Course Structure and Syllabus for B. Tech (CSE)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

TRIGUNA SEN SCHOOL OF TECHNOLOGY

ASSAM UNIVERSITY, SILCHAR

ASSAM, INDIA

ASSAM UNIVERSITY : SILCHAR
TRIGUNA SEN SCHOOL OF TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Table 1: Minimum credits to earn (for a degree under TSSOT)

Sl No	Degree	No of years	Min Credits
1	Bachelor of Technology	4	240
2	Bachelor of Technology (Lateral)	3	180
3	Master of Technology	2	120

Table 2: Types of courses (for a degree under TSSOT)

Sl. No	Category	Code	Remarks
1	Compulsory Foundation	CF	Leads to knowledge enhancement Mandatory for all discipline
2	Elective Foundation	EF	Value-based and are aimed at man-making education
3	Core	CC	Compulsory for all students
4	Discipline Centric Electives	EL	Supportive to the discipline of study
5	Project, Seminar, Group Discussion, Grand Viva, summer training, industrial training etc.	PT	Enabling students to get the industry exposure and engineering applications in real life problems

Table 3: Class-hour (for a degree under TSSOT)

Sl. No	Type of Classes (Lesson)	Credit	Class-hour
1	Theory lecture	1	1
2	Practical/ Lab session/tutorial/assignment/ home work	1	2

Table 4: Evaluation Types and narks distribution (for a degree under TSSOT)

Sl. No	Type of examination	Marks (100%)	Min pass mark (30%)	Total Pass mark (50%)
1	Internal assessment	20	06	50
2	Mid-term evaluation	30	09	
3	End Semester evaluation	50	15	

Table 5: Grades and Grade-points (for a degree under TSSOT)

Letter Grade	Grade Point	Marks domain
O (Outstanding)	10	90-100
A (Excellent)	9	80-89
B (Good)	8	70-79
C (Average)	7	60-69
D (Pass)	6	50-59
F (Fail)	0	<50
AB (Absent)	0	-

Table 6: SGPA and CGPA calculation (for a degree under TSSOT)

SGPA (Semester Grade Point Average)	CGPA (Cumulative Grade Point Average)
$SGPA = \frac{\sum C_i * G_i}{\sum C_i}$ where C_i= no of credits of the ith course G_i = grade point earned by the student in the ith course	$CGPA = \frac{\sum C_j * S_j}{\sum C_j}$ where C_j= total no of credits of the jth semester S_j = SGPA of the jth semester

Table 7: Course category vs Credit distribution for B.Tech degree under TSSOT

Sl. No	Category	Minimum Credit	Max credit	Total min
1	Compulsory Foundation	40	60	60
2	Elective Foundation	10	20	
3	Core	105	105	105
4	Discipline Centric Electives	35	40	35
5	Minor Project, Seminar, Industrial training	15	15	40
6	Major Project, Seminar, Grand Viva	25	25	
	Total (minimum)			**240**

Table 8: Course category vs Credit distribution for B. Tech (Lateral) degree under TSSOT

Sl. No	Category	Minimum Credit	Max credit	Total min
1	Core	105	105	105
2	Discipline Centric Electives	35	40	35
4	Minor Project, Seminar, Industrial training	15	15	40
5	Major Project, Seminar, Grand Viva	25	25	
	Total (minimum)			**180**

Table 09: Compulsory Foundation Courses for B. Tech (4 years) under TSSOT

S. No.	Course Code	Course Title	Hrs/week L:T:P	Credits	Preferred semester
1	SOTCF 01	Engineering Mathematics	4:0:0	4	I
2	SOTCF 02	Engineering Physics	4:0:0	4	I
3	SOTCF 03	Environmental Science	3:0:0	3	I/II/III
4	SOTCF 04	Communication Skill in English	3:0:0	3	I/II
5	SOTCF 05	Engineering Chemistry	4:0:0	4	I/II
6	SOTCF 06	Advanced Engineering Mathematics	4:2:0	5	II
7	SOTCF 07	Engineering Mechanics	4:0:0	4	II
8	SOTCF 08	Computer Systems and Programming	4:2:0	5	II
9	SOTCF 09	Electrical Technology	4:0:0	4	I/II
10	SOTCF 10	Basic Electronics	4:0:0	4	II
11	SOTCF 11	Probability and Statistics	4:0:0	4	III/IV
12	SOTCF 12	Engineering Physics Lab	0:0:4	2	With SOT CF 02
13	SOTCF 13	Engineering Chemistry Lab	0:0:4	2	With SOT CF 05
14	SOTCF 14	Engineering Drawing	0:0:4	2	I/II
15	SOTCF 15	Computer Systems and Programming Lab	0:0:4	2	With SOT CF 08
16	SOTCF 16	Electrical & Electronics Lab	0:0:4	2	With SOT CF 09/10
17	SOTCF 17	Workshop Technology	0:0:4	2	I/II
18	SOTCF 18	Operation Research and Industrial Management	4:0:0	4	III/V

