Syllabus Scheme – CSE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS

IIIT SONEPAT

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SONEPAT

HARYANA

Semester wise Syllabus Scheme for B. Tech (CSE)

Semester-I

S. No.	Code	Course Name	L	T	P	C
1.	MAL101	Engineering Mathematics I	3	1	0	4
2.	SAP102	Health, Sports & Safety	2	0	0	2
3.	BEL103	Fundamental of Electrical and Electronics Engineering	2	1	0	3
4.	BSL104	Applied Science	3	0	0	3
5.	CSC105	Computer Programming	3	0	0	3
6.	ECL106	Analog Electronics	3	0	0	3
7.	HUL107	Environmental Studies	2	0	0	2
8.	BEL108	Fundamental of Electrical and Electronics Engineering Lab	0	0	2	1
9.	BSL109	Applied Science Lab	0	0	2	1
10.	CSC110	Computer Programming Lab	0	0	2	1
11.	ECL111	Analog Electronics Lab	0	0	2	1
Total Credits			**24**			

Semester-II

S. No.	Code	Course Name	L	T	P	C
1.	MAL201	Engineering Mathematics-II	3	1	0	4
2.	ECL202	Digital Electronics	3	0	0	3
3.	CSC203	Data Structure	3	0	0	3
4.	HUL204	Communication Skills	2	0	0	2
5.	CSC205	Web Designing	2	1	0	3
6.	CSC206	Information Security	3	0	0	3
7.	ECL207	Digital Electronics Lab	0	0	2	1
8.	CSC 208	Data Structure Lab	0	0	2	1
9.	HUL209	Communication Skills Lab	0	0	2	1
10.	CSC210	Web Designing Lab	0	0	2	1
11.	CSC211	Information Security Lab	0	0	2	1
Total Credits			**23**			

Semester-III

S. No.	Code	Course Name	L	T	P	C
1.	CSC301	Discrete Mathematics	3	1	0	4
2.	CSC302	Design and Analysis of Algorithms	3	0	0	3
3.	CSC303	Computer Organization	3	1	0	4
4.	CSC 304	Object Oriented Programming using C++	3	1	0	4
5.	CSC305	Automata and Formal Languages	3	1	0	4
6.	CSC306	Cloud Computing	3	0	0	3
7.	CSC307	Design and Analysis of Algorithms Lab	0	0	2	1
8.	CSC308	Computer Organization Lab	0	0	2	1
9.	CSC309	Object Oriented Programming using C++Lab	0	0	2	1
Total Credits			**25**			

Semester-IV

S. No.	Code	Course Name	L	T	P	C
1.	CSC401	Database Management Systems	3	1	0	4
2.	CSC402	Statistical and Numerical Methods	3	1	0	4
3.	CSC403	Operating System	3	0	0	3
4.	CSC404	Computer Networks	3	0	0	3
5.	CSC405	Object Oriented Programming using Java	3	0	0	3
6.	CSC406	Practicum	0	0	6	3
7.	CSC407	Database Management Systems Lab	0	0	2	1
8.	CSC408	Operating System Lab	0	0	2	1
9.	CSC409	Computer Networks Lab	0	0	2	1
10.	CSC410	Object Oriented Programming using Java Lab	0	0	2	1
Total Credits			**24**			

Semester-V

S. No.	Code	Course Name	L	T	P	C
1	CSC501	Compiler Design	3	1	0	4
2	CSC502	Software Engineering	3	0	0	3
3	CSC503	Microprocessor and Interfacing	3	1	0	4
4	XXXXXX	Elective-I	3	0	0	3
5	CSC504	Professional Communication and Soft Skills	3	0	0	3
6	CSC505	Big Data	3	0	0	3
7	CSC506	Compiler Design Lab	0	0	2	1
8	CSC507	Software Engineering Lab	0	0	2	1
9	CSC508	Microprocessor and Interfacing Lab	0	0	2	1
10	CSC509	Summer Internship	0	0	0	0
Total credits			**23**			

List of Electives in Vth Semester		
Course Code	**Electives List**	**Name**
CSC551/CSC552	Elective I	Natural Language Processing/Python Programming

Semester-VI

S. No.	Code	Course Name	L	T	P	C
1	CSC601	Minor Project	0	0	4	2
2	CSC602	Artificial Intelligence	3	0	0	3
3	CSC603	Advance Software Engineering	3	0	0	3
4	XXXXXX	Management Elective I/II	3	0	0	3
5	XXXXXX	Elective III	3	0	0	3
6	XXXXXX	Elective IV	3	0	0	3
7	CSC604	Artificial Intelligence Lab	0	0	2	1
8	CSC605	Advance Software Engineering Lab	0	0	2	1
9	XXXXXX	Elective IV Lab	0	0	2	1
Total credits			**20**			

List of Electives in VIth Semester		
Course Code	Electives List	Name
CSC651	Elective III	Machine Learning
CSC691	Management Elective I	Organizational Behavior
CSC692	Management Elective II	Professional Ethics
CSC661	Elective IV	Internet of Things
CSL661	Elective IV Lab	Internet of Things Lab

Semester-VII

S. No.	Code	Course Name	L	T	P	C
1.	CSC701	Industry Internship Project	0	0	42	21
Total Credits			**21**			
OR (Main Course Subjects)						
1	CSC702	Major Project	0	0	10	5
2.	XXXXXX	Elective I	3	0	0	3
3.	XXXXXX	Elective II	3	0	0	3
4.	XXXXXX	Elective III	3	0	0	3
5.	XXXXXX	Elective IV	3	0	0	3
6.	XXXXXX	Elective V	3	0	0	3
7.	CSL XXX	Elective II Lab	0	0	2	1
Total Credits			**21**			

Semester-VIII

(Main Course Subjects)						
S. No.	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CSC802	Major Project	0	0	10	5
2.	XXXXXX	Elective I	3	0	0	3
3.	XXXXXX	Elective II	3	0	0	3
4.	XXXXXX	Elective III	3	0	0	3
5.	XXXXXX	Elective IV	3	0	0	3
6.	XXXXXX	Elective V	3	0	0	3
7.	CSLXXX	Elective II Lab	0	0	2	1
Total Credits			**21**			
OR						
1.	CSC801/ CSL802	Industry Internship Project/ InHouse Internship	0	0	42	21
Total Credits			**21**			

Note that

- Students who have opted for Industry Internship Project in 7th Semester have to mandatorily opt for main course subjects in 8th Semester. Similarly, those who opted for Main Course subjects in 7th Semester have to opt for Industry internship Projects/Inhouse Internship in 8th Semester.
- InHouse Internship option is available in 8th Semester only for those students who are interested to work with faculty mentored research project. The record of such students may be provided through TnP cell.

List of Electives in VIIth & VIIIth Semester		
Course Code	Electives List	Name
CSC751/ CSC851	Elective I	Soft Computing
CSC761/ CSC861	Elective II	GPU Computing
CSC771/ CSC871	Elective III	Blockchain Technologies
CSC781/CSC782/ CSC881/CSC882	Elective IV	Operational Research/ Research Methodology
CSC791/ CSC891	Elective V	Data Analytics & Visualization
CSL761/ CSL861	Elective II Lab	GPU Computing Lab

*Elective lab code will start with CSL followed by course number.

Semester Wise Credits – CSE								
Sem→	I	II	III	IV	V	VI	VII	VIII
Credits→	24	23	25	24	23	20	21	21
Total	181							

FIRST SEMESTER

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

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 offunctions 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)

References:

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

Course Code	**SAP102**
Course Title	**Health, Sports & Safety**
Number of Credits	**2-0-0-2**

Course Objectives:

- To increase awareness about Physical Fitness and Health.
- To teach basic components of Physical Fitness
- First aid techniques and sports injuries.
- To conduct various tests to measure physical fitness of the students.
- To provide information about Food and Nutrition.

Course Contents:

Unit 1: Physical Fitness & Health

Physical fitness, components of physical fitness, methods to improve components of physical fitness, health, components of health, health related fitness components, factors affecting overall health.

Respiratory rate, Breathing rate, Body Mass Index.

Physical Fitness Testing: Cooper's test, Push-up test, Squat test, Sit & Reach Test, Isometric Back strength test, Standing Broad jump test, Shuttle run test, 100 metre sprint test, one minute Sit-up test.

Unit 2: Yoga & its Elements

Yoga, elements of Yoga, Asanas, Pranayama, Surya Namaskar

Unit 3: First Aid & Sports Injuries

First aid, aim of first aid, techniques of first aid, CPR technique, Recovery position, introduction to sports injuries.

Unit 4: Nutrition & Balanced Diet

Nutrition, component of Nutrition, Balanced diet.

Unit 5: Sports & Psychology

Psychology, Sports Psychology, Motivation, Anxiety, Leadership, The Big 5 personality Test.

Course Outcomes:

- Students will be more aware about their overall health.
- Students will learn methods to keep them physically fit and to access their physical fitness.

Text Book:

1. Health & Physical education, Saraswati publications.
2. Indian First Aid Manual 2016, 7th edition by Red cross society.
3. Certificate of Yoga Professionals: Official Guidebook, Excel books 1st edition 2016.

Course Code	BEL103
Course Title	Fundamental of Electrical and Electronics Engineering
Number of Credits	2-1-0-3

Course outcomes:

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

Course Contents:

Unit-I: D.C. Circuits

Ohm's law, Kirchhoff's laws, Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformations, Thevenin and Norton Theorems, Star-to-Delta & Delta-to-Star transformations, Maximum power transfer theorem, Reciprocity theorem, and Transients and Steady-state analysis.

Unit II- A.C. Fundamentals

AC fundamentals, Phasor diagrams of series and parallel RL, RC, and RLC circuits, Power factor, Resonance in series and parallel RLC circuits, Steady state analysis for sinusoidal excitation.

Unit-III- Magnetic Circuits and Transformers

MMF, Magnetizing force, Magnetic flux and flux density, permeability, Reluctance and permeance, B-H curve, Simple magnetic circuits, Hysteresis and Eddy current losses.

Construction of single-phase transformer, Operating principle, EMF equation, Phasor diagram on no-load and full-load, Losses and Efficiency, Open and short circuit test.

Unit-IV- Semiconductor Diodes

P-N junction diodes and its working, Applications of diodes: Rectifier circuits, Zener diode as voltage regulator, light Emitting Diode.

Unit-V- BJT and MOSFET

Bipolar Junction Transistor: Simplified structure, operation of n-p-n and p-n-p transistors, Input and Output Characteristics of CE, CB, and CC configurations. Metal oxide semiconductor field effect transistor: Structure, Basic operation, Drain and Transfer Characteristics, Comparison between BJTs and MOSFETs.

Text Books:

1. Charles, K.A. and Sadiku, N.O., "Fundamental of Electric Circuits", Tata Mc-Graw Hill, Sixth Edition, 2018.
2. Hayt, W. H. and Kemmerly, J., “Engineering Circuit Analysis”, 8th Edition, McGraw Hill Education, 2013.
3. Boylestad, R. L. and Nashelsky, L., "Electronic Devices and Circuits theory", 10th Edition, Pearson Education, 2013.

Reference Books:

1. Sudhakar, A. and Palli, S. S., “Circuits and Networks: Analysis and Synthesis”, McGrawHill Education, 2017.
2. Sedra and Smith K. C., "Microelectronics Circuits", 5th Edition, Oxford University, 2009.

Course Code	**BSL104**
Course Title	**Applied Sciences**
Number of Credits	**3-0-0-3**

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).

Text Books:

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:

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

Course Code	**CSC105**
Course Title	**Computer Programming**
Number of Credits	**3-0-0-3**

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, 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, 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.

Text Books:

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

Reference:

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

Course Code	**ECL106**
Course Title	**Analog Electronics**
Number of Credits	**3-0-0-3**

Course outcomes:

- To study the operation and applications of semiconductor devices such as Diodes, BJTs, and MOSFETs.
- To study V-I characteristics and equivalent models of various semiconductor devices.
- To study DC and AC analysis of various amplifier circuits using BJTs and MOSFETs.
- To study various Oscillators circuits and operation amplifiers.

Course Contents:

Unit-I: Semiconductor diodes

P & N types Semiconductors, working of P-N Junction Diode, V-I characteristics of P-N junction diode, Power Supply, Rectifier circuits: Halfwave, Center-tapped and Bridge Full wave rectifiers, filters, ripple-factor, Applications of various diodes such as Zener as a voltage regulator, Photodiode, Light emitting diode, Varactor Diode and Tunnel diode.

Unit II- Bipolar Junction Transistors

Theory and operation of BJT, Transistor current components, Current amplification factors, Transistor circuit configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Transistor as an amplifier, Transistor load lines, Transistor as a diode, Transistor biasing and stabilization, Thermal runaway, BJT Small-signal model analysis, DC and AC analysis of a single stage transistor amplifiers circuits using h-parameters, Miller's theorem.

Unit-III- Oscillators

Feedback in amplifiers, Introduction to Oscillators, operation of oscillators, L-C oscillator, Colpitt's oscillator, Hartley oscillator, Crystal oscillator, Phase-shift oscillator, and Wein-bridge oscillator.

Unit-IV- Metal Oxide Semiconductor Field Effect Transistors

Theory and operation of MOSFETs, MOSFET small-signal model, MOS capacitor, MOSFET resistor, Applications of MOSFETs, DC and AC analysis of Common source (CS), Common Drain (CD), Common Gate (CG) MOSFET amplifiers.

Unit-V- Operational Amplifiers

Introduction, Block diagram of a typical Op-Amp, Schematic diagram of 741 IC operation amplifier, Ideal Op-Amp, Equivalent circuit of Op-Amp, Common -mode Rejection ratio (CMRR), Practical Op-Amp parameters, Op-Amp characteristics, Applications: Adder, Subtractor, Comparator, Integrator, and Differentiator.

Text Books:

1. Boylestad, R. L. and Nashelsky, L., "Electronic Devices and Circuits theory", 10th Edition, Pearson Education, 2013.
2. Streetman, B. G., & Banerjee, S., "Solid State Electronic Devices", 7th Edition, Upper Saddle River: Pearson/Prentice Hall, 2016.

Reference Books:

1. Neamen, D. A., "Semiconductor physics and devices: basic principles", 4th edition, McGraw- Hill, 2003.
2. Sedra, A. S., Smith, K. C., Carusone, T. C., and Gaudet, V. Microelectronic Circuits. Vol. 4. New York: Oxford University Press, 2004.

