms

Programs to illustrate basic language constructs in C like - Factorial, Sine/cosine and other mathematical series, Fibonacci series, calculating square• root of a number, calculating GCD of 2 integers (Euclid's method and otherwise), Calculating LCM of 2 integers and similar such programs.

Unit III- Arrays and applications

Introduction to one dimensional and 2-D array with examples. Representing a polynomial using 1-D array and polynomial operations, Use of 2-D array to represent a matrix and matrix operations. Character arrays (strings): String related functions (strlen, strcpy, strcat, strcmp, atoi, itoa, reverse, strstretc) and their function definitions.

Unit IV- Searching and Sorting methods

Selection sort, Bubble sort, Insertion sort, Linear search, merging of 2 sorted arrays.

Structures and Unions: Basic concept, array of structures and its applications.

Unit V- Pointers

Introduction (declaration and initialization), pointers and arrays, concept of dynamic memory allocation, use of pointers to represent variable-sized 1-D and 2-D arrays, pointers to structures.

File Management in C: Open, close, read and write operations, Sequential and text files.

Books:

Text:

1. Kernighan; Ritchie, "C programming Language", PHI
2. Bal guruswamy, "Programming in ANSI C", Tata McGrawHill Publishing

Reference:

1. Kakde and Deshpande, "C and data Structure", Charles River Media Publisher
2. Dromey R G, "How to Solve it by Computer", PHI
   Kanetkar, "Let us C".

Course Code	**ECL101**
Course Title	**Analog Electronics**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- To introduce the fundamentals of semiconductor devices, such as diode, BJT, MOSFET etc.
- To study the V-I characteristics, biasing, small signal analysis, etc. for various electronic devices.
- The student will be able to apply various devices into electronic circuits and can compute the various parameters.

Course content:

Unit I- Semiconductor diodes

P &N Type Semiconductors, , Theory of P-N Junction Diode, Junction Capacitance, Power Supplies, Rectifiers: Halfwave & Full wave rectifiers, filters, ripple-factor, Characteristics & Applications of Following Diodes, Zener as Regulators, Schottkey, Photodiode, LED, LCD, Varactor Diode &Tunnel Diode.

Unit II- Bipolar Junction Transistors

Junction Transistors Theory of Operation, Static Characteristics, Break Down Voltages, Current Voltage Power Limitations, Biasing of BJT Different Biasing Arrangements, Stability Factor, Thermal Runaway.

Unit III- Small signal & high frequency analysis of BJT

CE, CB, CC Amplifiers and Comparison High Frequency Analysis Calculation of Frequency Response, Gain Bandwidth Product.

Unit IV- Feedback Amplifiers

Positive and Negative Feedback Amplifiers Classification, Practical Circuits, Applications, Advantages. Oscillators Stability, Barkhausen Criteria, RC, LC & Crystal Oscillators.

Unit V- Field-Effect Transistors

Field Effect Transistor & MOSFET, Principle of Operation & Characteristic, Biasing Arrangement, Small Signal Analysis of CG, CD & CS, High Frequency analysis.

Books:

Text:

1. Milman and Halkias, "Integrated Electronics", Second Edition, 2011, McGraw Hill.
2. Boylestad and Nashelsky, "Electronic Devices & Circuit theory", 2011, Tenth Edition

Reference:

1. David A. Bell, "Electronic Devices and Circuits".
2. Milman and Halkias, "Electronic Devices and circuits", second Edition, 2011, McGraw• Hill.

Course Code	**HUL102**
Course Title	**Environmental Studies**
Number of Credits	**2-0-0-2**
Course Type	**GIR**

Course outcomes:

- Introduce to various natural resources, their importance and status.
- Introduce to the concepts of ecosystem, their structure and functions.
- Introduce to the concept of biodiversity conservation.
- Introduce to possible causes of various forms of environmental pollution and tl
- consequences, methods of prevention.
- Introduce to various social and climatic changes due to pollution.

Course content:

Unit I- Natural resources

Forest resources, Water resources, Mineral resources, Food resources, Energy Resources, Land resources. Ecosystem: Concept of an ecosystem, Structure and functions of an ecosystem, Producers, consumers and Decomposers, Ecological succession, Food chain, food webs and pyramids.

Unit II- Biodiversity and its conservation

Introduction, definitions: genetics, species and diversity,Value ofbiodiversity, Biodiversity at global, national and local level, India as a mega-diversity nation,Hot-spot ofbiodiversity, Threat to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Conservationof biodiversity: in-situ and ex-situ conservation.

Unit III- Environmental pollution

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid Waste management: Causes, effects and control measures of urban and industrial wastes.

Unit IV- Social issues and environment

Sustainable development, Water conservation, Rain water harvesting, Watershed management, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accident, Holocaust, Environmental rules and regulations.

Unit V- Human population and environment

Population growth, Environment and human health, Human rights, Value education, Role of information technology in environment and human health.

Books:

Text:

1. Rajgopalan R., Environmental Studies.

Reference:

1. Benny Joseph, Environmental Studies, McGraw-Hill.
2. ErachBarucha Environmental Studies University press (UGC).

Course Code	**BEL102**
Course Title	**Fundamentals of Electrical and Electronics Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments

- Introduction and use of measuring instruments- voltmeter, ammeter, multi-meter, oscilloscope, resistors, capacitors and inductors.
- To study and verify truth table of Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
- To design and verify operation of

(a) Half wave rectifier (b) Full wave Central tap rectifier (c) Bridge rectifier

- To verify KCL, KVL.
- To verify Thevenin's and Norton's theorems.
- To verify maximum power transfer theorem in DC circuits.
- To verify Reciprocity and Superposition theorems.
- To study frequency response of a series R-L-C circuit and determine resonant frequency and quality factor for various values of R, L and C.
- To study frequency response of parallel R-L-C circuit and determine resonant frequency and quality factor for various values of R, L & C.
- To perform open circuit and short circuit test on a single-phase transformer.

Course Code	**BSL102**
Course Title	**Applied Sciences Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments

- To study the characteristics of Photocell and to determine the work function of the cathode material.
- To calibrate an electromagnet and to study the dependence of Hall voltage on magnetic field and current through the sample.
- To study the input and output transfer characteristics of transistor in common base mode.
- To study the forward and reverse characteristics of semiconductor diode.
- To determine the band-gap in a semiconductor using reverse biased p-n junction diode.
- To determine e/m for an electron by Thomson's method.
- To calibrate an audio frequency oscillator and to determine the unknown frequency and phase of RC network by using single trace CRO.
- To determine the radius of curvature of a Plano-convex lens using Newton's Rings.
- To determine the wavelength of sodium vapor lamp by plane transmission grating.