Table 10: Elective Foundation Courses for B. Tech (4 years) under TSSOT

S. No.	Course Code	Course Title	Hrs/week L:T:P	Credits	Preferred semester
1	SOTEF 01	Economics and Human Development	3:0:0	3	I/II
2	SOTEF 02	Values and Ethics	3:0:0	3	I/II
3	SOTEF 03	Communication skill in French	3:0:0	3	I/II
4	SOTEF 04	International politics and relations	3:0:0	3	I/II
5	SOTEF 05	Human rights and duties	3:0:0	3	I/II
6	SOTEF 06	NCC	0:0:4	2	I/II
7	SOTEF 07	NSS	0:0:4	2	I/II
8	SOTEF 08	Materials Science	4:0:0	4	III/IV
9	SOTEF 09	Law for Engineers	3:0:0	3	I/II

List of Elective (Discipline) courses:

1. Cryptography & Information Security
2. Distributed Database
3. Graph Theory
4. Artificial Intelligence
5. Computer Graphics & Multimedia
6. Data Mining
7. Advanced Computer Architecture
8. Mobile Computing
9. Pattern Recognition
10. Information Retrieval
11. VLSI Design & Algorithms
12. Soft Computing
13. Computer Vision
14. Cloud Computing
15. Web Service and Service Oriented Architecture
16. Script Programming
17. Software Engineering
18. Image processing
19. Advanced Operating Systems
20. Quantum Computing
21. Data warehousing
22. Advanced Algorithm Design
23. Natural Language processing
24. Theory of Computation
25. Advanced Java programming
26. Enterprise Resource Planning
27. Fuzzy Systems
28. Neural Networks
29. Network On Chip
30. Formal System Verification
31. System Software
32. Java Programming
33. Engineering Statistics
34. Game Theory with Engineering Applications
35. Digital Signal Processing

ASSAM UNIVERSITY: SILCHAR
TRIGUNA SEN SCHOOL OF TECHNOLOGY
Course Structure of B. Tech Programme under TSSOT
FIRST YEAR

Year	Semester	Min. Credits					
		Semester	Offered for CF	Earned from CF	Offered for EF	Earned from EF	To be earned to complete first year programme
I	Sem I	26	24	40	5	10	**60**
	Sem II	34	28		11		

First Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	SOT CF 01	Engineering Mathematics	4			4
2	SOT CF 02	Engineering Physics	4			4
3	SOTCF 03	Environmental Science	3			3
4	SOTCF 04	Communication Skill in English	3			3
5	SOTCF 05	Engineering Chemistry	4			4
6	SOTCF 12	Engineering Physics Lab			4	2
7	SOTCF 13	Engineering Chemistry Lab			4	2
8	SOTCF 14	Engineering Drawing			4	2
	Total Credits (Compulsory Foundation)					**24**
9	SOT EF 01	Economics and Human Development	3			3
10	SOT EF 03	Communication skill in French	3			3
11	SOTEF 06	NCC			4	2
	Total Credits (Elective Foundation)					**8**

DETAILED SYLLABUS

SOTCF 01: Engineering Mathematics **4:0:0[4]**

UNIT I: **8 Hours**

Introduction:B Scalar triple product, vector triple product. Directional derivative, Gradient, divergence and curl of vector function and their properties. Green's theorem, Stocke's and divergence theorem(statement only with simple applications).

UNIT II: **8 Hours**

Co-ordinate Geometry: Transformation of axes: Translation, rotation, rotation followed by translation, pair of straight lines, Homogeneous and non-homogeneous form, angle between two straight lines. Systems of circles, orthogonal circles, radical axis, co-axial circles, limiting points. Parabola, ellipse and hyperbola and their properties, condition of tangency in each case, diameter, conjugate diameter and their related properties for central conics. Director circle, auxiliary circle and eccentric angle, conjugate and rectangular hyperbola, tracing of conics.