Course Code	**HUL107**
Course Title	**Environmental Studies**
Number of Credits	**2-0-0-2**

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 its 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, effectsand 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, Environmentalrules 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	**BEL108**
Course Title	**Fundamental of Electrical and Electronics Engineering LAB**
Number of Credits	**0-0-2-1**

Lab Objectives:

- To describe various hardware components of a electrical and electronic circuits.
- To apply the various laws and methods to solve the electrical and electronics problems.
- To apply different network theorems to find the current and voltage in every branch of a given circuit.
- Explain various semiconductor diodes to develop an electronic circuitry.

List of Experiments:

1. To study DSO, Function generator, Multimeter, and DC power supply.

2. To verify the Kirchoff's laws (KCL and KVL).

3. To verify Superposition theorem.

4. To verify Thevenin's and Norton's theorems.

5. To verify Maximum power transfer theorem in DC circuits.

6. To study frequency response of series RLC circuit and determine resonant frequency and quality factor for various values of R1, L, and C.

7. To study frequency response of parallel RLC circuit and determine resonant frequency and quality factor for various values of R, L, and C.

8. To observe the V-I characteristics of P-N Junction and Zener diode.

9. To perform open circuit and short circuit test on a single-phase transformer.

10. To study Half-wave and Full wave Rectifier circuits.

Course Code	**BSL109**
Course Title	**Applied Sciences Lab**
Number of Credits	**0-0-2-1**

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	**CSC110**
Course Title	**Computer programming Lab**
Number of Credits	**0-0-2-1**

List of Experiments

1. Write a program to find sum of n natural number using for loop.
2. Write a program to calculate GCD of two numbers.
3. Write a program to calculate the Factorial of a number.
4. 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.
5. Write a program to calculate Power (xy) (Using Recursion).
6. Write a program to solve TOH (Tower of Hanoi).
7. Write a program for Swapping of two numbers using call by value and call by reference.
8. Write a program to store variable and array in pointer. Also implement array pointer and pointer to an array.
9. Write a program for String Comparison.
10. Write a program for finding Substring from given string.
11. Write a program for finding Reverse of string.
12. Write a program to create dynamic array using malloc and calloc function.
13. Write a program to reallocation of an array using realloc function.
14. Write program to read any string from and close a file using fgets and fclose respectively.

Course Code	**ECL111**
Course Title	**Analog Electronics LAB**
Number of Credits	**0-0-2-1**

Lab Objectives:

- To describe various equipments such as CRO, Multimeter, function generator, bread-board, regulated power supply.
- To analyze the V-I characteristics of various semiconductor devices such as diodes, BJT, and MOSFETs.
- To study the applications of semiconductor P-N junction diode.
- To explain and analyze different transistor biasing techniques for amplification purpose.

List of Experiments

1. 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.

2. To study V-I characteristics of P-N junction diode.

3. To study Zener diode as a voltage regulator.

4. To study Half wave rectifier.

5. To study center-tapped full wave rectifier.

6. To study input and output characteristics of CE configuration of transistor.

7. To study input and output characteristics of CB configuration of transistor.

8. To study BJT fixed bias, self-bias, and voltage divider bias configurations.

9. To study transfer and Drain Characteristics of MOSFET.

10. To Study MOSFET in common source configuration.

SECOND SEMESTER

Course Code	**MAL201**
Course Title	**Engineering Mathematics-II**
Number of Credits	**3-1-0-4**

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:

Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons.
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	**ECL202**
Course Title	**Digital Electronics**
Number of Credits	**3-0-0-3**

Course outcomes:

- To understand the fundamentals of digital logic design.
- To study the applications of Combinational and sequential logic circuits.
- To study about Analog-to-digital and digital-to-analog convetors.

Course content:

Unit I: Number systems and K-map

Introduction to various number systems and their Conversion. Boolean Algebra and Logic Gates: Basic Logic Operations, Basic Identities, Algebraic Laws, Useful Boolean Identities, Algebraic Reductions, Complete Logic Sets, IEEE Logic Gate Symbols, Canonical Logic Forms, Karnaugh Maps, Minimization of Boolean expressions using K-map.

Unit-II: Combinational Logic Circuits

Introduction, Design procedure, Adders, Subtractors, Binary parallel adder, Look-Ahead-carry adder, BCD adder, Code convertors, Comparators, Multiplexers and Demultiplexers, Encoders and Decoders, Priority Encoder, Hazards and Hazard-free realizations.

Unit-III: 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.

Unit-IV: 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-V: Memories

Memory types and terminology, Real only memory (ROM), Random Access memory (RAM), organization and types, Semiconductor RAMs, Memory expansion, Non-volatile RAMs, Sequential memories, Magnetic memories, Charge-coupled devices, and Optical disk memory.

Text Books:

1. A. Anand Kumar, “Fundamentals of Digital Circuits”, 4th Edition, PHI, 2016.
2. Floyd T. L., “Digital Fundamentals” 11th Edition Pearson International Education, 2017.

Reference Books:

R P Jain, “Modern Digital Electronics”, McGraw-Hill Education (India) Pvt Limited, 2003

Course Code	**CSC203**
Course Title	**Data Structure**
Number of Credits	**3-0-0-3**

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 amongstthem.
- Understanding different sorting algorithms, their advantages and disadvantages,
- Appreciation of concept of dynamic memory allocation and its utilization, dynamic datastructures 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).

Unit II- Introduction to Stacks-ADTs, Stack Implementation using – Array and Linked List. Concept of recursion for various operations on Lined list such as – reversing list elements. Operations- PUSH & POP. Time Complexity of PUCH/POP using array & stack. Infix /postfix algorithms

Unit III Introduction to Queues- Queue using Circular Array, its implementation using two stack, various Operations – Enqueue/Deques Doubly Linked List- various Operations on queues.

Unit IV- Trees- Non-Linear Data structure introduction. Properties of trees- height, Level, Depth, Binary Trees, Full trees, Complexity analysis for trees.

Tree Traversing- Inorder, preorder, Post order, Implementation of traversing in trees using recursion methods. Count number of trees using recursion Various Trees representation, recursive programs for counting number of leaves, non leaves, finding full nodes of trees.

Unit V- Binary Search Tress- Introduction, complexity, operations such as insertion, deletion of elements AVL Tree and its operations

Text Books:

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	**HUL204**
Course Title	**Communication Skills**
Number of Credits	**2-0-0-2**

Course outcomes:

- To impart to the students, communication skills that they need in their academic, and later in the professional pursuit.
- To enhance their skills in Listening, Speaking, Reading, and Writing (LSRW)
- To train the students to adopt an innovative approach to English and learning.

Course content:

Unit I

Communication: meaning and its definition; modes of communication Listening, Speaking, Reading, and Writing. Types of communication: Oral communication and Written communication and visual communication. Visual communication and its importance: Theories of visual communication: Gestalt Theory, Semiotic theory, Constructivism, Ecological Theory, Cognitive Theory, Huxley-Lester Model.

Unit II

Barriers to communication. Understanding pronunciations – issues and challenges to comprehension: Received Pronunciation, Indian English, American English. Language as connected speech – issues and challenges to comprehension: Intonation, liaison, juncture

Unit III

Reading comprehension: Types of reading: Skimming (general purpose), and Scanning (specific purpose).
Comprehension by the use of Semantic markers and sign posting.

Unit IV

Writing skills: Structure and order: Understanding the Essay: Thesis statement and the topic sentences. Body of the Essay: Topic sentence, illustrations, supporting sentences: Types of essay writing: Narrative, Expository, Descriptive, Argumentative and cause and effect

Books:

Text:

1. Orient Longman, A Textbook of English for Engineers and Technologists.
2. A Course in Phonetics and Spoken English by J Sethi & PV Dhamija PHI

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	**CSC205**
Course Title	**Web Designing**
Number of Credits	**2-1-0-3**

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 developinga 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 elementsof 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, , YSlow, Word Press, Django framework Introduction.

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	**CSC206**
Course Title	**Information Security**
Number of Credits	**3-0-0-3**

Course outcomes:

- To understand the basic concepts of web threats, legal ethical and professional issues of information security.

UNIT-I Information and Security

Computer Security Concepts, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy.

UNIT- II Information and Security:

Information Systems:

Recent History, Trends, Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles, Privacy of Data.

UNIT-III Network Cryptography

Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues,

Unit -IV Database Security

The need for Database Security, RDBMS and SQL Injection attacks, Database Access Control, Inference, Database Encryption.

Unit -V Firewalls and Intrusion Detection and Prevention Systems

Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Biasing, Firewall Location and Configuration, Intrusion.

Detection Systems, Intrusion Prevention Systems, Unified Threat Management Products.

Text Books:

[T1] Godbole," Information Systems Security", Wiley

[T2] Merkov, Breithaupt," Information Security", Pearson Education

References:

[R1] Yadav, "Foundations of Information Technology", New Age, Delhi

[R2] Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill

[R3] Furnell, "Computer Insecurity", Springer
[R4] http://www.iiitd.edu.in/~gauravg/

Course Code	**ECL207**
Course Title	**Digital Electronics Lab**
Number of Credits	**0-0-2-1**

Lab Objectives:

- To describe various logic gates such as AND, NOT, OR, EX-OR, EX-NOR, NAND, and NOR.
- To analyze the Combinational logic circuits and Sequential logic circuits. To study the applications of semiconductor P-N junction diode.
- To design code convertors using logic gates.

List of Experiments

1. Introduction of Digital Logic Gates: Investigate logic behavior of NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR gates.
2. Gate-level minimization: Two level and multi-level implementation of Boolean functions.
3. To study Half adder and subtractor.
4. To study Full adder and subtractor.
5. To design BCD to Excess-3 code converter, gray code to binary converter, binary to gray code converter.
6. To design 4x1 Multiplexer and 1x4 De-multiplexer.
7. To design an 4x2 Encoder and 2x4 Decoder.
8. To design 4-bit binary adder and subtractor using IC 7483.
9. To construct SR and D flip flop, JK and T flip flop.
10. To design a MOD-8 synchronous UP and DOWN counters.

Course Code	CSC208
Course Title	Data Structure Lab
Number of Credits	0-0-2-1

List of Experiments

1. Insert a node in front of already created singly link list.
2. Insert a node at the end of already created singly link list.
3. Insert a node at user specified data in already created singly link list.
4. Delete a node from front of a Singly Linked List.
5. Delete node from end of a Singly Linked List.
6. Delete a node from any user specified index in a Singly Linked List.
7. Search a user specified data in a singly linked list and delete it from the list and print final list after deletion.
8. Print Elements of a single linked list using the Concept of recursion.
9. Print elements of a single-linked list in reverse order using recursion.
10. Write an Iterative Version to Reverse the elements of a single linked list.
11. Write a recursive version to reverse elements of a single linked list.
12. Implement Push and Pop Operations of Stack using - Array and Singly Linked List and Analyse its time complexity.
    a) STACK OPERATION USING ARRAY
13. Implement Push and Pop Operations of Stack using - Array and Singly Linked List and Analyse its time complexity.
    b) STACK OPERATION USING SINGLY LINK LIST.
14. Create a circular linked list and display its elements. Also counts the total number of elements in this list.
15. Perform Insertion of an element at the front, rear and middle of circular linked list.
16. Perform Insertion of an element at the front, rear, and middle of a Double linked List.
17. Implement Enqueue and Dequeue operation in a Queue using Array
18. Implement Enqueue and Dequeue operation in a Queue using Circular Array
19. Implement Queue using two stacks
20. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array
21. Write C programs to implement a double-ended queue ADT using
    i. array
22. Write C programs to implement a double-ended queue ADT using
    ii. doubly linked list.
23. Write a C program that uses functions to perform the following:
    i. Create a binary search tree of characters.
    ii. Traverse the above Binary search tree recursively in Post-order, Pre- order, In-order
24. Perform Double and Triple Order traversal on the tree and show output
25. Write a C program that uses functions to perform the following:
    i. Create a binary search tree of integers.
    ii. Traverse the above Binary search tree non recursively in order
26. Write a c program for indirect recursion and trace out its output manually
27. Write a c program to count the number of nodes in Binary Tree (use Recursive version)
28. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    1. Insertion sort
29. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    2. Merge sort
30. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    1. Quicksort

Course Code	**HUL209**
Course Title	**Communication Skills Lab**
Number of Credits	**0-0-2-1**

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	**CSC210**
Course Title	**Web Designing Lab**
Number of Credits	**0-0-2-1**

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 sheetvalidates 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.

Course Code	**CSC211**
Course Title	**Information Security Lab**
Number of Credits	**0-0-2-1**

List of Experiments

1. Make an experiment to implement WEP/WPA2 PSK, 802.1x EAP security protocol.
2. Implement firewall through App to login into bank-site,; to implement E-commerce, debit card transaction through payment gateway
3. Implement bio-metric system to have physical security through different access control permissions.
4. Implement RSA algorithm.
5. Implement DES algorithm
6. Implement Diffie-Hellman algorithm
7. Make a study of anyone simulation tool based on parameters of information security
8. Implement VPN through Packet-Tracer or any other network simulator tool.

THIRD SEMESTER

Course Code	**CSC301**
Course Title	**Discrete Mathematics**
Number of Credits	**3-1-0-4**

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'salgorithm. **Unit II Propositions:** Quantified propositions, fundamentals of logic, first orderlogic, 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, EulerianGraph, 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 ComputerScientists 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)

Course Code	**CSC302**
Course Title	**Design and Analysis of Algorithms**
Number of Credits	**3-0-0-3**

Course Objectives

- To understand the importance of algorithm and its complexity.
- To design and implement various programming paradigms and their complexity.

Course Content

Unit-I Algorithm Design paradigms: motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations.
Structure of divide-and-conquer algorithms: sets and disjoint sets, Union, Path compression, quick sort, Finding the maximum and minimum, Quick Sort, Merge sort, Heap and heap sort.

Unit-II Greedy Algorithms: Optimal storage, Knapsack problem, Job sequencing with deadlines,, Huffman coding, Minimum Spanning trees: Prim's algorithm & Kruskal's algorithm, Huffman codes.

Unit-III Dynamic programming: Overview, difference between dynamic programming and divide and conquer, Matrix chain multiplication, longest Common sequence, 0/1 knapsack., bellmonford and Floyd-Warshall algorithm.

Unit-IV Backtracking: Queen Problem, vertex cover graph coloring, Hamiltonian cycles. Branch and bound and its applications, 0/1 Knapsack problem, Traveling Salesman Problem.

Unit-V Computational Complexity: Complexity measures, Polynomial vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

Course Outcomes

- Ability to analyze the time and space complexity, given an algorithm.
- Ability to apply the techniques of algorithm in solving real world problems.
- Ability to develop systematically an algorithm for solving a problem.