Course Code	**CSL103**
Course Title	**Computer programming Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments:

1. Write a program to find sum of n natural number using for loop.
2. Write a program to find a number is divided by 2,7,11 or not using switch case
3. Write a program to calculate GCD of two numbers.
4. Write a program to calculate N^{th} term of Fibonacci Series.
5. Write a program to calculate the Factorial of a number.
6. Write programs using elements of an array to:
    i. Print position of smallest number in array.
    ii. Insert an element.
    iii. Delete a given element.
    iv. Find a given element.
7. Write a program to calculate Power (x^y) (Using Recursion).
8. Write a program to solve TOH (Tower of Hanoi).
9. Write a program for Swapping of two numbers using call by value and call by reference.
10. Write a program for sorting an array using Bubble sorting.
11. Write a program for sorting an array using Insertion sorting.
12. Write a program for sorting an array using Selection sorting.
13. Implement Row major and column major operations in 2-D array.
14. Write a program to calculate Mean and Standard Deviation of elements of an array.
15. Write a program to calculate Exponential Power (Using Recursion) x, y [x^y].
16. Write a program to store variable and array in pointer. Also implement array pointer and pointer to an array.
17. Write a program for String Comparison.
18. Write a program for finding Substring from given string.
19. Write a program for finding Reverse of string.
20. Write a program for changing Uppercase to Lowercase and vice-versa of string.
21. Write a program for connecting two strings (without using function).
22. Write a program for copying a String into another (s,t) (without using function).
23. Write a program for copying a String into another up to n elements (s,t,n) (without using function).
24. Write a program to find the Length of string.
25. Write a program to create dynamic array using malloc and calloc function.
26. Write a program to reallocation of an array using realloc function.
27. Write a program to show usability of local, global and static variables.
28. Write a program to using structure to enter name and roll no of Student.
29. Write a program to open a file and input any string in file using fopen and fputs respectively.
30. Write program to read any string from and close a file using fgets and fclose respectively.

Course Code	**ECL103**
Course Title	**Analog Electronics Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

Lab Objectives

- To know the working of analog circuits.
- To understand the concepts of diodes, rectifiers, transistors.

List of Experiments

- To get familiar with working knowledge of the following equipments
  a) CRO b) Multimeter c) Function generator d) Regulated power supply e) Bread Board f) Active & passive components.
- To study V-I characteristics of P-N junction diode.
- To study Zener diode as a voltage regulator.
- To study Half wave rectifier.
- To study center-tapped full wave rectifier.
- To study input and output characteristics of CE configuration of transistor.
- To study input and output characteristics of CB configuration of transistor.

Lab Outcomes

- Construct basic electronic circuits and verify their functionalities.
- Apply the design procedures to design basic analog circuits.

SECOND SEMESTER

Course Code	**MAL102**
Course Title	**Engineering Mathematics-II**
Number of Credits	**3-1-0-4**
Course Type	**GIR**

Course outcomes:

- To make students understand the basic importance of multivariable calculus (Differential and integral calculus), Vector calculus and ordinary differential equations in engineering.

Course content:

Unit I- Multiple Integrals

Double and triple integrals, change of order of integration, applications to area, volumes and Mass.

Unit II- Vector Calculus

Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, solenoidal and irrotational motion. Vector Integration: line, surface and volume integrals, Greens theorem, Gauss theorem and Stokes theorem (without proof).

Unit III- Ordinary differential Equations

First order ordinary differential equations: Exact equation Integrating factors, reducible to exact differential equations, Linear and Bernouli form, Orthogonal Trajectories, Existence and Uniqueness solutions, Picard's theorem, Picard's iteration method of solution (Statement only).

Unit IV- Solution of higher order linear differential equations

Solutions of second and higher order linear equation with constant coefficients. Linear dependence and independence. Method of variation of Parameters. Solution of Cauchy's equation, simultaneous linear equations.

Unit V- Laplace Transformation

Laplace transform - Inverse Laplace transform - Properties of Laplace transforms - Laplace transforms of unit step function, impulse function and periodic function - convolution theorem - Solution of ordinary differential equations with constant coefficients and system of linear differential equations with constant coefficients using Laplace transform

Books:

Text:

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons.
2. Piskunov, N., Differential and Integral Calculus, Mir publishers Moscow (vol.1, Vol.2)

References:

1. Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, Addison Wesley Longman.
2. Michael D. Greenberg, Advanced Engineering Mathematics, Pearson Education Pvt. Ltd.
3. Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, Narosa Publishers.

Course Code	**ECL102**
Course Title	**Digital Electronics**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- To understand the fundamentals of digital logic design.
- Applications of combinational and sequential logic circuits.
- To learn the HDL programming

Course content:

Unit I- Number systems

Representations, signed, 1's complement, 2's complement, saturation and overflow in fixed point arithmetic.

Unit II- Boolean Algebra

Axioms and theorems, DeMorgan's law, universal gate, duality, expression manipulation using axioms and theorems.

Unit III- Combinational logic and circuits

Introduction to switching algebra, canonical forms, two-level simplification, Boolean cube, logic minimization using K-map method, QuineMcCluskey tabular method, minimization for product-of-sum form, minimization for sum-of-product form, multiplexers, demultiplexers, decoders, encoders, hazard free synthesis, Arithmetic circuits, adders, half adder, full adder, BCD adder, ripple carry adder, carry-look ahead adder, combinational multiplier.

Unit IV- Sequential logic and circuits

Simple circuits with feedback, basic latches, clocks, R-S latch, master-slave latch, J-K flip flop, T flip-flop, D flip-flop, storage registers, shift register, ripple counter, synchronous counters, Finite State Machine (Moore/Mealy Machines), FSM with single/multiple inputs and single/multiple outputs etc.

Unit V- Controller design

Based on minimum number of flip-flops and shift register method. Multiple commands responding register design. Conditional response controller design.

Hardware description language: Programming and simulation, structural specification, behavioral specification, dataflow modeling, test bench, testing using test vectors, testing using waveforms, design of basic blocks to build larger circuits, case studies, adder. ALU, counters. shift registers, FSM design examples.

Books:

Text:

1. Digital Design, Morris Mano, Prentice Hall, 2002
2. Digital Fundamentals, 10th Ed, Floyd T L, Prentice Hall, 2009.

References:

1. Digital Design-Principles and Practices, 4th Ed, J F Wakerly, Prentice Hall, 2006.
2. Fundamentals of Digital Logic with Verilog Design, 2nd Ed, S. Brown and Z. Vrsaniec, McGraw Hill,2007.