UNIT III: **8 Hours**

Real Analysis: Sequence, Limit of a sequence, Limit theorems, squeeze theorem, Monotone sequence, Monotone convergence theorem, cuchy convergence criterion, Infinite series, convergence of infinite series, comparison test, root test, Raabe's test, logarithmic test, uniform convergence, properties of uniform convergence, Fourier series.

UNIT IV: **8 Hours**

Differential calculus: Limits and continuity of a function, Boundedness of a function, Intermediate value theorem, Differentiability, Maxima and minima of a function, Rolles theorem and mean value theorem, increasing and decreasing functions, intermediate forms.

UNIT V: **8 Hours**

Integral Calculus: Improper integral of first and second kind, comparison test, Absolute convergence, application of definite integral: Area between two curves. Curve tracing, area between curves when their equations are given in polar co-ordinates. Double integrations, triple integration (simple applications).

Text books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. Thomas and Finney , Calculus and analytical geometry, Narosa
3. B. S. Grewal, Higher Engineering Mathematics

SOTCF 02: Engineering Physics **4:0:0[4]**

UNIT I: **8 Hours**

Classical Physics**:** Properties of areas: Moments of inertia and product of inertia of areas, polar moment of inertia, principal axes and principal moments of inertia. Concept of stress and strain: Normal stress, shear stress, state of stress at a point, ultimate strength, allowable stress, factor of safety;; normal strain, shear strain, Hooke's law, Poisson's ratio, generalized Hooke's law;; analysis of axially loaded members. Surface tension: Angle of contact, excess of pressure inside a spherical surface, capillary rise, determination of surface tension by Jaegers' method. Viscosity: Stream line and turbulent motion, coeff. of viscosity, critical velocity, Poiseulle's equation for flow of liquid through a tube, viscometer.

UNIT II: **8 Hours**

Optics : interference, thin films – testing of the optical plane ness of surface, Young's double slit experiment – coherent sources – lasers, intensity in Young's experiment, interference in thin films, Newton's ring and Michelson interferometer. Diffraction: Fraunhofer – diffraction at single slit, diffraction at a circular aperture, diffraction at double slit, diffraction gratings, resolving and dispersive power of a grating. Polarisation: production and detection of circularly and elliptically polarized light, Quarter and half wave plates, optical activity, specific rotation, Lorentz half shade polarimeter, Determination of specific rotation and strength of sugar solution.

UNIT III: **8 Hours**

Heat and Thermodynamics: Second law of thermodynamics (it's different formulations), entropy, relation between entropy and probability, Kelvins absolute scale of temperature, thermodynamic relations and their applications, Maxwell's law of distribution of velocity and its experimental verification, most probable velocity, root mean square velocity, average velocity and their relations. Basic features of black body radiation spectrum, Wien's displacement law, Rayleigh-Jean's law, ultraviolet catastrophy, Planck's law.

UNIT IV: **8 Hours**

Solid State Physics: Crystal structure: Seven systems of crystals, Bravais space, lattice, crystal structure (bee, fee and sc) lattice dimensions, lattice planes, and miller indices and their significance, X-rays-absorption of X-rays diffraction, Bragg's law. Bragg's X-ray spectrometer.

UNIT V: **8 Hours**

Modern Physics: Lasers: Coherence – temporal and spatial, Einstien's spontaneous and stimulated emission, population inversion, laser gain (pumping), spectral narrowing in lasers coherence length, different types of laser source and their applications. Quantum theory: Wave particle, duality and uncertainty principle, Schrodinger equation and its application to particle in a box and harmonic oscillator.