Text Books

1. E. Horowitz, S. Sahni and Rajasekaran, *"Fundamentals of ComputerAlgorithms"*, Universities Press, 2008.
2. Cormen T. H., Leiserson C. E. and Rivest R. L. and Stein Clifford, *"Introductionto Algorithms",* Prentice Hall of India, Third Edition, 2010.
3. Skiena Steven S., "*The Algorithm Design Manual*", Springer, 2nd edition, 2008.

Reference Book

1. A.V. Aho, J.E. Hopcroft and J.D. Ullman, *"The Design and Analysis ofComputer Algorithms"*, Addison Wesley, 2009.

Course Code	**CSC307**
Course Title	**Design and Analysis of Algorithms Lab**
Number of Credits	**0-0-2-1**

Course Objectives:

- To learn how to analyze the complexity of algorithms.
- To learn to program brute force, divide and conquer, decrease and conquer, transform and conquer, greedy, and dynamic techniques.

List of Experiments:

- Data structures
- Sorting
- Maximum and minimum problem using divide and conquer strategy.
- Binary search.
- Heap Sort algorithm.
- Kruskal's algorithm.
- Prim's algorithm.
- Matrix chain multiplication
- Dijkstra's algorithm.
- Bellman-Ford algorithm.
- Depth-first search (DFS) on an graph.
- Breadth-first search (BFS) on an graph.
- Advanced data structures.
- Illustrating the different paradigms of algorithm design.
- Problems in string manipulation, graph theory, optimization.

Course Outcome:

- Ability to solve and analyze general algorithms based on space and time complexity.

Course Code	CSC303
Course Title	Computer Organization
Number of Credits	3-1-0-4

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 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

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

Reference Books

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

Course Code	**CSC308**
Course Title	**Computer Organization Lab**
Number of Credits	**0-0-2-1**

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

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, PentiumII Pentium III, Pentium IV Architecture, Programming, and Interfacing, 8th Edition*", PrenticeHall, 2009.

Course Code	**CSC304**
Course Title	**Object Oriented Programming using C++**
Number of Credits	**3-1-0-4**

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	**CSC309**
Course Title	**Object Oriented Programming using C++ Lab**
Number of Credits	**0-0-2-1**

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 in C++ to solve real world problems.

Course Code	**CSC305**
Course Title	**Automata and Formal Languages**
Number of Credits	**3-1-0-4**

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

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

Course Code	**CSC306**
Course Title	**Cloud Computing**
Number of Credits	**3-0-0-3**

Course Objectives

- To understand the basics of Cloud Computing.
- To understand the movement from a traditional network infrastructure to a Cloud solution.

Course Content

Unit-I Cloud Computing Basics

Cloud Computing overview, Applications, Service Delivery Models- SaaS and its examples, Platform as a Service (PaaS), Infrastructure as a Service(IaaS). Deployment Models- Public, Private and Hybrid, Community, Models, Benefits, Limitations and Security Concerns in the Cloud.

Unit-II Cloud Storage and Policies

Cloud Storage and its types, Provisioning Storage, Protection Capabilities, Storage Features,
Access Protocols, Storage Security, Disaster Recovery Capabilities, Disaster Recovery Considerations, Business Continuity Plan.
Compute Introduction, CPU Capabilities, Memory Requirements, Performance Considerations, Cost Considerations.

Unit-III Cloud Security

Cloud Security introduction, Challenges, Risks, Cloud Security Alliance Guidance, Security Policies, Standards and Compliance, Identity, Authentication, and Authorization, Multi-Factor Authentication,

Unit-IV Maintaining Cloud Solutions

Migration Types, Workload Management, Virtualizing Physical Systems, Migrating Security, Protocols and Services, Environmental Constraints.

Unit-V Policy, Risks and Governance

Technical policies in cloud, Contract requirements, Service Level Agreements, cloud governance model, decisions and recommendations**,** different cloud threats, cloud compliance and considerations. Cloud control challenges, Auditing the Cloud- Remote, Onsite, Criteria. Assessments for the cloud and challenges, cloud trust protocol.

Course Outcomes

- Ability to gain insight about basic technology behind the Cloud.
- Ability to comprehend the Cloud computing applications.
- Completing a Business case for going to the Cloud.

Text Books

1. Sosinsky Barrie, "*Cloud Computing: Bible*", Wiley Publication, 2011.
2. Velte Anthony T., Velte Toby J. and Elsenpeter Robert, "*Cloud Computing: A Practical Approach*", McGraw Hill, Indian edition, 2010.

Reference Books

1. Buyya Rajkumar, Broberg James and Goscinski Anderzej, "*Cloud Computing: Principles and Paradigms*", Wiley Publication, 2011.

FOURTH SEMESTER

Course Code	**CSC401**
Course Title	**Database Management Systems**
Number of Credits	**3-1-0-4**

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	**CSC407**
Course Title	**Database Management Systems Lab**
Number of Credits	**0-0-2-1**

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	**CSC403**
Course Title	**Operating System**
Number of Credits	**3-0-0-3**

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 Wileyand 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 Publications2014.

Course Code	**CSC408**
Course Title	**Operating System Lab**
Number of Credits	**0-0-2-1**

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	**CSC404**
Course Title	**Computer Networks**
Number of Credits	**3-0-0-3**

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, Routersand 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/performanceissues 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	CSC409
Course Title	Computer Networks Lab
Number of Credits	0-0-2-1

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-wiredcable and straight through cable using clamping tool.
- Install and Configure Wired and Wireless NIC and transfer files between systems in LANand 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/IPConfiguration)
- Establish Peer to Peer network connection using two systems using Switch and Router ina LAN.
- Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities todebug the network issues.
- Transfer files between systems in LAN using FTP Configuration, install Print server in aLAN 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
- Configure a Network Topology using packet tracer software.
- Configure a Network using various Routing Protocol.
- To get the MAC or Physical address of the system using Address Resolution Protocol.

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	**CSC405**
Course Title	**Object Oriented Programming using JAVA**
Number of Credits	**3-0-0-3**

Course content:

Unit 1- Introduction

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments. Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

Unit 2- Classes and Objects

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Unit 3- Inheritance

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Concept of Interfaces.

Unit 4 Exception Handling

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause

Unit 5 Multithreaded Programming

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread

Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication – Suspending, Resuming, and Stopping of Threads.

TEXT BOOKS

1. E. Balagurusamy, "Programming with Java", TataMc-Graw Hill, 5th Edition.
2. Sagayaraj, Denis, Karthick and Gajalakshmi, "Java Programming for Core and advanced learners", Universities Press (INDIA) Private Limited 2018.

REFERENCES:

1. Herbert Schildt, "The complete reference Java", TataMc-Graw Hill, 7 th Edition.
2. WEB REFERENCES: NPTEL & MOOC courses titled Java- https://nptel.ac.in/courses/106105191

Course Code	**CSC410**
Course Title	**Object Oriented Programming using JAVA Lab**
Number of Credits	**0-0-2-1**

Java Programs to practice concept of following important concepts-

1. Command Line Arguments
2. Scope of Variable Identifier
3. if Expression,
4. Nested if Expressions, if–else Expressions
5. Ternary Operator, Switch Statement
6. Iteration Statements, while Expression, do–while Loop, for Loop
7. Classes and Objects Modifiers
8. Class Members
9. Overloaded Methods
10. Overloaded Constructor
11. Inheritance
12. Exception Handling
13. Multithreaded Programming

Course Code	CSC402
Course Title	STATISTICAL AND NUMERICAL METHODS
Number of Credits	3-1-0-4

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 interpolationformulae, 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 Hypothesis Testing :- 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 forsmall 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.

Course Code	**CSC406**
Course Title	**Practicum**
Number of Credits	**0-0-6-3**

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.

Fifth Semester

Course Code	**CSC501**
Course Name	**Compiler Design**
Number of Credits	**3-1-0-4**

Course Objectives

- To understand the various phases of compiler and its use.

Course content

Unit I Introduction to Compiler

Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

Unit II Parsing Technique

Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing. Bottom up parsing: Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing , handling ambiguous grammar.

Unit III Syntax-Directed Translation

Semantic analysis : Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker. **Symbol Tables:** Symbol table format,organization for block structures languages, hashing, tree structures representation of scope information.Block structures and non-block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays.

Unit IV Symbol Tables

Code optimization: Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Data flow analysis: Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

Unit V Code Generation

Object code generation: Object code forms, machine dependent code optimization, register allocationand assignment generic code generation algorithms, DAG for register allocation

Course Outcomes

- Ability to apply the knowledge of lex tool & yacc tool to develop a scanner & parser
- Ability to design and develop software system for backend of the compiler

Text Books

1. Aho, Alfred V., Lam, Monica S., Sethi, Ravi and Ullman, Jeffrey D. "*Compilers Principles,Techniques and Tools"*. Pearson Education Limited Boston, 2014.

2. Hollub, Allen I. "*Compiler Design in C"*. Prentice-Hall Inc. New Jersey, 1990.

Reference Books

1. Louden, Kenneth C. "*Compiler Construction: Principles and Practice"*. CourseTechnology, 1997.
2. Bennet, J.P. "*Introduction to Compiler Techniques"*. Tata McGraw-Hill, 1990.

Course Code	**CSC506**
Course Name	**Compiler Design Lab**
Number of Credits	**0-0-2-1**

Lab Objectives

- The lab course provides the complete description about inner working of a compiler.
- The main focus is to understand working of compiler in detailed manner

List of Experiments

- Conversion of infix notation to postfix notation.
- To Recognize declarative statements
- Program to recognize arithmetic expression
- Program to Check valid If statements in C program and report errors to users
- Program to Check for un terminated, multi line comment statements in C program
- To Create an assembler that will display warning/errors when symbols are used but not defined andvice versa
- Write a program that will create and display content of Symbol table
- Implementation for lexical analyzer
- Write a C program to implement type checking
- Implement Predictive parser using C.

--**Note** The Instructor may add /tune experiments, wherever he/she feels in a justified manner

Course Outcomes

To understand different phases of compiler design

Course Code	CSC502
Course Name	Software Engineering
Number of Credits	3-0-0-3

Course Objective:

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

Unit-I Introduction to Software Engineering: Software crisis and factors, Exploratory vs software engineering of product development, chunking, abstraction vs decomposition, importance of software engineering. Types of projects- -Product vs. Service. SE history, Evolution of design techniques- high level language, control flow design, structure programming, object-oriented design. Introduction to life cycle models.

Unit-II Life Cycle Models: 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- pros. Cons, The V Model, Sashmi models, Incremental Process Models and their types, Unified process models. Spiral Model. Specialized process models and the measurements on predictive and adaptive scales

Unit-III Agile Framework: Agile Mind Set, principles of Agile methodology and various values. Types of agile frameworks. Agile Methodology- Scrum and Kanban frameworks introduction

Unit-IV Unified Modeling language- Introduction to UML, concept of user stories in UML, Use Case Diagrams- association. Aggregations, composition, Activity diagrams, sequential diagrams, merge activity. Instability index and importance

Data Flow Diagrams, Design modularity- Coupling and Cohesion concepts and their types.

Unit-V Project Management using Git: Project Management Concepts, managing project using Git

Git- introduction, installation, need of Git for project management, Architecture of Git, how to start project using Git, cloning remote Git repository from GitHub, Git ignore files, file status lifecycle, commit and staging, unstaging, renaming and moving files in git, working on remote repository, branching concept in Git, push and pull of data through git.

Course Outcomes

- Assessment in each module gives the overall Software engineering practice and project management using git
- 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, SeventhEdition, 2010.
3. Nartin Robert C. and Martin Micah, "*Agile Principles, Patterns, and Practices in C#"*, PrenticeHall, 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	CSC507
Course Name	Software Engineering Lab
Number of Credits	0-0-2-1

Lab Objectives:

- To understand the software engineering methodologies involved in the phases for project development. Able to design using UML Concepts
- Tools: StarUML/ UMLGraph/ Top cased
- Student need to practice and manage their code through the Git.
- Practice real time code management using Git

List of Experiments

1. Create user stories for the various real time scenarios
2. Identify Functional and Non-Functional requirements in a chosen Project(s)
3. Create user stories out of functional requirements for a chosen Project(s).
4. Create use case diagrams from the epics
5. Create Class diagrams for the use cases
6. Create Sequential diagrams for the class diagrams
7. Identify object states for classes(s) create State chart diagram for each identified object.
8. Identify various activities in a project and draw activity diagrams for corresponding Actions.
9. cloning remote Git repository from GitHub
10. commit and staging, unstaging using Git
11. Manage a Project using Git

List of Sample Project(S)- students have to understand the working of each sample project and choose any one to perform the above experiments

Course management system (CMS): A course management system (CMS) is a collection of softwaretools 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.

Ebidding: Auctions are among the latest economic institutions in place. In this project, explore theefficiency of common auctions when values are interdependent.

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

Lab Outcomes:

- Ability to develop software projects and software project process and command Git
- Ability to design a project module.
- Project management.

Course Code	**CSC503**
Course Name	**Microprocessors and Interfacing**
Number of Credits	**3-1-0-4**

Course Objectives

- To understand interfacing of 16-bit microprocessor with memory and peripheral chipsinvolving system design.
- To understand techniques for faster execution of instructions and improve speed of operationand performance of microprocessors.

Course Content

Unit-I Introduction to Microprocessor: History and Evolution, types of microprocessors, Block diagram of 8085, Pin Diagram of 8085, Addressing modes, Types of Instructions.

Unit-II Assembly Language Programming and Timing Diagram: Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings, Instruction cycle, Machine cycles, T states, Timing diagram for different machine cycles.

Unit-III Serial I/O and Interrupts: Serial I/O using SID, SOD. Interrupts in 8085, Issues in implementing interrupts, multiple interrupts and priorities, Daisy chaining, Interrupt handling, Enabling, disabling and masking of interrupts.

Unit-IV Data transfer techniques: Programmed data transfer, Parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA controller.

Unit-V Microprocessor Interfacing Techniques Interfacing memory and I/O devices: Addressing memory, interfacing static RAMs, Interfacing and refreshing dynamic RAMs, interfacing a keyboard, interfacing a printer, Interfacing A/D converters, D/A converters. Architecture of 8086: Pin diagram of 8086, addressing modes, Comparison of 8086 and 8088, minimum mode maximum mode, system timing, introduction to Pentium and further series of microprocessors

Course Outcomes

- Identify various addressing modes Perform various microprocessor based programs.
- Interpret & Solve various automation based problems using microprocessor.