Course Code	**CSL102**
Course Title	**Data Structures**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- Appreciation and practice of structured programming
- Ability to formulate the problem, devise an algorithm and transform into code
- Understanding different programming techniques and make an informed choice amongst them.
- Understanding different sorting algorithms, their advantages and disadvantages,
- Appreciation of concept of dynamic memory allocation and its utilization, dynamic data structures and implementation
- Understanding of concept of Abstract Data Type and implementations.

Course content:

Unit I- Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, Illustrative examples, Scope rules, parameter passing mechanisms, recursion, program stack and function invocations including recursion, Overview of arrays and array based algorithms - searching and sorting, Merge sort, Quick sort, Binary search, Introduction to Program complexity (Big Oh notation), Sparse matrices.

Unit II- Structures (Records) and array of structures (records). Database implementation using array of records. Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays.

Unit III- Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists, implementation of linked list using arrays and its operations. Introduction to linked list implementation using self-referential- structures/pointers.

Unit IV- Stack Queues and its operations. Implementation of stacks and queues using both array-based and pointer-based structures. Uses of stacks in simulating recursive procedures/ functions. Applications of stacks and queues.

Unit V- Lists - Singly-linked lists, doubly linked lists and circular linked lists. List traversal, insertion, deletion at different positions in the linked lists, concatenation list-reversal etc. Merge sort for linked lists.

Books:

Text:

1. Data Structures & Program Design in C: Robert Kruse, G. L. Tondo and B. Leung PHI- EEE.
2. Fundamentals of Data Structures in C : E. Horowitz, S. Sahni, and S. Anderson- Freed, University Press.

References:

1. Aho, Hop croft and Ullmann, -Data Structures and Algorithms, II Addison Weslev. 983.

Course Code	**HUL101**
Course Title	**Communication Skills**
Number of Credits	**2-0-0-2**
Course Type	**GIR**

Course outcomes:

- To impart to the students, the skill that they need in their academic, and later in the professional pursuit.
- To train the students to adopt an innovative approach to English language teaching and learning.

Course content:

Importance of Effective Communication; Reading, writing and oral communication skills; Methods/Modes of communication, choice of media; Barriers to communication. Basics of Technical report Writing, Referencing methods, Visual communication and its impact, Hands-on-experiences and Case studies.

Books:

Text:

1. Orient Longman, A Textbook of English for Engineers and Technologists.

References:

1. Quirk R.and Greenbaum S., A University Grammar of English.
2. Krishna swamv N., English Grammar (Longman publication) (Macmillan India Ltd)

Course Code	**CSL104**
Course Title	**Web Designing**
Number of Credits	**2-1-0-3**
Course Type	**GIR**

Course outcomes:

- Understand basic principles of web site design, considering the information architecture.
- Incorporate best practices in navigation, usability in website design
- Design of website adhering to current web standards (HTML, XML, CSS)
- Learning various scripting languages to create interactive components in web pages.

Course content:

Unit I- Introduction

Brief history of internet, introduction to world wide web, basic principles involved in developing a web site, rules of web designing, web standards, audience requirements, Design concept.

Unit II- Web essentials and standards

Clients, servers, introduction to Markup languages, scripting languages, Introduction to elements of HTML, XHTML and CSS, Introduction to Document object model (DOM), working with text, list, tables, frames, hyperlinks, Images multimedia, forms and controls. CSS properties, Id and Class, Box Model, creating page Layout and Site Designs.

Unit III- JavaScript

JavaScript as programming language, Data types, Values, Variables, Expressions and Operators. JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure, random functions and maths library, representing dates. Pattern Matching and Regular Expressions. JavaScript in web browsers, difference between server side and client-side JavaScript, embedding JavaScript in HTML and frameworks, Changing CSS style, hiding HTML elements, showing hidden HTML elements. DOM and event handling, error handling, mouse, text, drag, drop and keyboard events and node operations, Node operations, Cookies, Scripted HTTP, Animation and multimedia Forms of Debugging.

Unit IV- Website Development Tools

Google Web Designer, Macaw, Sketch, Firefox, YSlow, Word Press, open Element etc.

Books:

1. Thomas A Powell, HTML: The Complete Reference, Tata McGraw Hill Publications.
2. Scott Guelich, ShishirGundavaram, Gunther Birzniek; CGI Programming with Perl 2/e, O'Reilly
3. Doug Tidwell, James Snell, Pavel Kulchenko; Programming Web Services with SOAP, O' Reilly
4. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
5. Yong, XML Step by Step, PHI.
6. Chris Bales, "Web programming- Building Internet Application".
7. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
8. Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.

Course Code	**CSL105**
Course Title	**Application Programming**
Number of Credits	**3-0-0-3**
Course Type	**GIR**

Course outcomes:

- Aware about different tools for Web Programming.
- Background of working on web.
- Construct efficient web pages with CSS and JavaScript.
- Demonstrate competency in the use of common HTML code.
- Able to design efficient client as well as server-side scripts.

Course content:

Unit I- Introduction

Internet fundamentals, LAN, WAN, Introduction to common Internet terms, www, Basics of networking, DNS, URL, firewall, proxy, Web protocols - http and https.

Unit II- Designing web pages

HTML, forms, DHTML, XML, and CSS. Extensible Hypertext Markup Language (XHTML): XHTML syntax, headings, linking, images, special characters and horizontal rules, lists, tables, forms, internal linking, meta elements.

Introduction to Web Server - Setting up and configuration of Apache Tomcat server, Accessing pages from another machine.

Unit III- Server Side Programming

Introduction to web programming with PHP. Client side programming with JavaScript

Unit IV- Introduction to Python , Statements and Control Flow, Expressions, Methods, Typing, Libraries and Developmental Environment, Web Programming using Python.

Books:

Text:

1. Deitel H.M. and P. J. Deitel, Internet & World Wide Web - How to Program Prentice-Hall.
2. Goodman D, Morrison M., JavaScript Bible; Wiley India
3. Lutz, Mark, Learning Python (4th Ed.). 01Reilly

References:

1. Garfinkle S., Spafford G; Web Security, Privacy and Commerce; O'Reilly, 2002.
2. Atkinson L., Core PHP Programming, PrenticeHall.
3. N.P.Gopalan, Akilandeswari, Web Technology, Prentice-Hall.

Course Code	**ECL104**
Course Title	**Digital Electronics Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments:

- Realization of logic gates using IC.
- Implementation of all gates using universal gates.
- Construction of Half/Full Adder and Half/Full Subtractor.
- Realization of circuit for binary to gray conversion and vice-versa
- To design 4-bit binary adder and subtractor using IC 7483
- To construct circuit for 9’s complement of a BCD number.
- To construct a full adder using 3x8 decoder.
- To construct a 4:1 multiplexer circuit.
- To construct SR and D flip flop, JK and T flip flop.
- To design a binary converter using IC 7473 and 7400.