Text books:

1. D. S. Mathur, Elements of properties of matter, S. Chand & Co.
2. Jenkins and White, Fundamentals of Optics, McGraw Hill
3. B. B. Land, Lasers and Non-linear Optics, Wiley Eastern Ltd
4. Charks Kittle, Introduction to Solid State Physics, John Wiley & Sons
5. B. V. *Narayana* Rao, Modern Physics, Wiley Eastern Ltd
6. M.W. Zemansky, Heat & Thermodynamics, McGraw Hill
7. Chottopadhyay and Rakshit, Quantum Mechanics, Statistical Mechanics and Solid State Physics

SOTCF03: Environmental Science **3:0:0[3]**

As prescribed in the Assam University undergraduate courses in PG departments

SOTCF 04: Communication Skill in English **3:0:0[3]**

UNIT I: **8 Hours**

How speech organs work in English, Vowel sounds in the English language, Consonant sounds in the English language, Sound sequence: Diphthongs and Consonant clusters, Word accent in English, Stress and intonation in English, Accent and rhythm in connected speech.

UNIT II: **8 Hours**

Word order, Sentence types, Tense, Transformation of Sentences, Voice, Usage.

UNIT III: **8 Hours**

Process of Communication; Process of letter writing; Resume, Social correspondence, Types of Reports, Structure of formal reports, Elements of Style, Use of illustrations, Making presentations

UNIT IV and V: **8 Hours**

Group discussion.

Text books*:*

1. P. Balasubhramaniam, Phonetics for English Students
2. J. D. O'Connar, Better English Pronunciation
3. David Crystal, The Cambridge Encyclopedia of the English Language
4. John Selly, Oxford Guide to Writing & Speaking

SOTCF 05: Engineering Chemistry **4:0:0[4]**

UNIT I: **8 Hours**

Thermodynamics of Chemical Processes: Concept of entropy, Chemical potential, Equilibrium conditions for closed systems, Phase and reaction equilibria, Maxwell relations, Real gas and real solution. Electrochemical cells and EMF, Applications of EMF measurements:

UNIT II: **8 Hours**

Thermodynamic data, activity coefficients, solubility product and pH, corrosion. Kinetics of Chemical Reactions: Reversible, consecutive and parallel reactions, Steady state approximation, Chain reactions, Photochemical kinetics.

UNIT III: **8 Hours**

Bonding Models in Inorganic Chemistry: Molecular orbital theory, Valence-bond theory, Crystal field theory. Coordination Chemistry: Coordination numbers, Chelate effect, Coordination complexes and application, Bio-inorganic chemistry: Metal ions in Biological systems, environmental aspects of Metals, NO_x, CO, CO_2.

UNIT IV: **8 Hours**

Fundamentals of Microwave, IR and UV-VIS Spectroscopy: Basic concepts of spectroscopy, Selection rule, Determination of molecular structure.

UNIT V: **8 Hours**

Organic Reaction Mechanism**:** Mechanisms of selected organic, bio-organic, polymerization and catalytic reactions. Stereochemistry of Carbon Compounds: Selected Organic Compounds: Natural products and Biomolecules (Amino acids/nucleic acids/proteins).

Text books:

1. J. D. Lee, Inorganic Chemistry
2. Lewis, Physical Chemistry
3. I.L. Finar, Organic Chemistry (Vol. 1 & 2), Pearson Education

SOTCF 12: Engineering Physics Lab **0:0:4[2]**

As per the theory course SOT CF 02

SOTCF 13: Engineering Chemistry Lab **0:0:4[2]**

As per the theory course SOT CF 05

SOTCF 14: Engineering Drawing **0:0:4[2]**

Introduction to IS code of drawing;

Conics and Engineering Curves – ellipse, parabola, hyperbola, cycloid, trochoid, involute; Projection of lines – traces, true length;

Projection of planes and solids; sold objects – cube, prism, pyramid, cylinder, cone and

sphere; Projection on Auxiliary planes; Isometric projection, isometric scale;

Section of solids – true shape of section;

Introduction to CAD tools – basics; Introduction of Development and Intersection of surfaces.

Text books:

N. D. Bhatt, Engineering Drawing

SOTEF 01: Economics and Human Development **3:0:0[3]**

UNIT I: **8 Hours**

Introduction to Economics: What is Economics? Relationship of Economics and Engineering, Concept of Demand and Demand Function, Supply and Supply Function, Utility and Utility Function

UNIT II: **8 Hours**

Theory of Cost and Production: Concepts and types of Costs, Derivation of Cost Function and Profit Maximization, Start -run and Long -run behaviour of Production, Analysis and Properties of ISO quant, Meaning and Types of Production Function.