Text Books

1. Gaonkar, Ramesh S, "*Microprocessor architecture, Programming and applications with 8085"*, 6th Edition, Prentice Hall, 2013.
2. Brey, Barry B., "*The Intel Microprocessor, 8086/8088, 8018/80188, 80286, 80386, 80486, Pentiumand Pentium pro-processors – architecture, Programming and interfacing"*, 8th Edition, Prentice Hall 2012.

Reference Book

1. Ufferbeck John, "*The 8080/85 Family: Design, Programming & Interfacing"*, PHI India.

Course Code	CSC508
Course Name	Microprocessor and Interfacing Lab
Number of Credits	0-0-2-1

Lab Objectives

- To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.
- To provide practical hands on experience with Assembly Language Programming.
- To familiarize the students with interfacing of various peripheral devices with 8085 microprocessor.

List of Experiments

- Introduction of microprocessor 8085 trainer kit – 85AD
- The addition of two 8-bit numbers.
- The subtraction of two 8-bit numbers.
- The addition with carry of two 8-bit numbers.
- The subtraction with barrow of two 8-bit numbers.
- The addition of two BCD numbers.
- The subtraction of two BCD numbers.
- The multiplication of two 8-bit numbers by repeated addition method.
- The multiplication of two 8-bit numbers by bit Rotation method.
- The division of two 8-bit numbers by repeated addition method.
- The division of two 8-bit numbers by bit rotation method.
- The square of given numbers in array.
- To find largest number in an array.
- Study of 8086 microprocessor kit
- The addition of two 16-bit numbers.

Course Outcomes

- Explain the architecture, pin configuration of various microprocessors.
- Identify various addressing modes.
- Perform various microprocessor-based programs.

Course Code	CSC504
Course Name	Professional Communication and Soft Skills
Number of Credits	3-0-0-3

Course Objective

- To enhance the holistic development of students and improve their employability skills.

Course Content

Unit-I Introduction to Soft Skills & Professional ethics: Aspects of Soft Skills, Effective Communication Skills, Personality Development, Importance of Professional Ethics.

Unit-II Team Building: To know the nature of the team, To understand personal as well as professional goals of the members of the group, To work effectively in a team through building relationand interpersonal communication.

Unit-III Art of Negotiation: What is negotiation, Ways of negotiating, To understand the power of language and non-verbal communication.

Unit-IV Organizing Meetings: How to call the meeting, How to organize a meeting, How to designthe agenda and prepare minutes of the meeting.

Unit-V Presentation Skills: Reading, structure of presentation, verbs often required, language focus, importance of body language in presentation, preparing an outline of a presentation, ending the presentation.

Unit-VI Stress Management & Time Management: Kinds of stress, Identify the right reason/sof stress, How to handle the pressure, Techniques to cope with the stressful situation at a workplace.Goal setting, Understand the importance of time and How to prepare the time line.

Unit-VII Group Discussion & Public Speaking: Nature of discussion, Ways to form and present the arguments. To learn the skills of appearing in an interview and being successful in it.

Course outcomes

- Understand and recognize the importance of interpersonal skills.
- Understand the realistic perspective of work and work expectations.

Text boks

1. Rizvi, Ashraf., "*Effective Technical Communication"*, Tata McGraw Hill ,2008.
2. Mohan, Krishan., "*Developing Communication Skills"*, Mac Millan India Limited, 2009.

Reference Books

1. Dale, Carnegie., "*How to win Friends and Influence People"*, New York: Simon &Schuster, 1998.
2. Coleman, Daniel. "*Emotional Intelligence"*. Bantam Book, 2006.

Course Code	**CSC505**
Course Title	**BIG DATA**
Number of Credits	**3-0-0-3**

Course Objectives:

- To explore the fundamental concepts of big data and its business implications.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.

Course Contents:

Unit-I Introduction to Big Data: Introduction to Big Data Platform, Challenges of Conventional Systems, Big Data architecture and characteristics, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data Analytics.

Unit-II Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop, Analysing the Data with Hadoop, Hadoop pipes, Hadoop Echo System.

Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce features, Real-world Map Reduce.

Unit-III: HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces

Unit-IV: Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud.

Unit-V: Hadoop Eco System Frameworks: **Pig** - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, **Hive -** Apache Hive architecture and installation, Hive shell, Hive services, comparison with traditional databases, **HBase** – Hbase concepts, Hbase vs RDBMS, advanced usage of HBase.

Course Outcomes:

- Ability to apply Map Reduce programming model to access and process distributed data.
- Ability to manage job execution in Hadoop environment and develop Big Data solutions.

Text Book:

4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging BusinessIntelligence and Analytic Trends for Today's Businesses", Wiley.
5. Thomas Erl, Wajid Khattak, Paul Buhler, “Big Data Fundamentals: Concepts, Drivers and Techniques”, PrenticeHall.

Reference Book:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly.

Course Code	CSC509
Course Name	Summer Internship
Number of Credits	0-0-0-0
Course Type	Non-Credit

The students may carry out a summer internship of a minimum of 4 weeks in Industry/ reputed Institute/organization/IIIT Sonepat* after the 4th semester. A Project report based on training and corresponding proofs of training will be submitted by the student at the start of the 5th semester. In this course, the credits will not be counted for the calculation of the final CGPA. Only the grades will appear on the Grade card and transcript.

*Institute internship at IIIT Sonepat may be offered to student(s) by a faculty mentor on a mutually agreed project. It's totally depending on the faculty discretion/institute's policy, whether to offer such internship to a student(s), if a faculty mentor agrees on supervising a student(s) during the summer internship then the such student(s) will be given a certificate by the faculty mentor.

List of program Electives

Course Code	CSC551
Course Name	Natural Language Processing
Number of Credits	3-0-0-3

- To understand the application of computational methods in linguists.
- To apply statistical and probabilistic methods for parameter estimation and inference.
- To know how the computational methods, give insight into observed humanlanguage phenomena.

Course Content

Unit-I Sound: Biology of Speech Processing; Place and Manner of Articulation; WordBoundary Detection; Argmax based computations; HMM and Speech Recognition.

Unit-II Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

Unit-III Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

Unit-IV Meaning: Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

Unit-V Web 2.0 Applications: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual InformationRetrieval (CLIR).

Course Outcomes

- Ability to compare and contrast approaches to natural language processing
- Ability to comprehend and analyze the various elements of speech processing
- Ability to design and develop machine learning techniques in the area of NLP

Text Books

1. Jurafsky, Dan and Martin, James, *"Speech and Language Processing, 2nd Edition"*, PrenticeHall, 2013.
2. Manning, Christopher and Heinrich, Schutze, "*Foundations of Statistical NaturalLanguage Processing*", MIT Press, 1999.

Reference Books

1. Allen, James, "*Natural Language Understanding, 2nd edition*", Benjamin Cumming, 2002.
2. Charniack, Eugene, "*Statistical Language Learning*", MIT Press, 1996.

Course Code	**CSC552**
Course Title	**Python programming**
Number of Credits	**3-0-0-3**

Course contents

Unit 1- Basics of python

Introduction: The Python Programming Language, History, features, Installing Python, Running Python program, Debugging : Syntax Errors, Runtime Errors, Semantic Errors, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. Conditional Statements: if, if-else, nested if –else Looping: for, while, nested loops Control statements: Terminating loops, skipping specific conditions.

Unit 2- Functions

Functions: Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters, Boolean Functions, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.

Unit 3 Lists:

Lists: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods Tuples and Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Method

Unit 4- Classes and Objects

Regular Expressions – Concept of regular expression, various types of regular expressions, using match function. Classes and Objects: Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding,

Data Encapsulation, Data Hiding.

Books and References:

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ,2nd edition, Wes McKinney,O'Reilly Media (2017).
2. Data Science from Scratch: First Principles with Python, Joel Grus O'Reilly Media (2015)

Sixth Semester

Course Code	**CSC601**
Course Name	**Minor Project**
Number of Credits	**0-0-4-2**

This minor project work will involve detailed literature survey, implementation, and experimentation plan. Atthe end of the 6th semester, the project work should have been demonstrated and work done will be evaluated

Course Code	**CSC602**
Course Title	**Artificial Intelligence**
Number of Credits	**3-0-0-3**

Course Objective

To enable the students to understand Artificial Intelligence principles in Depth. By the end of thiscourse, Student will be able to Implement various AI based concepts and algorithms.

Unit – I Introduction to Artificial Intelligence

Basic concept of artificial intelligence (AI), history of AI, AI and consciousness, weak and strong AI, physical symbol, system hypothesis, comparison of computer and human skills, practical systems based on AI, development of logic, components of AI.

Unit -II Problem Solving Agents

Introduction to Intelligent Agents, Nature of Environment, Structure of Intelligent Agent- Reflex based agents and goal based.

Problem Solving Agents - The structure, Algorithm for Problem Solving Agent, Various examples of problem solving Agents.

Unit -III Search Strategies

Acting Under Uncertainty, Bayes Theorem, Uninformed Search Strategies- Breadth First Search,Uniform Cost Search, and Depth First Search.

Informed Search Strategies- Introduction, A* Search Algorithm and example, Heuristic Function - Admissibility and Consistency, Memory Bound Search Strategies.

Local Search Strategies- Introduction, Simulated Annealing, Local Beam Search Algorithms, Global Search.

Unit-IV Intelligent Agents

Introduction to Game playing Agents, Alpha Beta Pruning and Move Ordering, Min Max Algorithm Imperfect Real Time Decisions, Cutting off search, Forward pruning, and Alternate approaches for developing Artificial Intelligence based Game programs.

Unit – V Prolog

Basic concept of programming languages related to artificial intelligence problems, concept of programming in Logic, basic prolog constructs, Applications of Prolog, Relations in Prolog

Family Relationship in Prolog, Data Objects - Introduction, Data Objects - Atoms and Numbers, Variables, Structures, Representation of Lists. List Operations Membership, Length Calculation, Concatenation, Union of two Lists, operations on Lists such as Intersection of Two Lists. Types of Operators- Comparison, Arithmetic Operators, Structures and Matching in Prolog, Built in Predicates- Identifying Terms, Decomposing Structures, Inbuilt Mathematical Predicates

Text books

1. Russel and Norvig, Artificial intelligence A Modern Approach, 2nd Edition, PearsonPrintice Hall Publication, 2010.

Reference Books

1. Kevin Knight , Elaine Ric, Artificial Intelligence, Tata mcgraw Hill publishing house,2017
2. Winston, Artificial Intelligence, PHI publication, 2006.

Course Code	**CSC604**
Course Name	**Artificial Intelligence Lab**
Number of Credits	**0-0-2-1**

Lab Objective

- To get familiarize with advanced topics of the Artificial Intelligence using Prolog..

List of Experiments

Implement following problems using Prolog-

1. Check if a given element is present in the List or not
2. Find total number of elements in a list
3. Check if a list is sorted or not.
4. Represents facts in Prolog
5. Implement Tower of Hanoi
6. Implement chess quiz challenge puzzle
7. Implement Water Jug problem
8. Implement A Puzzle of 8 Blocks Movement
9. Implement Monkey and Banana Problem
10. Implement Farmer Crosses River Puzzle

Course Code	**CSC603**
Course Title	**Advance Software Engineering**
Number of Credits	**3-0-0-3**

Course Objective

To enable the students to understand Advance Software Engineering principles specially the principles of software testing and Project deployment in detail. By the end of this course student will be able to design both manual as well as automated software testing strategies and have command on Project testing and Containerizing software Applications

Unit-1 Introduction

Introduction to software design Principles, testing misconceptions, Objectives, Debugging, Quality Assurance, management and Control and testing, Error defects and failures, Defect root causes and effects analysis, testing principles, Test Planning, monitoring, control, activities and Test Analysis, Traceability Matrix.

Unit-2 Test Techniques

Black-box vs. White-box Test Techniques Introduction and need, examples, - boundary value Analysis, Decision, cause Effect Graphing techniques, Decision and Branch coverages table, Test Organization.
Test Estimation Techniques. Cost Estimation Techniques Functional Point Analysis.

Unit-3 Software Reviews

Review of SDLC Models, Reviews Techniques - Key terms, Static Testing Basics, Work Products Static Testing, Benefits of Static Testing, Static vs. Dynamic Testing, Review Process, Work Product Review Process, Roles and responsibilities in a formal review, Review Types, Applying Review Techniques, Success Factors for Reviews.

Unit-4 Introduction to Automation Tool

Basic introduction to Selenium, Understanding the core concept of Browser driver classes and WebdriverInterface, running test cases in browser, basic Selenium WebDriver methods, locators in Selenium WebDriver- id, Xpath, CSS Selectors, Name, ClassName, TagName, Link Text, Identifying the Web elements using locators. Techniques to automate Web elements such as checkbox, dropdown, Synchronization in Selenium etc.

Unit-5 Introduction Docker & Containerizing Applications

Introduction to Docker- Traditional Workflow vs, Industry Need, Docker Architecture and Docker Hub OS level Virtualization, Advantages, Disadvantages, DocerFiles and Container creation, Volumes and their Sharing. Docker port expose and publish
Importing images from docker hub, Containerizing- creation, removing, operations on containers, images.

Course Outcomes

1. Understanding of Testing techniques
2. Automation Testing using Selenium
3. Project Deployment and Containerizing software Applications concepts

Text Books

1. Pressman, R. S., "Software Engineering: A Practitioners Approach, 7 th edition", McGraw Hill, 2010.
2. Docker Demystified: Learn How to Develop and Deploy Applications Using Docker by Saibal Ghosh Publisher BPB Publications
3. Selenium with Java – A Beginner's Guide: Web Browser Automation for Testing using Selenium with Java by Pallavi Sharma , Publisher : BPB Publications

Reference Books

1. Sommerville, Ian, "Software Engineering", Addison-Wesley 9 th Edition, 2011.

2. Jalote Pankaj, "Software Project Management in practice", Pearson Education, New Delhi, 2002

Course Code	**CSC605**
Course Title	**Advance Software Engineering Lab**
Number of Credits	**0-0-2-1**

Lab Objective

To get familiarize with advanced topics of the Software engineering specially - Software Testing using selenium as open-source tool and Containerizing software applications.

List of Experiments

1. Understanding manual testing through excel
2. Understanding the core concept of Browser driver classes and Webdriver Interface
3. Run tests in Browser like - Google Chrome, Microsoft Edge
4. Getting Started with basic Selenium WebDriver methods
5. Identifying the Web elements using following Locators (with Live examples)
    - id
    - Xpath
    - Css Selectors
    - Name
    - ClassName
    - TagName
    - Link Text
6. Techniques to identify objects using Regular Expressions.
7. Explore functional testing using selenium.
8. Docker Installation- windows/ubuntu/EC2
9. Operations on images –

- Pull a centos/ubuntu image from dock hub
- Create a container for the pulled images.