Course Code	**CSL106**
Course Title	**Data Structures Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments

- Write a C program that uses functions to perform the following:
    1. Create a singly linked list of integers.
    2. Delete a given integer from the above linked list.
    3. Display the contents of the above list after deletion.
- Write a C program that uses functions to perform the following:
    1. Create a doubly linked list of integers.
    2. Delete a given integer from the above doubly linked list.
    3. Display the contents of the above list after deletion
- Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array
- Write C programs to implement a double ended queue ADT using
    1. array and
    2. doubly linked list respectively.
- Write a C program that uses functions to perform the following:
    1. Create a binary search tree of characters.
    2. Traverse the above Binary search tree recursively in Postorder
- Write a C program that uses functions to perform the following:
    1. Create a binary search tree of integers.
    2. Traverse the above Binary search tree non recursively in order
- Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    1. Insertion sort
    2. Merge sort
- Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    1. Quick sort
    2. Selection sort
- Write C programs for implementing the following graph traversal algorithms:
    1. Depth first traversal
    2. Breadth first traversal

Course Code	**HUL103**
Course Title	**Communication Skills Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments:

1. Presenting a book chapter using Power Point slides.
2. Data Analysis: Maintaining multiple results obtained over time and reporting them using charts and graphs.
3. Technical Documentation - Requirement/specification documentation, Design documentation, Test-cases documentation, Use-cases documentation.
4. Writing an installation/instruction manual.
5. Writing an abstract of a technical article - summarizing an article in 300 words.
6. Summarizing 3 papers into a report and its presentation.

Course Code	**CSL107**
Course Title	**Web Designing Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments

- Use HTML5 to create a document that contains the following text -
  Welcome to web application lab IIIT Sonepat
  Welcome to the world of internet programming.
  We have provided coverage for many internet related topics.
  Write the first line in title. Use H2 and H4 for text (the second and third lines of text). Insert a horizontal rule between the h2 element and h4 element. Open your new document in a web browser to view the marked up document.

- Create a link to each of the following.

  a. The file home.html, located in the students directory.

  b. The file home.html, located in web subdirectory of students directory.

  c. The file home.html, located in internet directory in your parent directory.

  d. The Vice Presidents e-mail address (vicepresident@whitehouse.gov)

- Create an HTML5 document that uses an image as an email link. Use attribute alt to provide the description of the image and link.

- Create a college registration form to obtain a users first name, last name, telephone number and email address. In addition, include an optional survey question that has the users qualification. Place the optional survey question in a details elements so that the user can expand the details element to see the question.

- Make a navigation button using a div with a link inside it. Give it a border, background and text color, and make them change with the user hovers the mouse over the button. Use an external stylesheet. Make sure your style sheet validates at http://jijsaw.w3.org/css-validator/. Note that some warnings may be unavoidable, but your css should have no errors.

- Write a CSS rule that makes all text 3 times larger than the base font of the system and colours the text green.

- Write a script that displays the letter A to D on the same line, with each pair of adjacent letters separated by 2 spaces. Write the script using the following methods :

  a. Using one document.write statement.

  b. Using two document.write statement.

- Write a script that asks a user to enter two numbers, obtains the two numbers from the user and outputs the text that displays the sum, product, difference and quotient of the two numbers.

- Write a script that contains a button and a counter in a div. The button should decrement the counter each time it's clicked with a default initial value of 100.

- Write a web page that enables the user to play the game of 15. There is a 4-by-4 board (implemented as an HTML5 table) for a total of 16 slots. One of the slots is empty. The other slots are occupied by 15 tiles , randomly numbered from 1 through 15 any tile next to the currently empty slot can be moved into the currently empty slot by clicking on the tile. Your program should create the board with the tiles out of order. The user's goal is to arrange the tiles in sequential order row by row using the DOM and the click event , write a script that allows the user to swap the positions of the open position and an adjacent tile .[Hint: The click event should be specified for each table cell.]

Course Code	**CSL108**
Course Title	**Application Programming Lab**
Number of Credits	**0-0-2-1**
Course Type	**GIR**

List of Experiments

- Creating an HTML Web page forms.
- Creating Home Page using HTML.
- Creating XHTML and CSS and understanding its use in creating web pages.
- Setting up and configuration of Apache Tomcat server.
- Understanding modification ot Web.XML
- Creating Websites using PHP.
- Understanding JavaScript.
- Creating a Web page with back end in PHP and front end in JavaScript and hosting it on Apache Tomcat Server.
- Writing and understanding program in Python.
- Use Python Libraries like Math's statistics to create programs for Scientific Computations.

Third Semester

Course Code	**ITC303**
Course Title	**Software Engineering**
Number of Credits	**3-0-0-3**
Course Type	**PE**

Course Objective:

- To understand the Software Engineering Practices and Process Models.
- Assessment in each module gives the overall Software engineering practice.
- Ability to enhance the software project management skills.

Unit-I Introduction to Software Engineering: Role of Software Engineering, Software Evolution, Software Development Life Cycle. Software Process Models: Software process models, Software Specification, Software design and implementation, Software validation, Automated process support, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized process models, Agile Methodology.

Unit-II Software Requirement: Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Software Models, Data Flow Diagrams, Entity Relationship Diagrams, Designing the architecture.

Unit-III Quality: Quality concepts, Review techniques, Software Quality Assurance (SQA): Verification and Validation, SQA Plans, issues.

Unit-IV Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing, Software Testing Strategies - Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Testing- applications, verification, Software configuration management, Product metrics.

Unit-V Project management: Project Management Concepts, Process and Project Metrics, Estimation for Software projects, Project Scheduling, Risk Management, Maintenance. Assessment: Preparation of Risk mitigation plan.

Course Outcomes

- Assessment in each module gives the overall Software engineering practice.
- Ability to enhance the software project management skills.
- Ability to comprehend the systematic methodologies involved in SE.

Text Books:

1. Sommerville Ian, "*Software Engineering*", Addison-Wesley, Ninth Edition, 2011.
2. Pressman R. S., *"Software Engineering: A Practitioners Approach"*, McGraw Hill, Seventh Edition, 2010.
3. Nartin Robert C. and Martin Micah, "*Agile Principles, Patterns, and Practices in C#"*, Prentice Hall, 2007

Reference Books:

1. Jalote Pankaj, "*Software Project Management in practice*", Pearson Education, New Delhi, 2002.
2. Mall Rajib, *"Fundamentals of Software Engineering"*, PHI Publication, Third Edition, 2009.