UNIT III: **8 Hours**

Price output determination under different market structure: Perfect competition, Monopoly, Monopolistic competition and oligopoly

UNIT IV: **8 Hours**

Theory of Distribution: Derived demand, Factor price determination: wage, rent, capital, service, profit

UNIT V: **8 Hours**

Human Development and Economic Development: Meaning, difference between Human Development (HD) and Human Resource Development (HRD), Human Development Index (HDI) and its measurement, Human Development and sustainable Growth, Human Development and Governance, Millennium Development Goals (MDG).

Text books:

1. Koutsoyianis, Modern Micro-economics, McMillan
2. Henderson and Qnout, Microeconomic Theory: A Mathematical Approach, McGraw Hill
3. R. P. Barthwal, Microeconomic Analysis, Willey Eastern
4. Hahbub ul Haq, Reflections on Human Development, Oxford University Press
5. J. Field, Social Capital, Routledge

Second Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	SOTCF 06	Advanced Engineering Mathematics	4	2		5
2	SOTCF 07	Engineering Mechanics	4			4
3	SOTCF 08	Computer Systems and Programming	4	2		5
4	SOTCF 09	Electrical Technology	4			4
5	SOTCF 10	Basic Electronics	4			4
6	SOTCF 15	Computer Systems and Programming Lab			4	2
7	SOTCF 16	Electrical & Electronics Lab			4	2
8	SOTCF 17	Workshop Technology			4	2
	Total Credits (Compulsory Foundation)					**28**
9	SOT EF 02	Values and Ethics	3			3
10	SOTEF 05	Human rights and duties	3			3
11	SOTEF 07	NSS			4	2
12	SOTEF 09	Law for Engineers	3			3
	Total (Elective Foundation)					**11**

DETAILED SYLLABUS

SOTCF 06: Advanced Engineering Mathematics **4:2:0[5]**

UNIT I: **8 Hours**

Ordinary Differential Equations: Solution of 1st order and 1st degree differential equations by exact method. Integrating factors, Leibnitz's linear equation, Bernoulli's equation, differential equation of 1st order and of higher degree, Clairaut's equation, differential equations of 2nd and higher order with constant co-efficients, method of variation of parameters for solving 2nd order differential equations.

UNIT II: **8 Hours**

Partial Differential Equations**:** formulation and classification of p.d.e.s, Lagranges's and Charpits method, characteristic curves and surfaces, four standard forms of non -linear equations, linear equations with constant co-efficient, canonical forms, wave equations and heat equations, Laplace equation in Cartesian, cylindrical and spherical co-ordinates, cylindrical and spherical co-ordinates, variable separable method.

UNIT III: **8 Hours**

Laplace Transformations: Standard unit step functions, periodic functions-convolution theorem application to ordinary differential equation with constant coefficient. Fourier series solution of wave equation, Separation of variables method to solve heat equation, Laplace equation, Diffusion equation; Integral transform method to solve 2nd order p.d.e.

UNIT IV: **8 Hours**

Complex Variables: complex number and functions, limit, continuity, derivative of a complex function, analytic function. Cauchy-Riemann equations, harmonic function, complex integration, line integral in complex plane, Cauchy's integral theorem. Cauchy's Integral formula, power series, radius of convergence of a power series, Taylor series and Maclaurins series, Laurent series.

UNIT V: **8 Hours**

Numerical Analysis: Error in numerical methods, round-off error, truncation error (definition only), interpolation, Lagrange interpolation formula, Newton Divided difference, Newton forward and backward interpolation formula, Numerical solution to non-linear equations, Bisection method, Newton-Raphson method, Sectant method, Fixed point iteration method, Numerical differentiation, Numerical Integration, rectangle rule, Mid-point rule, trapezoidal rule, Simpson's rule, Simpson's $3/8^{th}$ rule.

Textbooks:

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley Eastern.
2. V. Krishnamurthy, V. P. Mainra. And J. L. Arora, An Introduction to Linear algebra, Affiliated East-West.
3. Boyce and R. C. Diprima, Elementary differential equations and Boundary Value Problems, Wiley.
4. Thomas and Finney, Calculus and Analytical Geometry, Narosa
5. B. S. Grewal, Higher Engineering Mathematics

SOTCF 07: Engineering Mechanics **4:0:0[4]**

UNIT I: **8 Hours**

Force systems: Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force and a couple, Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimensions; plane frames and trusses.