10. Finding number of images, containers running on Host Machine and various relevant operations such as
    - Finding number of Processes running on host machine vs process running inside container.
    - Existing containers, renaming containers, collecting container statistics, removing container history, inspect
11. Pulling, Removing, zipping, tagging various docker images.
12. Creating a Docker image without Dockerfile
13. Practice Basic Dockerfile Directives
14. Practice Containerizing using DocerFiles

List of Electives in 6th Semester

Course Code	**CSC651**
Course Title	**Machine Learning**
Number of Credits	**3-0-0-3**

Course Objectives

This course objective is to provide an overview of Machine Learning and its application in real life. The primary objective is to introduce student to the fundamental principles and methodologies of Machine Learning

Course Contents

Unit-I Introduction to Machine Learning Pipeline

Introduction to Machine learning Pipeline, Problem definition, Data ingestion, Data preparation, Datasegregation, Candidate model selection Model deployment, Performance monitoring.

Unit-II Basics of Feature Engineering

Feature Selection and Feature Engineering- Univariate selection, Correlation heatmaps, Wrapper-basedmethods,Filter-based methods,Embedded methods,

Feature engineering-Imputation, Outlier management, One-hot encoding, Log transform, Scaling, Datemanipulation

Unit-III Supervised Learning

Supervised versus unsupervised learning, classification, Preprocessing data,Binarization,Mean removal, Scaling,Normalization,Label encoding, Logistic regression classifiers, k- Nearest Neighbour (kNN), The Naïve Bayes classifier, Confusion matrixes ,Support Vector Machines.
Decision tree, Building a decision tree classifier, Building a decision tree classifier, random forests, Regression- Simple, Multiple linear regressions, Problems in Regression Analysis.

Unit-IV Unsupervised Learning

Introduction, Applications, Clustering as a machine Learnig task, clustering types, partitioning methods, k-medoids, hierarchical clustering, and density based methods, Association rules, apriori algorithm for association rule learning

Unit-V ML Evaluation Technique

Classification metrics- Accuracy, confusion matrix, Per-class accuracy, log-loss, AUC, Ranking Metrics-Precision-Recall, Precision-Recall Curve and the F1 Score, NDCG Regression Metrics-RMSE, Quantiles of Error, difference between Training metrics and EvaluationMetrics. Offline Evaluation Mechanisms: Hold-Out Validation, Cross Validation, and Bootstrapping

Course Outcomes

- Ability to understand the principles of Machine Learnig..

Text Books

1. Saikat Dut, Subramanian chandramouli, Amit Kumar Das, "Machine Learning, 2020 *Edition*",Pearson, 2020.
2. Tom, Mitchell, "Machine Learning", McGraw-Hill, 2017.

Reference Books

1. Ethem, Alpaydin, "Introduction to Machine Learning", PHI, 2005.
2. 2. H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques",Morgan Kaufmann, 2000.

Course Code	**CSC691**
Course Title	**Organizational Behavior**
Number of Credits	**3-0-0-3**

Objectives

- To develop an insight into the nature and meaning of Organizational Behaviour.
- To provide the learner with conceptual and theoretical foundations ofOrganizational Behaviour.
- To enhance learner efficacy by raising their understanding of basic concepts in Organizational Behaviour - stress, conflict, group dynamics etc.

Unit – I: Introduction to OB

Definition and Nature of OB, Diversity, Ethics, Culture.Reward systems and Organizational Behaviour. Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification.

UNIT-II: Theoretical Perspective

PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits. PERCEPTION and VISUAL COMMUNICATION: Theories of visual communication: Gestalt, Constructivism, Ecological, Semiotics, Cognitive. MOTIVATION: Theories of motivation: Herzberg's Two Factor theory, Maslow's Need Hierarchy theory.

UNIT-III: Dynamics of OB I

COMMUNICATION: communication and its Types, Barriers to communication. GROUPS IN ORGANISATION: Nature, Types, Group Cohesiveness, Effective Team Building, Stress and Conflict: Meaning and types of stress.

Unit – IV : Dynamics of OB II

LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Groups Vs. Teams, Nature of groups – group dynamics.

Course Outcomes

After the completion of the course the learner should be able to:

- Understand the nature and meaning of Organizational Behaviour.
- Appreciate the conceptual and theoretical foundations of Organizational Behaviour.
- Raise awareness and knowledge of basic concepts in Organizational Behaviour and theirsignificance for groups and organization.

Course Code	**CSC692**
Course Title	**Professional Ethics**
Number of Credits	**3-0-0-3**

Course Objective

- To enable the students to create on awareness on Engineering Ethics and Human Values, toinstill Moral and Social Values and loyalty and to appreciate the rights of others.

Course Contents

Unit-I Human Values: Morals, values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Character, Spirituality, Introduction to Yoga and meditation for professional excellence and stress management.

Unit-II Engineering Ethics: Senses of 'Engineering Ethics', Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self-interest, Customs and Religion, Uses of Ethical Theories.

Unit-III Engineering as Social Experimentation: Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law.

Unit-IV Safety, Responsibilities and Rights: Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights, Intellectual Property Rights (IPR), Plagiarism, Discrimination.

Unit-V Global Issues: Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility.

Course Outcome

- Students will be able to apply ethics in society, discuss the ethical issues related toengineering and realise the responsibilities and rights in the society.

Text Books

1. Martin Mike W., Schinzinger Roland, "*Ethics in engineering*", Tata Mc Graw Hill, 4th Editin,2005.
2. Govindarajan M., Natarajan S., Senthilkumar V.S., "*Engineering Ethics",* Prentice Hall of India,2013

Course Code	**CSC661**
Course Name	**Internet of Things**
Number of Credits	**3-0-0-3**

Course Objectives

The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. It is becoming the Internet of Things (IoT). The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things

Course content

Unit I IOT – What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

Unit II IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards –Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer Security

Unit III IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Unit IV WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web Architecture StandardizationforWoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals andBusiness Intelligence

Unit V IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT,

Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Course Outcomes

- Understand the application of IoT.
- Use of Devices, Gateways and Data Management in IoT.

Text Books

- Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
- Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the InternetofThings", Springer, 2011.
- David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
- Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

Reference Books

- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach Connecting Everything", 1st Edition, Apress Publications, 2013
- CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Course Code	**CSL661**
Course Name	**Internet of Things Lab**
Number of Credits	**0-0-2-1**

Lab Objectives

- The lab course provides the complete description about inner working of a IOT.
- Market forecast for IoT devices with a focus on sensors

List of Experiments

- Study and Install Python in Eclipse and WAP in Data Types in Python
- A program for arithmetic operation in Python
- A program Looping Statement in Python
- Study and Install IDE of Arduino and Different Types of Arduino
- Define and Explain Eclipse IoT Project.
- List and summarize few Eclipse IoT Projects.
- Sketch the architecture of IoT Toolkit and explain each entity in brief.
- Describe gateway-as-a-service deployment in IoT toolkit.
- Explain application framework and embedded software agents for IoT toolkit.
- Study and Configure Rasberry Pi.

--**Note** The Instructor may add /tune experiments, wherever he/she feels in a justified manner

Course Outcomes

- To understand Python Scripting Language which is used in many IoT devices
- Ability to Understand Raspberry PI platform, that is widely used in IoT applications

Text books:

1. Banerjee, Mrityunjoy (1995). *Organization Behaviour* . Allied Publication: New Delhi.
2. Newstorn, John W and keita, Davis (1999). *Organization Behaviour.* Tata McGraw Hill: NewDelhi.
3. Pareek, Udai and Khanna, Sushama (2016). *Understanding Organizational Behaviour.* 4th ed.,Oxford University Press: New Delhi.

Reference books:

4. Etizioni, Amtai (1995). *Modern Organizations.* Prentice Hall: New Delhi.
5. Luthans, Fred (1998). *Organization Behaviour.* McGraw Hill: Boston 1998
6. Prasad, L.M (2003). *Organizational Behaviour.* S. Chand & Sons: New Delhi.
7. Robins, Stephen P . (1999). *Organization Behaviour.* Tata McGraw Hill: New Delhi.

Syllabus for 7th and 8th Semester

Course Code	**CSC701/CSC801,CSL802**
Course Name	**Industry Internship Project/Inhouse Internship**
Number of Credits	**0-0-42-21**

Detailed Guidelines regarding Industry internship and in House are attached in Appendix -1

Course Code	**CSC702/CSC802**
Course Name	**Major Project/ Major Project**
Number of Credits	**0-0-10-5**

The major project work is a major project designed and developed under the guidance faculty mentor. This could be an extension of mini project or a fresh project equivalent to its credits. This aims to perform detailed learning of latest technologies in industry/ research and implement it by the end of semester.

At the end of semester, the Major project work should have been demonstrated and work done will be evaluated.

List of Electives

Course Code	**CSC751/ /CSC851**
Course Title	**Soft Computing**
Number of Credits	**3-0-0-3**

This course concentrates on a sub-branch of AI, namely Computational Intelligence (CI) – the study of adaptive mechanisms to enable or facilitate intelligent behaviour in complex and changing environments. These mechanisms include those AI paradigms that exhibit an ability to learn or adapt to new situations, to generalize, abstract, discover and associate.

Course content:

Unit-1 Introduction - The Case for Imprecision, An Historical Perspective, The Utility of Fuzzy Systems, Limitations of Fuzzy Systems, Statistics and Random Processes, Uncertainty and Information, Fuzzy Sets and Membership, Chance versus Fuzziness, Sets as Points in Hypercubes, Soft Computing, Fuzzy System, Genetic Algorithm, Particle Swarm optimization introduction.

Unit-2 Fuzzy Sets – Basic concepts of Crisp Set, Operations on Sets, Properties of sets, Fuzziness, vagueness and Inexactness, Set Membership, Features of Fuzzy sets- Normality, height, Support, Core, cardinality, Fuzzy Membership Functions like Triangular function, Trapezoidal function, Gaussian function and *S*- function, transformations to membership functions. Linguistic variables. Operations on Fuzzy Sets, Fuzzy relations and Operations on fuzzy Relations.

Unit-2 Fuzzy Logic- Fuzzy logic Basics, Fuzzy Rules- Fuzzy if-then, Fuzzy if-then else, Fuzzy Reasoning- Quantifiers, Fuzzification of Input Variables, Evaluation of Fuzzy Rules, Aggregation , Defuzzification methods- Centroid Method, Centre–of-Sum (CoS) method, Mean- of- Maxima(MoM) method, Practical implications of Fuzzy logic, fuzzy controller system, fuzzy decision support system.

Unit-4- Genetic Algorithm -Introduction to evolutionary algorithms, Optimization problems, Chromosome, Chromosome encoding/decoding, Selection, GA Operators - Crossover, Mutation, Genetic Algorithm (GA)- fitness function, Population, parameters, GA Convergence, Single Objective vs. Multi objective GA, The Pareto-optimal Front.

Unit-5- Particle Swarm Optimization Introduction -Optimization problems with single objective function, PSO with bounding velocity, constraint optimization, discrete optimization, multi-objective PSO.

TEXT BOOKS

1 Sivanandam, S. N., and S. N. Deepa., , 2007. *PRINCIPLES OF SOFT COMPUTING.* John Wiley & Sons

2. Mohan, C., 2015. *An introduction to fuzzy set theory and fuzzy logic*. MV Learning.

REFERENCES:

1. Engelbrecht, A.P., 2007. Computational Intelligence: An Introduction.

2. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989.-

Course Code	**CS761/CSC861**
Course Title	**GPU Computing**
Number of Credits	**3-0-0-3**

Course Objectives:

- Distinguish between traditional computing and GPU computing the data-parallel execution models.
- Describe a typical GPU architecture and programming model.

Course Contents:

Unit 1: Review of Traditional Computing

Review of traditional computing model; Flynn’ s taxonomy; multithreading and concurrency; a brief history of GPU computing.

Unit 2: Fundamentals of GPU Computing

GPU architecture; stream processors, cache hierarchy, graphic pipeline; data parallel execution model; GPU programming model; problem decomposition and mapping; synchronization.

Unit 3: Programming GPUs with CUDA

CUDA device architecture; threads, blocks, grids, warps; scheduling; CUDA memory hierarchy, local memory, global memory, constant memory and texture memory; CUDA examples; CUDA profiling and optimization

Unit 4: Programming GPUs with OpenCL

OpenCL syntax; OpenCL device architecture; OpenCL execution model; OpenCL examples; OpenCL profiling and optimization

Unit 5: GPU Algorithms and Applications

Parallel prefix sum; parallel convolution; parallel histogram; video processing; options pricing on the GPU;

Course Outcomes:

- Ability to write efficient CUDA programs and execute them on a GPU.
- Ability to write efficient OpenCL programs and execute them on a GPU.

Text Book:

6. Kirk, David B., and W. Hwu Wen-Mei. Programming massively parallel processors: a hands-on approach. Morgan kaufmann, 2016.
7. Gaster, Benedict, Lee Howes, David R. Kaeli, Perhaad Mistry, and Dana Schaa. Heterogeneous computing with openCL: revised openCL 1. Newnes, 2012.

Reference Book:

1. CUDA C++ Programming Guide. Available here https://docs.nvidia.com/cuda/cuda-c-programming-guide/index.html
2. AMD APP SDK, OpenCL User Guide. Available here http://developer.amd.com/wordpress/media/2013/12/AMD_OpenCL_Programming_User_Guide2.pdf

Course Code	**CSL761/CSL861**
Course Title	**GPU Computing LAB**
Number of Credits	**0-0-2-1**

Lab Objectives:

- Ability to write efficient CUDA programs and execute them on a GPU.

List of Experiments:

1. Installation of GPU CUDA Environment Setup and Hello World Program.
2. Write and test CUDA program for Matrix-Matrix Multiplication.
3. Write and test CUDA program Vector Reduction.
4. Write and test CUDA program for Vector Reduction with Unlimited Input Elements.
5. Write and test CUDA program to find solution of simultaneous linear equations.
6. Write and test CUDA program for Strassen Matrix multiplication.
7. Write and test CUDA program to implement Monte Carlo algorithm.
8. Write and test CUDA program for DES encryption and decryption.
9. Write and test CUDA program for AES encryption and decryption.
10. Write and test CUDA program for random number generation.

Lab Outcomes:

- Understanding of how Graphics Processing Unit (GPU) helps in implementing complex parallel computing applications.