Course Code	**ITC307**
Course Title	**Software Engineering Lab**
Number of Credits	**0-0-2-1**
Course Type	**PE**

Lab Objectives:

- To understand the software engineering methodologies involved in the phases for project development.
- Open Source Tools: StarUML/ UMLGraph/ Top cased

Prepare the following documents and develop the software project startup, prototype model, using software engineering methodology for at least two real time scenarios or for the sample experiments:

- Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
- Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
- Data Modeling – Use work products
- Software Designing – Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
- Prototype model – Develop the prototype of the product

The SRS and prototype model should be submitted for end semester examination.

List of Sample Experiments:

Course management system (CMS): A course management system (CMS) is a collection of software tools providing an online environment for course interactions.

Easy Leave: This project is aimed at developing a web based Leave Management Tool, which is of importance to either an organization or a college.

E-Bidding: Auctions are among the latest economic institutions in place. In this project, explore the efficiency of common auctions when values are interdependent.

Electronic Cash counter: This project is mainly developed for the Account Division of a Banking sector to provide better interface of the entire banking transactions.

Lab Outcomes:

- Ability to develop software projects and software project process
- Ability to design and develop project modules and assign resources
- Ability to comprehend, assess, and calculate the cost of risk involved in a project management.

Course Code	**ITC304**
Course Title	**Computer Organization**
Number of Credits	**3-0-2-4**
Course Type	**PC**

Course Objectives

- To understand the basic hardware and software issues of computer organization.
- To provide an overview on the design principles of digital computing systems.
- To understand the representation of data at machine level.

Course Content

Unit-I General System Architecture: Stored Program control concept (Von-Neumann architecture principle), Flynn's Classification of computers (SIMD, MISD, MIMD), Structure organization (CPU, Caches, Main memory, Secondary memory unit & I/O), Register Transfer Operation, Micro-operations, Addressing Modes, Operation instruction set (Arithmetic & logical, Data transfer, Control flow), Instruction set format, , Instruction Set Architecture (Instruction set based classification of processor i.e. RISC, CISC, RISC vs CISC Comparison).
Unit-II Processor Design: Arithmetic & logic unit, Stack organization, CPU Architecture types, Accumulator Based- Register, Stack Memory, Register, Detailed data path of a typical register-based CPU, Fetch, Decode, and Execute Cycle.
Unit-III Computer Arithmetic and Control Design: Addition & Subtraction, Multiplication Algorithms (Booth‟s Multiplication Algorithm), Division Algorithm, Floating point arithmetic operations. Control Design: Microprogrammed & Hard-wired control options, Hard-wired design methods, State table method, Multiplier control, CPU control unit. Microprogrammed, Basic concepts, control Memory, Address Sequencing.
Unit-IV Memory Hierarchy & I/O Organization: Memory Hierarchy, need for Memory Hierarchy, locality of reference principle, cache memory, main & secondary, Memory parameters, access cycle time, cost per unit, concpt of virtal memory.
Programmed, Interrupt driven I/O, Direct Memory Access, Synchronous and asynchronous data transfer.
Unit-V Introduction to Parallelism: Goals of parallelism, Instruction level parallelism, pipelining, superscaling, Processor level parallelism, Multiprocessor system overview.

Course Outcomes

- Ability to analyze the abstraction of various components of a computer.
- Ability to apply performance metrics to find the performance of systems.
- Ability to identify high performance architecture design.

Text Books

- Hayes J.P, "Computer architecture & Organization", Third Edition, McGraw Hill, 2017.
- Hamacher, C., Vranesic, Z. and Zaky, S., "Computer Orgnization", McGraw Hill Education; 5th Edition (4 November 2011).

Reference Books

- Patterson, David A and Hennessy, John. L, *"Computer Organization and Design"*, Morgan Kaufmann; 3rd Edition (27 July 2007).
- Stallings, William, *"Computer Organization and Architecture Designing for Performance"*, Sixth Edition, Pearson Education Asia, 2003.

Course Code	**ITC308**
Course Title	**Computer Organization Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Lab Objectives

- Learn how to write simple programs in the assembly language
- Understand the different forms of addressing and implement them

List of Experiments

- Introduction to gates
- Ripple Carry Adder
- Carry-look-ahead adder
- Registers and Counters
- Wallace Tree Adder
- Combinational Multipliers
- Booth's Multiplier
- Arithmetic Logic Unit
- Memory Design
- Associative cache Design
- Direct Mapped Cache Design
- CPU Design
- Mathematical expressions
- File operations-1
- File operations-2
- PROJECT-Select any project of your choice

Lab Outcomes

- To expose the students to the various key aspects of Computer Organization & Architecture.
- Prototyping of experiments with support of a virtual environment.

Reference Book

1. Brey Berry B., "*The Intel Microprocessor 80x86, Pentium, Pentium Pro processor, Pentium II Pentium III, Pentium IV Architecture, Programming, and Interfacing, 8th Edition*", Prentice Hall, 2009.

Course Code	**ITC305**
Course Title	**Digital Systems Design**
Number of Credits	**3-1-0-4**
Course Type	**PC**

Course Objectives

- Foundation in design and analysis of the operation of digital gates.
- Design and implementation of combinational and sequential logic circuits.

Course Content

Unit-I Sequential Logic Circuits: Concept of a sequential circuits, memory elements: latches, flip-flops, Master-Slave and Edge-Triggered Flip-Flops, designing of synchronous and asynchronous sequential circuits, Shift registers: Principle of 4-bit shift resistors. Shifting principle, Timing Diagram, SISO, SIPO, PISO and PIPO resistors, Finite state models.

Unit-II Digital Logic Families: Introduction to digital ICs, Specification Terminologies, TTL, Schottky TTL, ECL, MOS Logic, CMOS Logic, Tri-state logic: Characteristics and properties

Unit-III Analog-to-digital and Digital-to-analog convertors: Introduction to analog-to-digital and digital-to-analog convertors, DAC: Weighted-resistor type DAC, R- 2R ladder type DAC, ADC: counter type, tracking-type, flash-type, dual-slope type ADCs

Unit-IV Programmable logic devices: Introduction, Real only memory (ROM), ROM organization and types, Programmable array logic, Programmable logic array, PROM, Programmable logic devices, RAMs, Magnetic memories.

Unit-V Concepts in VHDL: Introduction, Entity, architecture, VHDL operators, Combinational logic circuit design and implementation in VHDL, User defined data types, arrays and attributes, Sequential circuit implementation in VHDL.