UNIT II: **8 Hours**

Friction: Laws of Coulomb friction, problems involving large and small contact surfaces; square threaded screws; belt friction; rolling resistance. Kinematics and Kinetics of particles: Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables; central force motion. Properties of areas: Moments of inertia and product of inertia of areas, polar moment of inertia, principal axes and principal moments of inertia.

UNIT III: **8 Hours**

Concept of stress and strain: Normal stress, shear stress, state of stress at a point, ultimate strength, allowable stress, factor of safety;; normal strain, shear strain, Hooke's law, Poisson's ratio, generalized Hooke's law;; analysis of axially loaded members. Torsion: Torsion of cylindrical bars, torsional stress, modulus of rigidity and deformation.

UNIT IV: **8 Hours**

Flexural loading: Shear and moment in beams; load, shear and moment relationship; shear and moment diagrams; flexure formula; shear stress in beams; differential equation of the elastic curve, deflection of beams. Transformation of stress and strain: Transformation of stress and strain, principal stresses, principal strains, Mohr's circle for stress and strain.

UNIT V: **8 Hours**

Combined loading: Axial and torsional; axial and bending; axial, torsional and bending. Column: Buckling of slender columns, Euler bucking load for different end conditions.

Textbooks:

1. J. L. Meriam and L. G. Craige. Engineering Mechanics (Vol. 1 and 2) John Willey.
2. F. P. Beer and R. Johnston. Vector Mechanics for Engineers: Statics and Dynamics McGraw Hill.
3. H. Shames. Engineering Mechanics. Prentice Hall.
4. Timoshenko and D. H. Young. Engineering Mechanics. McGraw Hill.

SOTCF 08: Computer Systems and Programming **4:2:0[5]**

UNIT I: **8 Hours**

Introduction to Computer:Overview of Computer organization and historical perspective of computer applications in various fields of science and management. Concepts of the finite storage, bits, bytes, kilo, mega and gigabytes. Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions. Binary arithmetic, Floating-point arithmetic, signed and unsigned numbers.

UNIT II: **8 Hours**

Introduction to Programming: Concept of algorithms, Flow Charts, Data Flow diagrams etc., Introduction to the Editing tools. Programming using C: Concept of variables, program statements and function calls from the library, data types, int, char, float etc., declarations and expressions, arithmetic operation, relational and logical operations, C assignment statements, extension of assignment of the operations. C primitive input output functions, C Statements.

UNIT III: **8 Hours**

Control Statements: Branching: conditional execution using if, else. switch and break statements may be mentioned. Looping: Concept of loops, example of loops in C using for, while and do-while. continue may be mentioned. One dimensional arrays and example of iterative programs using arrays, 2-d arrays Use in matrix computations.

UNIT IV: **8 Hours**

Functions: Concept of Sub-programming, functions Example of functions. Argument passing, Recursion Pointers: Pointers, relationship between arrays and pointers, Argument passing using pointers, Array of pointers, Passing arrays as arguments.

UNIT V: **8 Hours**

Structures and Unions: Defining C structures, passing strings as arguments Programming examples. Unions Data Files: Concept of files, file operations – opening, closing, reading, writing and processing, Binary files.

Textbooks:

1. V. Rajaraman and Neeharika Adabala "Fundamentals of Computers"(6th Ed.), Prentice Hall of India,2014.
2. K.R.Venugopal &Sudeep R. Prasad, "Mastering C"(New Ed.), McGraw Hill Education, 2015.
3. Yashwant Kanetkar, "Let us C"(14th Ed.), BPB Publications, 2016.

References:

1. Godfried, "Computer Programming in C"(3rd Ed.), McGraw Hill Education,2010.
2. Kernighan & Ritchie, "C Programming Language"(2nd Ed.), The (Ansi C Version), PHI,2015.

SOTCF 09: Electrical Technology **4:0:0[4]**

UNIT I: **8 Hours**

Introduction: Sources of energy; General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables, Steam, Hydel, Gas and Nuclear power generation.

UNIT II: **8 Hours**

DC Circuits: Kirchoff's laws, node voltage and mesh current methods, Delta-star and star-delta conversion, Superposition principle, Thevenin's and Norton's theorems.

UNIT III: **8 Hours**

Single phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, solution of R,L,C series circuits. The j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series – parallel circuits.