Course Code	**CSC771/CSC871**
Course Title	**Blockchain Technologies**
Number of Credits	**3-0-0-3**

Course Objectives:
To give students the understanding of emerging abstract models for Blockchain Technology and to familiarize with operational aspects of Blockchain Technology and Development..

Course Contents:

Unit-1 Introduction to Blockchain

Understanding Ledger, Types of Ledgers, Peer to Peer Network, Blockchain Introduction- Block Structure, Blockchain Features, Types of Blockchain- Public and Private, permissioned Blockchains.

Unit-II Cryptography in Blockchain Technology

Cryptography Introduction, Introduction to Public and Private Keys, Categories of Cryptography- Symmetric and Asymmetric cryptography, Hash Function, Merkle Tree.

Consensus Algorithms - Introduction to Consensus, The Two General Problem, Byzantine General's Problem, Byzantine Fault Tolerance, Proof of Work Consensus, Drawback of Proof of Work Consensus, Proof of Stake Consensus, Transaction Flow in Blockchain.

Unit-III Public Blockchains-

Bitcoin: Introduction, Life Cycle of Transaction, Bitcoin Mining, Bitcoin Wallets, Bitcoin Wallets Installation, Bitcoin Networks, Bitcoin Explorer

Ethereum vs. Bitcoin, Smart Contract Introduction, Ethereum Virtual Machine Introduction, Ethereum Gas Introduction, Ethereum Development Life Cycle, Solidity Basics, Remix IDE Introduction, Smart Contract Development Use Case, Smart Contract Development, Compile Smart Contract.

Unit- IV Permissioned Blockchain

Enterprise Blockchain, Enterprise Blockchain Components, Hyperledger Fabric Introduction, Hyperledger Fabric Transaction Cycle, Hyperledger Fabric Setup Prerequisites, Hyperledger Fabric Setup, Hyperledger Fabric Networks, Hyperledger Fabric Dev Network, Hyperledger Fabric Test Network, Chain code Introduction, Chaincode Life Cycle, Chaincode Development Ways, Chaincode Development Use Cases.

Unit V - Private Blockchain: Multichain

Multichain Blockchain Introduction, Multichain Features, Multichain Architecture, Multichain Setup, Create Multichain Blockchain, Multichain Assets, Multichain Streams, Multichain Streams Handson, Multichain Mining Introduction, Perform Mining in Multichain

Course Outcomes:

- Describe the primitives of Blockchain Technologies and development.

Text Book:

1. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing
2. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Book:

3. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
4. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform,

Course Code	**CSC781/CSC881**
Course Title	**Operations Research**
Number of Credits	**3-0-0-3**

Course Objectives

- To provide quantitative insight and understanding of fundamental methods of linear programming problems.
- To demonstrate the powerful capabilities of optimization theory to enable reducing costs, improving efficiency, optimal usage of resources and providing benefits in many other key dimensions in engineering / industry / managerial / decision making problems.
- To have flavor of both sound theoretical foundation of various methods and their actual implementations in problems solving.

Course outcomes:

- Understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type.
- Build and solve Transportation and Assignment Models.
- Design new simple models, like: CPM, PERT to improve decision–making and develop critical thinking and objective analysis of decision problems.

Course content:

Unit I-Introduction: Hyperplane and hyperspheres, Convex sets and their properties, Convex functions, Linear Programming Problems; Formulation through examples, Basic feasible and optimal solutions, Extreme points, Graphical Method, Simplex Method, Big-M Method, Degeneracy, Duality and Dual LPP and its properties, Dual simplex Algorithm and sensitivity analysis.

Unit II -Transportation Problem: Mathematical formulation, basic feasible solution, North-West Corner Method, Least Cost Method, Vogel's approximation Method, Optimal solution by U-V Method, Stepping Stone Method, Degeneracy in Transportation problem.

Unit III Assignment Problem: mathematical formulation, solution by Hungarian Method, unbalanced problem, Traveling Salesman problem and its solution.

Unit IV- Game Theory: Two-Person Zero sum games, The Maximin-minimax principle, pure and mixed strategies, graphical solution, Dominance property, General solution of mxn rectangular games, Linear programming of GP.

Unit V-Network Analysis: PERT: Background, development, networking, estimating activity time, Determination of earliest expected and allowable times, determination of critical path, PERT cost, scheduling of a project, CPM method, Applications of these methods

Books:

Text:

1. Operations Research by V.K. Kapoor, Sultan Chand & Sons
2. Operations Research by K.Swarup, P.K.Gupta and Man Mohan,Sultan Chand and Sons.

References

1.Introduction to Operations Research by F.S. Hillier and G.J. Libermann, McGraw Hill.

2.Linear Programming by V. Chvatal, W.H. Freeman publishers.

3.Mathematical Programming: Theory and Methods by S.M. Sinha, Elsevier Publications.

4.Linear programming by G. Hadley, Narosa Publishing House.

5. Operation Research: An Introduction by H. A. Taha, Prentice Hall of India.

Course Code	**CSC782/CSC882**
Course Title	**Research Methodology**
Number of Credits	**3-0-0-3**

Course contents:

Unit-1 Introduction-

Nature and Purpose of Research: Meaning of research, aim, Nature and scope of research, Prerequisites of research, Types of research: Exploratory, Descriptive and Experimental. Research Problem: Types of research problems, Characteristics of a good research problem, Hypothesis: Meaning and types of hypotheses, Research proposal or synopsis. Research Methods: Qualitative and Quantitative

Unit-2 Data Collection and Analysis

Types of data, Methods of data collection, Sample and Population, Sampling Techniques, Characteristics of a good sample, Tools of Data Collection: Observation method, Interview, Questionnaire, various rating scales, Characteristics of good research tools

Unit-3- Descriptive Statistics

Tabulation, Organization, and Tabulation and Graphical Representation of Quantitative data, Measures of Central Tendencies: Mean, Median, Mode Measures of Variability: Range, Quartile Deviation, Standard Deviation, and Coefficient of variation, Correlation analysis, regression analysis. Multiple Correlation-testing of Hypothesis-Tests based on t-P, Z and Chi-square.

Unit-4 -Algorithm research & Report

Algorithmic research problems, types of algorithmic research, types of solution procedure, steps of development of algorithm, steps of algorithmic research, design of experiments.
Research Report: Structure and Components of Research Report, Types of Report, Characteristics of Good Research Report, Bibliographical Entries, Research Ethics.

Books and References

1. Research Methodologies, R. Panneerselvam, Prentice Hall, 2007.
2. Research in Education, Best John V. and James V Kahn, Wiley eastern, 2005.
3. Elements of Educational Research, Sukhia, S.P., P.V. Mehrotra, and R.N. Mehrotra, PHI publication, 2003.
4. Methodology of Research Education, K. Setia, IEEE publication, 2004.
5. Research methodology, Methods and Techniques, Kothari, C.R., 2000.

Course Code	CSC791/ /CSC891
Course Title	Data Analytics & Visualization
Number of Credits	3-0-0-3

Course Objective: To elaborate the basics of data science and provide a foundation for understanding the challenges and applications.

Unit-I: Introduction to Data Analytics: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics.
Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.

Unit-II: Data Preprocessing:
Data Cleaning and Data Integration: Missing Values, Noisy Data, Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution

Unit-III: Data Reduction and Data Transformation: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data.

Unit-IV: Data Visualization: Visualizing Data Distribution- Distribution Function, Histograms, Percentiles, Box Plots, Stratification, Heat Map, Correlation Statistics, ANOVA, Data Visualization Practices- Scatter plots, Faceting, Data Transformation, Visualizing Multimodal Distributions, Data Visualization Principles.

Unit-V: Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Practice and analysis with R/Python.
Analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalization, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.

Course Outcomes

1. Ability to manage, manipulate, clean, and analyze different types of data.
2. Ability to visualize data using different visualization techniques.
3. Ability to develop dashboards for real-time data sets.
4. Ability to understand data correlation, reduction, prediction, and summarization.

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, (3rd Ed.),Morgan Kaufmann.
2. Rafael A. Irizarry, “Introduction to Data Science”, CRC Press, 2019.
3. Roger D. Peng R Programming for Data Science Reference Books: Trevor Hastie Robert, Tibshirani Jerome Friedman, The Elements of Statistical Learning, Springer

Appendix-1

Indian Institute of Information Technology Sonepat

Industry Internship Project/ InHouse Internship

Common Guidelines
for
Department of Computer Science and Engineering and Information Technology

This manual is intended only for use by students, TnP/ IRC members/industry mentors for planning, facilitating and implementing Internship course. It is a useful resource that provides guidelines to all stakeholders who are involved in this course

Introduction

Internship is an educational endeavor at IIIT Sonepat linking holistically the industry experience with university instruction. It is an effort to enable students to develop learning in unacquainted work life situations and understand the rapidly changing needs and challenges of a professional workplace. In the present day scenario, it bears an economic relevance to the society by creating a sound base for experiential and cooperative learning thus promoting innovation and research in the country.

The Internship course provides students with the opportunity to intern in the professional setting of a company, and help develop their abilities as a professional. Internship is a course with twenty (21) credit units and all Academic Regulations that apply to on-campus courses shall also apply to Internship. The duration of Internship is of **16 to 20** weeks and it's offered during the seventh semester after the students have completed three years of course, which consists of a judicious mix of Foundation, Skill, Perspective, Core and Elective courses. Internship is an integral part of the curriculum. The student is awarded letter grades, and the grades are included in the CGPA calculations. This ensures the minimum requirement for encouraging learning and maintaining academic rigor. Internship provides a comprehensive exposure to the professional workplace, to understand real-time industry scenarios, to learn organization structure and function, to develop personality traits, and to enhance communication and presentation skills.

Course Outcome

After completion of this semester long course the student trained in his specialized area of operation

- Will be able to critically think, observe and communicate
- Will acquire the work experience through advance learning (in terms of depth, complexity and engagement) in an industrial environment
- Will be able to apply, extend and test the knowledge gained from class room experience to understand and mitigate complex issues and address real industry challenges
- Will be able to assimilate technical and administrative or managerial skills from his interactions with a variety of individuals, systems and practices

Evaluation Scheme

Evaluation Component	Weightage	Due Date
Mid Semester Marks as Submitted through TnP	20	As Per Academic Calendar
End Sem Project Report Assessment	30	
Endsem Seminar Presentation (Departmental Review by IRC/faculty Mentor, IIIT Sonepat)	50	
TOTAL	100	

*Midsem grading for Industry Internship will be submitted by TnP cell by following standard benchmarks/bifurcation/Performa for 20 Marks such as feedback from industry/ Mid sem report/ppt/ etc., whereas for InHouse Students it will be carried out by the IRC/faculty Mentor.

The Records of Evaluation will be submitted to Exam office (Internship Evaluation Sheet + Statement of marks (refer Annexure -1) + (one Industry Internship Report Hard bound copy for Library Purpose).

Role and responsibility of student

- Student should be proactive in finalizing the project titles in consultation with the industry mentor.
- Once the project titles are finalized, student should immediately inform the faculty mentor of the same. Students should ensure that project title is finalized by the end of first month of commencement of Internship.
- The student should opt for **PROJECT TITLES** that are in line with the course outcomes. The project goals must have appropriate academic rigor and industry relevance. The outcomes/deliverables should be useful for the industry in terms of productivity, quality and performance.
- Students need to prepare a **MID-SEMESTER PROJECT REPORT** to be submitted electronically to TnP keeping the Industry Mentor in CC. A copy of the report should be uploaded in the **GOOGLE LINK** that will be sent to you through TnP. This report along with feedback from industry will form the basis of mid-sem evaluation along with presentation and viva-voice, if required. The format for Project Reports can be found in Appendix. The Performa for the Mid Semester is attached here.
- Students need to prepare a **FINAL ENDSEM PROJECT REPORT** to be submitted in **Hard Copy format** to Internship Review Committee(IRC) at IIIT Sonepat during their end-sem presentation. **Two Hard Bound copies** of the Internship project report should be carried by the student during the end-sem presentation. This report will form the basis of final project evaluation along with presentation and viva-voice. The format for Project Reports can be found in Appendix.
- During Internship, if a student miss a day(s) due to bad weather or illness, then he/she must inform over Email to the Industry Mentor while keeping the TnP in CC. Absence from Internship continuously for a duration not

exceeding 3-days, will require the approval of the TnP cell. In such cases, the TnP will approve your leave over email by keeping the Industry Mentor in CC.

- The student will act as a bridge between the Industry Mentor and TnP/IRC/Faculty Mentor. This is only possible, if the student timely completes and meets the evaluation scheme stated above and actively engaging with all stakeholders. Always remember that attendance and promptness are expected.
- Student is expected to facilitate conversation or exchange of information between the TnP and Industry Mentor.
- TnP may make surprise visits (or calls) to Industry Mentor following proper channel; if a student does not update performing well or not sincere in his/her work.
- Any violation of Code of Conduct during the Internship program will be liable to disciplinary action from the Institute.

Note- In case a student score Letter "F" grade in Internship course then he/she has to repeat the internship.

Role and responsibility of TnP

Following are the roles and responsibilities of the TnP

Activities	**Due Date**	**Quality Check to ensure**
Moderating and handholding the student in the selection of Industry and guiding regarding all guidelines/ rules of Internship with due consultation with Industry Mentor	First week of Start of Internship	To ensure that Rules are shared by student to respective faculty mentor.
Conducting Midsem Evaluation by TnP, Viva Voce, evaluating Mid-sem Project Report and submission of Midsem grading	To be completed between As per academic calendar	1. Ensure that student submits his Midsem project report to TnP keeping Industry Mentor in CC. 2. Submit Midsem marks and Internship completion certificate to the office IIIT as per academic calendar 3. Submit database of Student interns across various industries/organization.
Conducting Endsem Seminar, Viva Voce, evaluating Final Project Report (In presence of IRC)	As per academic calendar	Ensure that student prepares his Endsem project report as per the guidelines given in the handout and submit hardcopy to department. Finalize all marks leading upto End-sem

Role and responsibility of Industry Mentor

Following are the key facilitation requirements from the Industry Mentor to successfully conduct Internship course leading to awarding grades to those students who fulfill all the requirements of the course:

Activities	**Source of Information Flow**	**Due Date**
Help extended to student during Induction to Internship	Student will directly contact the industry mentor after allocation to concerned department by company HR	1st Week of Internship
Sharing Email ID and contact information with TnP.	Student will submit the details through a GOOGLE FORM sent to them through TnP.	2nd week of Internship
Allocation of project title to student, the project titles should meet the course outcomes outlined above	Student will discuss with Industry Mentor and share the Project Title with TnP and CC to Faculty Mentor/IRC members.	3rd Week of Internship
Moderating the goals and key specific objectives of the Project.	The deliverables of the Project (Improvement in Quality, Cost and Productivity) will be decided by the Industry Mentor	4th Week of Internship
Handholding the student in preparing an action plan to achieve the deliverables	TnP and Industry Mentor will collaborate to address the specific goals of the Project and the student will **document** the action plan	4th Week of Internship
Quick Interaction and Feedback of student performance with Industry Mentor	If possible, please spare some time (preferably in person) to share student feedback and his progress with the TnP cell during the one-to-one interaction/through electronic media.	Once each during the middle and end of the Internship Period

Moderating and approving the **Final Project Report** to be submitted to the Institute	• Please check, verify and sign the Final Project Report • Please guide the student to adhere to copyright violations/policies (if any) while documenting his work in the report	
Taking time out to fill M**idsem feedback**	The document will be personally shared by the TnP cell (either in hard or soft copy format, based on your convenience). Please kindly fill and return the form over TnP email.	Once during the middle of the Internship Period. Mid Term Evaluation to be done as per academic calendar

Appendix-1: GUIDELINES FOR THE PREPARATION OF A PROJECT REPORT

1.1 INTRODUCTION TO PROJECT REPORT

A project report is one of the main components of evaluation in Internship. After the completion of a project, a student submits a report on the project carried out by him. This report is usually termed as project report. The weightage given to this component of evaluation is can be found in the evaluation scheme detailed above. This report will be scrutinized by a faculty coordinator/ IRC committee for subsequent grading.