Course Outcomes

- Design methodologies for combinational and sequential digital systems.
- Basic knowledge of VHDL for system modelling.
- Implementation of digital systems on reconfigurable programmable logic devices.

Text Books

1. Mano, M. M. and Ciletti, M. D. “Digital Design: With an Introduction to the Verilog HDL, 5th Edition”, Pearson Education, 2013.
2. Uyemura, J. P. “A First Course in Digital Systems Design: An Integrated Approach, 1st Edition”, Nelson Engineering, 1999.
3. A. Anand Kumar, “Fundamentals of Digital Circuits”, 4th Edition, PHI, 2016.

Reference Books

1. Roth, C. H. and John, L. K., "*Digital System Design Using VHDL, 2nd Edition"*, Cengage Learning, 2008.
2. Perry, D. L. "*VHDL: Programming by Example, 4th Edition"*, McGraw-Hill, 2002.

Course Code	**ITC309**
Course Title	**Digital Systems Design Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Lab Objectives

- To know the concepts of Combinational circuits,
- To understand the concepts of flip-flops, registers and counter.

List of Experiments

- Introduction of Digital Logic Gates: Investigate logic behavior of NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR gates.
- Gate-level minimization: Two level and multi-level implementation of Boolean functions.
- Combinational Circuits design assemble and test: adders and subtractors.
- Code Converter: BCD to Excess-3 code converter, gray code to binary converter, binary to gray code converter.
- Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
- Design of multiplexers and de-multiplexers.
- Design of encoders and decoders.
- Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce an 8-bit product.
- Parallel adder and accumulator: design, implement and test.
- Flip-Flop: assemble, test and investigate operation of S-R, D & J-K flip-flops.
- Counters: Design, assemble and test various Asynchronous and Synchronous binary counter with parallel load.
- Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.

Lab Outcomes

- Construct basic combinational circuits and verify their functionalities.
- Apply the design procedures to design basic sequential circuits.
- Learn about counters and Shift registers.

Course Code	**ITC302**
Course Title	**Automata and Formal Languages**
Number of Credits	**3-1-0-4**
Course Type	**PC**

Course Objectives

- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages.

Course Content

Unit-I Machines: Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA), State transition graph, Transition table, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Moore and Mealy machine, Minimization of Finite Automata

Unit-II Regular Expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non-Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages

Unit-III Context Free Grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs

Unit-IV Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG

Unit-V Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, Recursive and recursively enumerable languages, Halting problem, Introduction to Un-decidability, Undecidable problems about TMs. Post correspondence problem (PCP)

Course Outcomes

- Ability to relate practical problems to languages, automata, and computability
- Ability to demonstrate an increased level of mathematical sophistication. Ability to apply mathematical and formal techniques for solving problems

Text Books

1. Hopcroft, John E., Motvani, Rajeev and Ullman, Jaffrey D. "*Introduction to Automata Theory, Languages and Computation 3rd edition*". Pearson Education, 2014.
2. Linz, Peter, "*An Introduction to Formal Language and Automata*", Narosa Pub House, 2011.

Course Code	**ITC306**
Course Title	**Practicum-I**
Number of Credits	**0-0-6-3**
Course Type	**GIR**

This practical course constitutes a minor project work based on the concurrently studied theory in that semester. This course is designed to give students supervised practical application of the courses that they learn in that semester.

Course Code	**ITC301**
Course Title	**DISCRETE MATHEMATICS**
Number of Credits	**3-1-0-4**
Course Type	**PC**

Course Objectives:

To learn mathematical concepts and methods

To apply concepts of probability in engineering disciplines

Course Outcomes:

1. Understand sets, relations, functions and discrete structures
2. Apply Propositional logic and first order logic to solve problems
3. Count discrete event occurrences
4. Formulate and solve recurrence relations
5. Formulate and solve graph problems

Course Content:

Unit I Sets: Finite and Infinite sets, cardinality, Principle of Inclusion and Exclusion, Principle of Mathematical Induction (Weak & Strong versions)

Relations and functions: properties of binary relations, reflexive, symmetric, transitive, Partial, Equivalence and Total ordered relations, partitions, Transitive closure and Warshal's algorithm.

Unit II Propositions: Quantified propositions, fundamentals of logic, first order logic, Permutations, Combinations, Numeric Functions, Generating Functions.

Unit III Recurrence Relations and Recursive Algorithms: recurrence relations, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions, general solutions, solution by substitution, solution by characteristic equations, solution by generating functions.

Unit IV Graphs: Digraphs, Un-digraphs, Konigsberg seven bridges problem, Eulerian Graph, Hamiltonian Graph.

Planar Graphs, Euler Formula. Five color theorem, Four color conjecture,

Unit V Trees: Spanning Trees, BFS, DFS, Weighted Graphs, Minimum spanning trees, Krushkal's, Prim's algorithms.

Text books

1. Mott, Kandel, & Baker: *Discrete Mathematics for Computer Scientists and Mathematicians*, Prentice Hall, 2001.
2. Tremblay and Manohar: *Discrete Mathematical Structures*, McGraw Hill, 1987

Reference books

Kenneth H. Rosen : McGraw-Hill Higher Education; 8 edition (July 9, 2018)

FOURTHSEMESTER

Course Code	**ITC404**
Course Title	**Database Management Systems**
Number of Credits	**3-1-0-4**
Course Type	**PC**

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 Content

Unit-I 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.

Unit-II 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

Unit-III Database Design: Dependencies and Normal forms, dependency theory - functional dependencies, 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

Unit-IV 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.

Unit-V Implementation Techniques: Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes,.

Course Outcomes

- Ability to Install, configure, and interact with a relational database management system
- Ability to master the basics of SQL and construct queries using SQL

Text Books

1. Silberschatz, A., Korth, Henry F., and Sudharshan, S., *"Database System Concepts, 5th Edition"*, Tata McGraw Hill, 2016.
2. Elmasri, Ramez and Navathe, Shamkant B., *"Fundamentals of Database Systems 7th Edition"*, Pearson, 2015.

Reference Book

1. Date, C. J, Kannan, A. and Swamynathan, S., "*An Introduction to Database Systems, 8th edition"*, Pearson Education, 2012.

Course Code	**ITC410**
Course Title	**Database Management Systems Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Lab Objectives

- To give a good formal foundation on the relational model of data
- To present SQL and procedural interfaces to SQL comprehensively

List of Experiments

- Introduction to SQL and installation of SQL server/oracle.
- Data Definition Language (DDL) commands in RDBMS
- Data Manipulation Language (DML) and Data Control Language (DCL)
- High level language extensions with cursors
- Data types and create a database and write the program to carry out the following operation.
- Create tables department and employee with required constraints.
- Working with null values, matching the pattern from the table.
- Aggregate functions: grouping the result of a query.
- Set operators, Nested Queries, Joins and Sequences.
- Views, indexes, database security and privileges: Grant and Revoke commands, Commit and Rollback commands.
- Triggers
- As a designer identify the views that may have to be supported and create views.