UNIT IV: **8 Hours**

Electrical Measuring Instruments: DC PMMC instruments, shunt and multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watt-hour meter, extension of instrument ranges.

UNIT V: **8 Hours**

Electrical Machines: Introduction to magnetic circuits, transformers, DC and AC motor principles,

Textbooks:

1. P.C. Sen, Principles of Electric Machines and Power Electronics, Wiley Eastern 2003.
2. Vincent DEL TORO, Electrical Engineering Fundamental's Prentice Hall India, Ed 2002.

SOTCF 10: Basic Electronics **4:0:0[4]**

UNIT I: **8 Hours**

Junction Diode: p-n junction, V-I characteristics, diode resistance, capacitance, switching time, diode applications. Breakdown mechanism, Zener and avalanche, break down characteristics, Zener diode and its applications, rectifiers & voltage regulator.

UNIT II: **8 Hours**

Transistor: Bipolar junction transistor, CE, CB and CC configurations and characteristic curves, Fixed and Self Biasing Circuits. Junction field Effect Transistor, MOSFET, working of Depletion and Enhancement types of MOSFET, transfer characteristics.

UNIT III: **8 Hours**

Operational Amplifier (OPAMP): Ideal OPAMP, their characteristics, differential amplifier, Inverting and Non Inverting amplifier, Common mode rejection ratio (CMMR), slew rate, Application of OPAMP, Adder, Substractor, Differentiator, and Integrator.

UNIT IV: **8 Hours**

Digital Electronics**:** Number systems, conversion of bases, Boolean Algebra, logic gates, Concept of universal gate, Karnaugh Maps, SR Flip-Flops, JK Flip-Flops D Flip-Flops, T Flip-Flops, Counter, Johnson Counter, Modulo 5 counter, Decade Counter.

UNIT V: **8 Hours**

Electronics Instruments: Electronic voltmeter, Ammeter, Function Generator Digital Multimeter and their applications, CRO and its applications, Transducer definition, Different types of transducers, resistive transducer, capacitive transducer, inductive transducer, LVDT, Strain Gauge.

Textbooks:

1. J. Millman and Halkias, Electronic devices and circuits TMH, 1999.
2. Salivahanan, Suresh Kumar, Vallavaraj, Electronic devices and circuits TMH, 1999

References:

1. J. Millman and Halkias, Integrated Electronics, Analog & Digital Circuits & Systems, TMH – 2000.
2. Boylestad & Nashelsky, Electronic Devices & Circuit Theory, PHI – VIth Edition.
3. Sedra & Smith, Micro Electronic Circuits Oxford, University Press, 2000
4. J.B.Gupta, Electronic Devices & Circuits, S. K. Kataria, IInd Edition.

SOTCF 15: C Programming Lab **0:0:4[2]**

Experiments should include but not limited to:

1. Write a program to produce ASCII equivalent of given number
2. Write a program to find divisor or factorial of a given number.
3. Write a program to evaluate the following algebraic expressions after reading necessary values from the user (ax+b)/(ax-b)

2.5 log x-cos 30+|x2-y2|+sqrt
(2xy) (x5+10x4+8x3+4x+2)

4. Write a program to find sum of a geometric series
5. Write a program to cipher a string
6. Write a program to check whether a given string follows English capitalization rules
7. Write a program to find sum of the following series

1+ ½ + 1/3 +_____+1/20

8. Write a program to search whether a given substring exist in an input string or not and then delete this string from input string.
9. Write a recursive program for tower of Hanoi problem
10. The Fibonacci sequence of numbers is 1, 1, 2, 3, 5, 8……. Based on the recurrence relation F(n)=F(n-1)+F(n-2) for n>2

Write a recursive program to print the first m Fibonacci number

11. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices

a) Addition of two matrices b)
Subtraction of two matrices
c) Finding upper and lower triangular matrices
d) Trace of a matrix
e) Transpose of a matrix
f) Check of matrix symmetry
g) Product of two matrices.

12. Write a program that takes two operands and one operator from the user perform the operation and then print the answer
13. Write a program to print the following outputs:

```
1                                   1
2 2                                 2 2
3 3 3                             3 3 3
4 4 4 4                         4 4 4 4
5 5 5 5 5                     5 5 5 5 5
```

14. Write functions to add, subtract, multiply and divide two complex numbers (x+iy) and (a+ib) Also write the main program.
15. Write a menu driven program for searching an sorting with following options:-

a) Searching (1) Linear searching (2) Binary searching
b) Sorting (1) Insertion sort (2) Selection sort

16. Write a program to copy one file to other, use command line arguments.
17. Write a program to mask some bit of a number (using bit operations)
18. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.