Writing a report is no less than an art. It is a written exposition of your work, which tells about the project, methodology adopted, reporting results and discussion, testing theories and validation. Please note that it is not just some documentary evidence showcasing the quality of your work, but also an useful source of information to other fellow students and teachers alike. It is a valuable record, which is often referred to by persons working in that area. It is written to inform the reader and acquaint him/her with the results arrived at and the conclusions reached. It is therefore essential that the report is written and organized in such a manner that a reader has no difficulty in understanding it.

Here in this note we present a format with appropriate guidelines on writing a report on a Internship project. It is therefore expected that all the reports submitted by the intern students should conform to the suggested format and structure.

1.2 PAGE SET-UP & NUMBER OF COPIES

The size of the report should be such that it is easy to use, handle, and preserve the report. Also, the writing should be such that a reader is able to read it with ease.

For this purpose, please note the following:

(a) Size 9" x 11", which is called the quarto size and is usually known as the "thesis size"(A4).

(b) Writing of the report: The report should be written or typed in double space on one side of the sheet and the pages should be numbered serially.

(c) Margin: About 1" on all the four sides of the sheet.

(d) No. of copies: 4 hard bound copies (One for Industry mentor, one for student, one for Faculty Mentor and One for Departmental record)

1.3 CONTENTS OF PROJECT REPORT

Apart from the top cover, the report should contain the following:

(a) Cover page

(b) Certificate

(c) Joining Report

(d) Acknowledgements

(e) Abstract Sheet

(f) Table of Contents

(g) A brief introduction of the organization's business sector

(h) Overview of the organization

(i) Plan of your internship program

(j) Introduction

(k) Main Text

(l) Outcomes

(m) Conclusions and/or Recommendations

(n) Appendices(if necessary)

(o) References

We now elaborate these items in some detail.

(a) Cover page

These are the first pages of the report. It should contain the title of the report, name(s) of the author(s), name of the organization and the name of the institute. The format of these pages should adhere to the specifications. Title should not exceed 100 characters including blanks, etc.

(b) Certificate

Prescribed format of certificate to be issued by the supervisor from industry must be mandatorily part of your final project report. The template for the same is given in Appendix.

(c) Joining Report

Please see Appendix for the Joining Report Format.

(d) *Acknowledgements*

There are many persons who may have helped a student during the work carried out by him in his project. It is one's duty to acknowledge it and thank them for their help.

Customarily, thanks are due to the following in the order given below:

(i) Head of the organization (Director/ Dean/HoD. Etc)

(ii) Co-ordinator of the Internship programme at the organization.

(iii) Professional expert in charge of the project

(iv) Faculty of the Institute

(v) Other persons(form the organization and/or outside the organization, etc)

(e) *Abstract*

This is the third page of the report. It is one of the important pages. A reader, on going through it, should be able to know what the project is, who wrote it and under whose supervision, what has been done (in brief), how it has been done, what the main results are, etc. A format of this page is given. Student should give two extra copies of this page duly filled.

This page contains the abstract. Every report must have it. The abstract is written to allow the reader to determine what kind of information is given in the report and to point out its key features. It is never intended as a substitute for the original document, but is meant to contain sufficient information to allow the reader to ascertain his interest. The abstract should be concise. Only in unusual case should it contain more than 200 words. The nomenclatures used should be meaningful, that is, only standard terminology should be used.

(f) *Table of Contents*

The table of contents is in the same form as it is found in any book. The main divisions as well as the subdivisions should be listed together with the number of the first page on which it appears.

For example:

CONTENTS Page no.

(g) A brief introduction of the organization's business sector (Note: 1 Page maximum)

Provide an overview of the main area or business sector in which the organization falls into, i.e., telecommunications, manufacturing, financial service etc. Here you should discuss the main business sector and NOT the organization under consideration. For example, if the organization is in the telecommunication sector, then you should briefly describe all aspects of this sector in Indian context. You should NOT include an introduction of your Internship Company here as this would be covered in the next section.

(h) Overview of the organization (Note: 3 Pages maximum)

- Brief history
- Business size (Total number of stocks, commodities, number of employees etc)
- Product lines (list complete range of products/services)
- Competitors
- Brief summary of all departments

(i) Plan of your internship program

- A brief introduction of the branch/department when you performed your internship
- Start and end dates of your internship
- The names of the departments you visited and the duration of stay
- Duties and responsibilities performed (Provide a detailed description of your duties and responsibilities, describe the project you were assigned

(j) Background and description of the problem

In this the problem is introduced. So, the introduction should contain the purpose of the report, sufficient background material, including literature survey to present the reader a clear picture of the work. An outline of the work should also form a part of the introduction.

The purpose of writing the introduction is to arouse the curiosity of the reader in the report. Therefore, a proper and interesting introduction should include a brief history of the topic coupled with the statement of the immediate problem, the reasons for interest in it and a discussion of the method of attack or treatment. Generally, an introduction is not more than one page. Therefore, a proper and interesting introduction should include a brief history of the topic coupled with the statement of the immediate problem, the reasons for interest in it and a discussion of the method of attack or treatment.

(k) Main Text

In this the work, the method of treatment and the results are presented. It may run into ***one or more than one chapters/section under different headings and sub-headings***.

It should ideally contain the following

- Assumptions made,
- Experimental work/data collection,
- The survey done, or algorithm presented
- A description of activities or programs or case studies outlined,
- The results obtained/illustrations,
- The discussion and interpretations, etc.

Significant discrepancies in results should be called to the reader's attention, even when it is admitted that no reasonable explanation can be offered.

(l) Outcomes

The principal outcomes as identified from the results of your analysis are to be highlighted in this section preferably in bulletted form.

(m) Conclusions and/or Recommendations (if any)

The conclusions and recommendations are based on the discussions and interpretations of the results obtained. It would be helpful to the reader if other possibilities pertaining to the stated conclusions and recommendations are discussed.

(n) Appendices (if necessary)

The contents of an appendix are essentially those that support or elaborate the matter in the main text. divert the attention of the reader from the main problem, is generally put into the Appendix. We give below some broad items, which normally form part of the appendix. These are:

- Calculation Sheets/ Lengthy derivations of mathematical formulae (if that is not the project itself)./ Supplementary details of instructions/ Flow charts/ Computer programs/ Questionnaires/ Large maps/ Nomenclature, etc.

NOTE for CSE/IT students: If the project itself is to make a computer program of some problem, then flow charts and the computer program have to be in the main body. One is expected to decide according to ones own needs.

(o) References

All the references should be given in the section called *References.* We cite below two examples of writing references.

Suppose we have to refer to a paper entitled *An Integral Equation Satisfied by the Square of Webers' Parabolic Cylindrical Function, whose* author is S.C. Mitra and which appeared in the Journal of the London Mathematical Society whose volume is 11, the year of publication 1936, and the article is published on pages 252 to 256. We shall write it as follows:

1. Mitra, S. C., " An Integral Equation Satisfied by the Square of Webers' Parabolic Cylindrical Function" *Jour. Lond. Math. Soc*., 11 (1936), pp. 252-256.

Suppose we have to refer to a book called *An Introduction to Linear Algebra* by Dr. V. Krishnamurty and others which was published by Affiliated East West Press Pvt. Ltd., New Delhi in the year 1976. This we shall write as:

1. Krishnamurty, V. & others, *An Introduction to Linear Algebra* Ist edition, Affiliated East West Press, New Delhi (1976).

[Specimen Outer cover]

A REPORT

ON

(Title of the Project in Capital Letters)

By

Name (s) of the student (s) Enrolment/Registration No.

---------- ----------

Prepared in the partial fulfillment of the
Internship Course

AT

(Station Name and Address)

Indian Institute of information Technology, Sonepat

(Month, Year)

Format of Certificate

Certificate of authenticity

CERTIFICATE

This is to certify that Internship Project of _____Name of Student_____ titled _____Title of project_____is an original work and that this work has not been submitted anywhere in any form. Indebtedness to other works/publications has been duly acknowledged at relevant places. The project work was carried during ___Start date_____ to _____End Date_____ in _____ Name of Organization_____

Signature Internship IRC member/TnP officer	**Signature of industry mentor/Supervisor**
Name:	**Name:**
Designation:	**Designation:**
(Seal of the organization with Date)	***(Seal of the organization with Date)***

Format of Joining Report

Indian Institute of information Technology, Sonepat

Internship

JOINING REPORT (to be Submitted to TnP)

Date of Joining The Internship Station _____

<table>
<tr><td rowspan="2">Period of Internship</td><td>From</td><td>To</td><td>Total Months</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Student Information</td><td colspan="2">Name</td><td>Roll No</td><td>Branch</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="4">Student's Signature with Date</td></tr>
<tr><td>Name and Address of the Internship Station</td><td colspan="4"></td></tr>
<tr><td>Location of the Project</td><td colspan="4"></td></tr>
<tr><td>Name and Designation of the Industry Guide/ Industry Mentor for the Project</td><td colspan="4"></td></tr>
</table>

	Signature of Industry Mentor
Industry Mentor Contact No.	
Industry Mentor E-mail Address	

Sample for Mid Semester Evaluation (To be Submitted by TnP) for each student

Please find below the rubrics for all Internship assessments. Casual attitude to deadlines, not communicating in time and no rigor in work done are the most important parameters to look for during assessment.

MEANING OF RUBRICS FOR MIDSEM SEMINAR (**Maximum: 40 Mark**)

MIDSEM SEMINAR: EVALUATION (to filled by industry mentor/ Shared by TnP Cell)

Criteria	Max marks	Inadequate Marks		Average Marks		Good Marks		Marks awarded
Background content	6	**Material not clearly related to topic OR background dominated seminar**	**1 to 2**	**Material sufficient for clear understanding but not clearly presented**	**3 to 4**	**Material sufficient for clear understanding AND effectively presented**	**>5**	
Motivation for study	4	**Objective and motivation of the project are not clear or described.**	**<2**	**Major research questions and context of literature are framed but not adequate**	**2 to 3**	**Major research questions and context of literature are framed and discussed. Critical background is mastered**	**4**	
Objectives of the work	14	**Not clearly defined/Yet to be defined/No scope of project work/**	**5 to 6**	**Objectives are defined but not critical or complex in nature and not equivalent to credits of work/**	**6 to 10**	**Objectives are defined/ critical and equivalent to credits of work**	**10 to 14**	
Milestones (Methods) identified	8	**Main points of the work under discussion not identified. Only learning and training with no scope for research questions**	**3**	**Methods too brief. less complex, less significant, less exhaustive/ less imaginative and less impactful on organization**	**4 to 6**	**Interesting, exhaustive and complex methods planned, time consuming analysis, significant and impactful to organization**	**6 to 8**	

Individual contribution & Knowledge of subject	4	**Significance not mentioned or just hinted/ Does not have grasp of information/ answered only rudimentary questions**	**1**	**Significance mentioned/ answered all questions but failed to elaborate**	**2 to 3**	**Significance exceptionally well explained/ Demonstrated full knowledge/ answered all questions with elaboration**	**4**	
Communication & presentation skills	4	**Low**	**<2**	**Medium**	**2 to 3**	**High**	**5**	
Expected Total	40		**1 to 16**		**19 to 29**		**29 to 40**	

(Signature of Industry Mentor)

Guidelines for Inhouse Internship

Annexure – II

Code- CSL802

Indian Institute of Information Technology, Sonepat – Institute's InHouse Plan Document

In House INTERNSHIP PLAN			
NAME OF THE PROGRAMME	B. TECH. (CSE/IT)		
PROGRAMME TITLE	Inhouse INTERNSHIP		
NAME OF FACULTY		DEPARTMENTENT	
E-MAIL		MOBILE NO.	

Internship Overview

Internships are important as they help the student in developing professional aptitude, strengthen skills, and provide a greater door to opportunity.

INTERNSHIP OUTCOMES

- ✓ To explore the domain of interest thoroughly.
- ✓ To review the state-of-the-art methods, tools, and technologies in the chosen domain.
- ✓ To formulate a problem statement for solving any real-time problem.
- ✓ To learn skills required to solve the chosen problem.
- ✓ To implement the proposed solution.
- ✓ To compare the proposed solution with currently available solutions

TEACHING AND LEARNING ACTIVITIES

Week and Date	**Discussion Objectives**	**Remarks**
As per Academic calendar	✓ Motivation ✓ Need of Internship ✓ Schedule of Intern ✓ Need of discipline and punctuality ✓ Searching the domain of interest ✓ Outcomes of internship ✓ Problem formulation ✓ Problem Objectives ✓ Specifying the reason and relevance of solving ✓ the problem ✓ Impact/ contribution in research after solving ✓ the problem ✓ Tools/Framework requirement ✓ Submitting internship plan	Through online meetings, PowerPoint Presentations & discussions.
As per Academic calendar	✓ Registration of program (NPTEL/ Udemy/Coursera) for learning tools/framework for solving the problems ✓ Attending workshops ✓ Discussion of modules in the program	Through online meetings, PowerPoint Presentations & discussions.

	✓ Approval of internship plan	
	✓ Weekly Progress Monitoring of the following tasks: ✓ Modules covered ✓ Webinar attended ✓ One research paper reading related to the application of domain	Through online meetings, Power Point Presentations & Discussion.