Lab Outcomes

- Design and implement a database schema for a given problem-domain
- Normalize a database
- Populate and query a database using SQL DML/DDL commands.

Course Code	**ITC403**
Course Title	**Operating Systems**
Number of Credits	**3-0-0-3**
Course Type	**PC**

Course Objectives

- To provide knowledge about the services rendered by operating systems
- To provide a detailed discussion of the various memory management techniques
- To discuss the various file-system design and implementation issues

Course Content

Unit-I Introduction: Introduction to Operating system and types of operating system. Role of OS in real life applications., Understand the concept of process, attributes related to process and operations performed on the process, Discuss the process state diagram, role of context switching and dispatcher, Threads and System Calls

Unit-II Process Management: Process Scheduling, Discuss why we need to perform CPU scheduling and under which condition this scheduling is done and goals related to it. Explain the different CPU Scheduling Algorithms: First Come First Serve, Shortest Job First, Round Robin Scheduling, Longest Job First, Highest Response Ratio Next, Priority Based Scheduling etc

Unit-III Memory Management Introduction, Discuss the contiguous and non-contiguous memory management techniques, Familiarize with the concept of Virtual Memory, Types of partitioning, paging

Unit-IV Deadlock Strategies, Introduction, Deadlock handling Mechanism, Deadlock Prevention, Safe unsafe state, Banker Algorithm, Resource allocation graphs, Deadlock Avoidance and Recovery Contiguous and Non-Contiguous allocation, Virtual memory Management, Demand Paging, Page Placement and Replacement Policies.

Unit-V File System: Basic concepts, File System design and Implementation, directory structure- Single vs. Two level, MBR, allocation methods, Disk Scheduling, Disk Management, I/O Systems, Scan, C- Scan , Look , C- Look. Protection and Security issues

Course Outcomes

- Ability to comprehend the techniques used to implement the process manager
- Ability to comprehend virtual memory abstractions in operating systems

Text Books

1. Galvin, Silberschatz and Gagne, "*Operating System Concepts 10th edition*", John Wiley and Sons, 2018.
2. Stallings, William, "*Operating Systems –Internals and Design Principles 8th Edition*", Pearson Publications, 2014.

References Book

1. Tanenbaum, Andrew, "*Modern Operating Systems, 4th Editions*", Pearson Publications 2014.

Course Code	**ITC409**
Course Title	**Operating Systems Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Lab Objectives

- To understand and appreciate the principles in the design and implementation of operating systems software.
- To provide a detailed discussion of the various memory management techniques

List of Experiments

- Implementation Of FCFS scheduling Algorithm
- Implementation of Round Robin Algorithm
- Implementation of SJF or SRT Algorithm
- Implementation of Priority Scheduling Algorithm
- Implementation of Semaphore and Monitor
- Implementation Of Dead Lock Detection Algorithm(Banker's Algorithm)
- Implementation of Process Synchronization(Sleeping Barber Problem)
- Implementation of Process Synchronization(Dining Philospher Problem)
- Implementation of Process Synchronization(Readers Writers Problem)
- Implementation of Page Replacement Algorithm FIFO
- Implementation of Page Replacement Algorithm LRU
- Implementation of Page Replacement Algorithm Optimal Page Replacement

Lab Outcomes

- Understand the design approaches of operating systems.

Course Code	**ITC402**
Course Title	**Computer Networks**
Number of Credits	**3-0-0-3**
Course Type	**PC**

Course Objectives

- To implement a simple LAN with hubs, bridges and switches.
- To describe how computer networks are organized with the concept of layered approach.

Course Content

Unit-I Layered Network Architecture: ISO-OSI Model, TCP/IP, Data Communication Techniques: Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta Modulation (DM), Data Modems, Multiplexing Techniques, Frequency Division, Multiplexing Hierarchies, Transmission Media, Error Detection: Parity Check Codes, Cyclic Redundancy Codes.

Unit-II Data Link Protocols: Stop and Wait protocols, Noise free and Noisy Channels, Performance and Efficiency, Sliding Window protocols, MAC Sublayer: The Channel Allocation Problem, Carrier Sense multiple Access Protocols, Collision Free Protocols, FDDI protocol, Distributed Queue Dual Bus (DQDB) protocol, Virtual LAN.

Unit-III Network Layer protocols: Design Issues: Virtual Circuits and Datagrams, Routing Algorithms, Optimality principle, Shortest path routing Algorithms, Flooding and Broadcasting, Distance Vector Routing, Link State Routing, Flow Based Routing, Multicast Routing; Flow and Congestion Control: General Principles, Congestion control in datagram subnets, Choke Packets, Load Shedding, Jitter Control, RSVP. Interworking: Bridges, Routers and Gateways, IP packet, IP routing

Unit-IV Transport Layer Protocols: Design Issues, Quality of Services, Introduction to sockets, Connection Management: Addressing, Connection Establishment and Releases, Use of Timers, Flow Control and Buffering, Multiplexing, The internet Transport Protocols: User Datagram protocol UDP/TCP Layering, Segment Format, Checks Sum, Timeout Connection Management.

Unit-V Session Layer protocol: Dialog Management, Synchronization, OSI Session primitives, Connection Establishment. Introduction to network management: Remote Monitoring Techniques: polling, traps performance management, class of service, quality of service, security management, firewalls.

Course Outcomes

- Ability to master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks.
- Ability to be familiar with network tools and network programming.

Text Books

1. Forouzan, A., "*Data Communication and Networking, Fourth Edition*", McGraw Hill, International Edition, 2017.
2. Tanenbaum, S., "C*omputer Networks, Fifth Edition* ", Prentice Hall, India, 2013.

Reference Book

1. Olifer, Natalia and Olifer Victor, "*Computer Network: Principles, Technologies and Protocols for network design"*, Wiley India Publication, 2006.
2. Kurose, James F. and Ross, Keith W., "Computer Networking: A Top-Down approach", Pearson Education; Sixth edition (30 June 2017).

Course Code	**ITC408**
Course Title	**Computer Networks Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Lab Objectives

- To describe how computer networks are organized with the concept of layered approach.
- To implement a simple LAN with hubs, bridges and switches.

List of Experiments

- Study of different typed of Networks Cable and Practically Implement the cross-wired cable and straight through cable using clamping tool.
- Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and Wireless LAN.
- Install and configure Network Devices: HUB, Switch and Routers.
- Connect the Computers in Local Area Network.
- Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration)
- Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.
- Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.
- Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
- Router Configuration Using Packet Tracer.
- Connection oriented Client server applications with TCP Assignment.
- Connectionless Client server applications with UDP Assignment.
- Programs using RPC remote procedure call.
- Study of Socket Programming and Client – Server Model.
- Configure a Network Topology using packet tracer software.
- Configure a Network using Distance Vector Routing Protocol.
- Configure a Network using Link State Vector Routing Protocol.
- To get the MAC or Physical address of the system using Address Resolution Protocol.
- Simulate the Implementing Routing Protocols using border gateway protocol (BGP)
- Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

Lab Outcomes

- Understand fundamental underlying principles of computer networking.
- Understand details and functionality of layered network architecture.
- Analyze performance of various communication protocols.

Text Books

1. Forouzan, A., “Data Communication and Networking, 4th Edition”, McGraw Hill, International Edition, 2017.
2. Tanenbaum, S., “Computer Networks, 5thEdition”, Prentice Hall, India, 2013.

Reference Book

1. Olifer, Natalia, “Computer Network”, Wiley India Publication, India, 2006

Course Code	**ITC401**
Course Title	**Object Oriented Programming**
Number of Credits	**3-0-0-3**
Course Type	**PC**

Course Objectives

- To learn the basics of Object-Oriented Concepts and Design.
- To get accustomed to Object oriented programming.

Course Content

Unit-I Introduction to Object Oriented Programming: Basic concepts of OOP, Benefits of OOP, Introduction to object-oriented design and development, Design steps, Design example, Object oriented languages, Comparison of structured and object-oriented programming languages. Arrays, Pointers and Functions: Arrays, Storage of arrays in memory, Initializing Arrays, Multi-Dimensional Arrays, Pointers, accessing array elements through pointers, passing pointers as function arguments, Arrays of pointers, Pointers to pointers, Functions, Arguments, Inline functions, Function Overloading Polymorphism.

Unit-II Classes and Objects: Data types, operators, expressions, control structures, arrays, strings, Classes and objects, access specifiers, constructors, destructors, operator overloading, type conversion. Storage classes: Fixed vs Automatic declaration, Scope, Global variables, register specifier, Dynamic memory allocation.

Unit – III Inheritance: Inheritance, single Inheritance, Multiple Inheritance, Multi-level inheritance, hierarchical inheritance, hybrid inheritance, Virtual functions and Polymorphism. Exception Handling: List of exceptions, catching exception, handling exception.

Unit-IV Streams and Files: Opening and closing a file, File pointers and their manipulations, Sequential Input and output operations, multi-file programs, Random Access, command line argument, string class, Date class, Array class, List class, Queue class, User defined class, Generic Class.

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

Course Outcomes

- Ability to understand the features of object oriented programming.
- Ability to design and develop object-oriented software.
- Ability to understand how to apply the major object oriented concepts and advanced features.

Text Books

1. Dietel, Paul J. and Dietel, Harvey M., "C++ for Programmers", Prentice Hall, 10th Edition, 2016.
2. Bjarne, Strustrup,*"The C++ programming Language"*, Addison Wesley 2013.

Reference Book

1. Lafore, Robert, *"Object Oriented Programming in Turbo C++"*, Galgotia Publications 2001.
2. Booch, *"Object Oriented Analysis and Design with Applications"*, Addison Wesley, 2007.
3. Balagurusamy, *"Object Oriented programming with C++"*, Tata McGraw Hill, 2017.

Course Code	**ITC407**
Course Title	**Object Oriented Programming Lab**
Number of Credits	**0-0-2-1**
Course Type	**PC**

Labs Objectives

- To understand the object oriented principles.
- To construct the robust and maintainable programs.
- To design, write, compile, test and execute programs using high level language.

List of Experiments

- Implementation of array and pointers.
- Implementation of functions.
- Implementation of function overloading.
- Implementation of classes and objects.
- Implementation of functions in classes.
- Implementation of operator overloading.
- Implementation of different types of inheritance.
- Implementation of Streams.
- Implementation of various operations on files.
- Implementation of exception handling.
- Implementation of STL.

Lab Outcomes

- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

Course Code	**ITC406**
Course Title	**Practicum-II**
Number of Credits	**0-0-6-3**
Course Type	**GIR**

This practical course constitutes a minor project work based on the concurrently studied theory in that semester. This course is designed to give students supervised practical application of the courses that they learn in that semester.

Course Code	**ITC405**
Course Title	**STATISTICAL AND NUMERICAL METHODS**
Number of Credits	**3-1-0-4**
Course Type	**PC**

Course Objectives:

To learn mathematical concepts and methods

To apply concepts of numerical and statistical methods in engineering disciplines

Course Outcomes:

1. Construct a curve by least squares method
2. Determine an interpolating function for data
3. Finding Numerical integration and solution of IVP's
4. Analyze the data based on large and small sample sizes, testing of Hypothesis

Course Content:

Numerical Methods:

Unit I Curve fitting by the method of least squares: Fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curves. Gauss-Seidal iteration method to solve a system of equations – Power method for finding largest Eigen value. Numerical solution of algebraic and transcendental equations by Bisection, Regula-Falsi method Newton-Raphson's method.

Unit II Interpolation: Lagrange interpolation, Forward, backward and central differences, Newton's forward and backward interpolation formulae, Gauss's forward and backward interpolation formulae, Numerical differentiation,

Unit III Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Solution of Initial value problems: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta method of 2nd & 4th orders for solving first order ordinary differential equations.

Statistical Methods:

Unit IV Random variables and their distributions: Random variables (discrete and continuous), probability functions, density and distribution functions, special distributions (Binomial, Hypergeometric, Poisson, Uniform, exponential and normal). Mean and variance. Chebyshev's inequality, joint probability mass function, marginal distribution function, joint density function.

Unit V Testing of Hypothesis: Testing of Hypothesis, Null and alternative hypothesis, level of significance, one-tailed and two-tailed tests, tests for large samples (tests for single mean, difference of means, single proportion, difference of proportions), tests for small samples (T,F and Chi-square tests), goodness of fit, contingency tables, analysis of variance (one way and two way classification), Non-parametric tests, regression, correlation.

Text books

1. Jain, Iyengar and Jain, *Numerical Methods for Scientific and Engineering Computation*, New Age International Publications, 2008.
2. Miller and Freund, *Probability and Statistics for Engineers*, Pearson, 2005.

Reference books

1. **S.S. Sastry** Introductory methods of Numerical Analysis PHI learning pvt ltd. 2018.