MILESTONE 1

- ✓ The domain is fixed.
- ✓ Problem is formulated.
- ✓ Internship objectives and plans of students for the next three months are approved.
- ✓ Course for learning required tools/framework is registered.

As per Academic calendar	✓ Weekly Progress Monitoring of the following tasks: ✓ Project Work Implementation ✓ Number of objectives covered.	Through online meetings, Power Point Presentations & Discussion.

MILESTONE 2

- ✓ Completion of training course
- ✓ Assessment of tools/framework learnt during the course with one presentation
- ✓ Completion of 40% of the project
- ✓ Mid Sem Presentations Completed.

As per Academic calendar	✓ Weekly Progress Monitoring of the following tasks: ✓ Project Work Implementation ✓ Number of objectives covered.	Through online meetings, Power Point Presentations & Discussion.

MILESTONE 3

- ✓ Completion of training course
- ✓ Assessment of tools/framework learnt during the course
- ✓ Project Work Implementation

As per Academic calendar	✓ Weekly Progress Monitoring of the following tasks: ✓ Modules covered ✓ Webinar attended ✓ One research paper reading related to application of domain	Through online meetings, Power Point Presentations & Discussion.

MILESTONE 4

✓ Comparative Analysis of proposed solution with state-of-the-art methods

As per Academic calendar	✓ Installation of Latex ✓ Learning to write a research paper ✓ Organization of paper ✓ Literature review ✓ Writing the review ✓ Writing of result section ✓ Submission of first draft of the paper ✓ Revisions of the research paper ✓ Submission of final paper	Through online meetings, Power Point Presentations & Discussion
MILESTONE 5 Submission of one research paper to a journal/conference of repute		
As per Academic calendar	✓ Submission of final report ✓ Project Demonstration ✓ Viva- Voce	Through online meetings, Power Point Presentations & Discussion
MILESTONE 6 ✓ Complete Demonstration of Project as per academic calendar ✓ Submission of project Report ✓ Submission of research paper ✓ Writing one-page write-up of the learning during internship. ✓ Final presentation and viva		

Assessment Criteria

S.no	Evaluation Component	Weightage (%)	Due Date
1.	Mid Semester Evaluation	20	As Per Academic calendar
2.	End Semester Report	30	
3.	End Semester Viva/Demonstration	50	

Appendix-1: GUIDELINES FOR THE PREPARATION OF A INHOUSE PROJECT REPORT

1.1 INTRODUCTION TO PROJECT REPORT

A project report is one of the main components of evaluation in Internship. After the completion of a project, a student submits a report on the project carried out by him. This report is usually termed as project report. The weightage given to this component of evaluation is can be found in the evaluation scheme detailed above. This report will be scrutinized by a faculty coordinator/ IRC committee for subsequent grading. Writing a report is no less than an art. It is a written exposition of your work, which tells about the project, methodology adopted, reporting results and discussion, testing theories and validation. Please note that it is not just some documentary evidence showcasing the quality of your work, but also an useful source of information to other fellow students and teachers alike. It is a valuable record, which is often referred to by persons working in that area. It is written to inform the reader and acquaint him/her with the results arrived at and the conclusions reached. It is therefore essential that the report is written and organized in such a manner that a reader has no difficulty in understanding it. Here in this note we present a format with appropriate guidelines on writing a report on a Internship project. It is therefore expected that all the reports submitted by the intern students should conform to the suggested format and structure.

1.2 PAGE SET-UP & NUMBER OF COPIES

The size of the report should be such that it is easy to use, handle, and preserve the report. Also, the writing should be such that a reader is able to read it with ease.

For this purpose, please note the following:

(e) *Size* 9" x 11", which is called the quarto size and is usually known as the "thesis size"(A4).

(f) *Writing of the report*: The report should be written or typed in double space on one side of the sheet and the pages should be numbered serially.

(g) *Margin*: About 1" on all the four sides of the sheet.

(h) *No. of copies*: 3 hard bound copies (One for Industry mentor, one for student, one for Faculty Mentor and One for Departmental record)

1.3 CONTENTS OF PROJECT REPORT

Apart from the top cover, the report should contain the following:

(p) Cover page

(q) Certificate

(r) Joining Report

(s) Acknowledgements

(t) Abstract Sheet

(u) Table of Contents

(v) A brief introduction of the organization's business sector

(w) Overview of the organization

(x) Plan of your internship program

(y) Introduction

(z) Main Text

(aa) Outcomes

(bb) Conclusions and/or Recommendations

(cc) Appendices(if necessary)

(dd) References

We now elaborate these items in some detail.

(a) Cover page

These are the first pages of the report. It should contain the title of the report, name(s) of the author(s), name of the organization and the name of the institute. The format of these pages should adhere to the specifications. Title should not exceed 100 characters including blanks, etc.

(b) Certificate

Prescribed format of certificate to be issued by the supervisor from industry must be **mandatorily** part of your final project report. The template for the same is given in Appendix.

(c) Joining Report

Please see Appendix for the Joining Report Format.

(d) *Acknowledgements*

There are many persons who may have helped a student during the work carried out by him in his project. It is one's duty to acknowledge it and thank them for their help.

Customarily, thanks are due to the following in the order given below:

(vi) Head of the organization (Director/ Dean/HoD. Etc)

(vii) Co-ordinator of the Internship programme at the organization.

(viii) Professional expert in charge of the project

(ix) Faculty of the Institute

(x) Other persons(form the organization and/or outside the organization, etc)

(e) *Abstract*

This is the third page of the report. It is one of the important pages. A reader, on going through it, should be able to know what the project is, who wrote it and under whose supervision, what has been done (in brief), how it has been done, what the main results are, etc. A format of this page is given. Student should give two extra copies of this page duly filled.

This page contains the abstract. Every report must have it. The abstract is written to allow the reader to determine what kind of information is given in the report and to point out its key features. It is never intended as a substitute for the original document, but is meant to contain sufficient information to allow the reader to ascertain his interest. The abstract should be concise. Only in unusual case should it contain more than 200 words. The nomenclatures used should be meaningful, that is, only standard terminology should be used.

(f) *Table of Contents*

The table of contents is in the same form as it is found in any book. The main divisions as well as the subdivisions should be listed together with the number of the first page on which it appears.

For example:

CONTENTS	Page no.
Introduction	5
1.3 …	5
1.4 …	6

(g) A brief introduction of the organization's business sector (Note: 1 Page maximum)

Provide an overview of the main area or business sector in which the organization falls into, i.e., telecommunications, manufacturing, financial service etc. Here you should discuss the main business sector and NOT the organization under consideration. For example, if the organization is in the telecommunication sector, then you should briefly describe all aspects of this sector in Indian context. You should NOT include an introduction of your Internship Company here as this would be covered in the next section.

(h) Overview of the organization (Note: 3 Pages maximum)

- Brief history
- Business size (Total number of stocks, commodities, number of employees etc)
- Product lines (list complete range of products/services)
- Competitors
- Brief summary of all departments

(i) Plan of your internship program

- A brief introduction of the branch/department when you performed your internship
- Start and end dates of your internship
- The names of the departments you visited and the duration of stay
- Duties and responsibilities performed (Provide a detailed description of your duties and responsibilities, describe the project you were assigned

(j) Background and description of the problem

In this the problem is introduced. So, the introduction should contain the purpose of the report, sufficient background material, including literature survey to present the reader a clear picture of the work. An outline of the work should also form a part of the introduction.

The purpose of writing the introduction is to arouse the curiosity of the reader in the report. Therefore, a proper and interesting introduction should include a brief history of the topic coupled with the statement of the immediate problem, the reasons for interest in it and a discussion of the method of attack or treatment. Generally, an introduction is not more than one page. Therefore, a proper and interesting introduction should include a brief history of the topic coupled with the statement of the immediate problem, the reasons for interest in it and a discussion of the method of attack or treatment.

(k) Main Text

In this the work, the method of treatment and the results are presented. It may run into ***one or more than one chapters/section under different headings and sub-headings***.

It should ideally contain the following

- Assumptions made,
- Experimental work/data collection,
- The survey done, or algorithm presented
- A description of activities or programs or case studies outlined,
- The results obtained/illustrations,
- The discussion and interpretations, etc.

Significant discrepancies in results should be called to the reader's attention, even when it is admitted that no reasonable explanation can be offered.

(l) Outcomes

The principal outcomes as identified from the results of your analysis are to be highlighted in this section preferably in bulletted form.

(m) Conclusions and/or Recommendations (if any)

The conclusions and recommendations are based on the discussions and interpretations of the results obtained. It would be helpful to the reader if other possibilities pertaining to the stated conclusions and recommendations are discussed.

(n) Appendices (if necessary)

The contents of an appendix are essentially those that support or elaborate the matter in the main text. divert the attention of the reader from the main problem, is generally put into the Appendix. We give below some broad items, which normally form part of the appendix. These are:

- **Calculation Sheets/ Lengthy derivations of mathematical formulae (if that is not the project itself)./ Supplementary details of instructions/ Flow charts/ Computer programs/ Questionnaires/ Large maps/ Nomenclature, etc.**

NOTE for CSE/IT students: If the project itself is to make a computer program of some problem, then flow charts and the computer program have to be in the main body. One is expected to decide according to ones own needs.

(o) References

All the references should be given in the section called *References.* We cite below two examples of writing references.

Suppose we have to refer to a paper entitled *An Integral Equation Satisfied by the Square of Webers' Parabolic Cylindrical Function, whose* author is S.C. Mitra and which appeared in the Journal of the London Mathematical Society whose volume is 11, the year of publication 1936, and the article is published on pages 252 to 256. We shall write it as follows:

2. Mitra, S. C., " An Integral Equation Satisfied by the Square of Webers' Parabolic Cylindrical Function" *Jour. Lond. Math. Soc*., 11 (1936), pp. 252-256.

Suppose we have to refer to a book called *An Introduction to Linear Algebra* by Dr. V. Krishnamurty and others which was published by Affiliated East West Press Pvt. Ltd., New Delhi in the year 1976. This we shall write as:

2. Krishnamurty, V. & others, *An Introduction to Linear Algebra* Ist edition, Affiliated East West Press, New Delhi (1976).

[Specimen Outer cover]

A REPORT

ON

(Title of the Project in Capital Letters)

By

Name of the student (s) Enrolment/Registration No.

--- ---

Prepared in the partial fulfillment of the
Internship Course

AT

(Station Name and Address)

Indian Institute of information Technology, Sonepat

(Month, Year)

Format of Certificate

Certificate of authenticity

CERTIFICATE

This is to certify that Internship Project of _____Name of Student_____ titled _____Title of project_____is an original work and that this work has not been submitted anywhere in any form. Indebtedness to other works/publications has been duly acknowledged at relevant places. The project work was carried during ___Start date_____ to _____End Date_____ in _____ Name of Organization_____

Signature Mentor faculty	
Name:	
Designation:	
Seal of the organization with Date)	

Format of Joining Report

Indian Institute of information Technology, Sonepat

INHOUSE Internship

JOINING REPORT

Date of Joining The Internship Station _____

<table>
<tr><td rowspan="2">Period of Internship</td><td>From</td><td>To</td><td>Total Months</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Student Information</td><td colspan="2">Name</td><td>Roll No</td><td>Branch</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="4">Student's Signature with Date</td></tr>
<tr><td>Name and Address of the Internship Station</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Name and Designation of the Mentor faculty for the Project</td><td colspan="4"></td></tr>
<tr><td colspan="4">Signature of Faculty Mentor</td></tr>
<tr><td>Faculty Mentor E-mail Address</td><td colspan="4"></td></tr>
</table>

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SONEPAT
भारतीय सूचना प्रौद्योगिकी संस्थान सोनीपत
(An Autonomous Institute of National Importance under Act of Parliament)
Phone: +91 1744 233189, Email: sonepatiiit@gmail.com, website: www.iiitsonepat.ac.in

Internship Evaluation Sheet

SECTION-A

Name of Student: - _____ Name of Company: - _____
Roll No: _____ Project Location: -_____
Faculty Mentor: -_____ Duration: -_____
Project Title: -_____

Contact Details of Industry Mentor _____

Student Signature:- _____

SECTION-B (To be completed by IRC/Faculty Mentor)

Please provide your assessment of the student based on your interaction/observations. Please tick the appropriate box for each parameter (* IRC- Institute Review Committee)

	A	**B(30)**						**C**
Assessment Parameter	**Mid Sem (20)**	**1 Very Poor**	**2 Poor**	**3 Avg.**	**4 Good**	**5 Very Good**	**NA Not Accessible**	**Report/manuscript (30)**
A. Understanding of the organizational situation & the need for the Project								
B. Clarity of project objective & deliverable								
C. Planning undertaken for the project								
D. Methodology used for the project								
E. Execution of the project								
F. Skills & Attitude of the Student								
Total (B)[90]{X}								
Scaled(B)[50]	**Round(1.66* X)** =							
A {20}+ Scaled(B)[50]+C {30}=100	=							

G. Please provide the grade that you would award to the student based upon his/her performance: (Faculty may Map the above scale of 1 to 5 into 50 marks).

S.no	Component	Marks Obtained
1.	Mid Sem (20)	
2.	Faculty Mentor (50)	
3.	Report (30)	
4.	Total(100)	

*Midsem grading for Industry Internship will be submitted by TnP cell by following standard benchmarks/bifurcation/Performa for 20 Marks such as feedback from industry/ Mid sem report/ppt/ etc. , whereas for InHouse Students it will be carried out by the concerned faculty mentor/IRC **The Records of Evaluation will be submitted to Exam office (Internship Evaluation Sheet + Statement of marks (refer Annexure -1) + (one Industry Internship Report Hard bound copy for Library Purpose).**

[1]Incomplete-I, Withdrawal-W, Grade Awaited-GA, Project-S (Satisfactory) / X (Unsatisfactory)

Signature (Faculty Mentor) **Date___**

Annexure for Marks Submission for Industry Internship Project/ Inhouse internship
Format of Marks Submission to the Exam Office

Indian Institute of Information Technology Sonepat								
SEMESTER- RESULT, Batch -								
Subject:	**Industry Internship Project/ Inhouse internship**		**Session:**	**May/June, year**				
Faculty Mentor/ End Semester Viva C1 (50)								
							C3(30): Report	
S. No	**Roll No.**	**Name**	**Faculty Mentor//** End Semester Viva **C1 (50)**	**Mid Sem C2(20)**	**Report C3 (20)**	**Total Theory (100)**	**Grade Theory (100)**	**Remark**