SOTCF 16: Electrical and Electronics Lab **0:0:4[2]**

List of Electrical Experiments

1. Verification of Thevenin's theorem
2. Verification of Superposition theorem
3. Phasor Diagram and Power factor of LCR circuit.
4. Measurement of Power and Power factor in single phase Load using three ammeters/voltmeters.
5. Calibration of Energy Meter/Wattmeter/Voltmeter/Ammeter
6. Two wattmeter method of measuring power in three phase circuit (resistive load only)
7. Load test on Single Phase Transformer, Regulation and Efficiency of Transformer
8. Short Circuit/Open Circuit tests on Single Phase transformer
9. Measure the armature and field resistance of a D.C. Machine
10. Connection and starting of a Three Phase Induction Motor using direct on line or Star Delta Starter.
11. Starting and Speed Control of a D.C. shunt motor
12. Resonance

List of Electronic Experiments

Practical will be based on Analog Electronics.

Some lab experiments must be performed using any circuit simulation software e.g. PSPICE.

SOTCF 17: Workshop Technology **0:0:4[2]**

Wood and Wood Working (Carpentry): Classification and conservation of wood, common varieties of Indian timber, defects in timber, carpentry tools, auxiliary materials used in carpentry.

Bench Work and Fitting**:** Operations commonly used in bench and fitting work, description and use of vices, hammers, chisels, files, scraper, hacksaw, punches, measuring and marking tools, reamers, punches, gauges.

Manufacturing Processes**:** Classification of manufacturing processes, manufacturing and basic definitions, industrial safety, ferrous and non-ferrous metals, steels and alloy steels, heat treatment of metals and alloys.

Smithing and Forging: introduction, forging materials, heating devices, hand tools and appliance, smith forging operations.

Welding and Related Processes: Introduction, weldability, types of welding, metallurgy of weld, gas welding, arc welding, resistance welding, solid state welding, soldering, brazing, welded joints and edge preparation, safety in welding.

Workshop Practices:

Sawing and simple joints, planning
Chipping marking and filing
Forging operation
Welding joint preparation
Metal arc welding and gas welding practice

Textbooks:

1. Hazra & Choudhury, Workshop Technology Vol. I &Vol. II

SOTEF 02:Values and Ethics **3:0:0[3]**

UNIT I: **8 Hours**

Facts and Values, Moral and non-moral values, Ethics and Morality. Moral frameworks: Utilitarianism, Rights/Duty Ethics, Virtue Ethics, Normative Ethics and Applied Ethics.

UNIT II: **8 Hours**

Science, Technology and Human values. Crisis of values in contemporary context, Need for values in global change, Trans-cultural human values, Technology and Personal and social values, Human centered technology. Problems of Technology transfer. Ethics on IPR.

UNIT III: **8 Hours**

Possibility of an ethics for the animate and inanimate. Animal ethics, Bio-ethics, Medical Ethics, Human Gene Therapy: Scientific and Ethical considerations. Cloning.

UNIT IV: **8 Hours**

Professional and Business Ethics. Ethical issues in Engineering practice. Codes of professional ethics. Conflicts between business demands and professional ideals: Case studies. Ethics in Corporate Sectors, Managerial Ethics.

UNIT V: **8 Hours**

Environmental Ethics. Technological growth and its impact on Environment. Environmental degradation and pollution. Environmental Regulations. Concept of Sustainable Development. Eco friendly technologies. Energy crisis and renewable energy resources. Ethics of the Eco-System.

Textbooks:

1. T. L. Beauchamp. Philosophical Ethics. An Introduction to Moral Philosophy. Georgetown University. McGraw Hill.
2. Peter Singer. Practical Ethics. Cambridge University Press.
3. Mike W. Martin. Ethics in Engineering. McGraw Hill.
4. Michael Bayles. Professional Ethics. Wadsworth.
5. Bruce O. Watkins and Meador Roy. Technology and Human Values: Collision and Solution. AnnArbor Science.
6. Dr. Subir Chowdhury. Blending the best of the East & West. EXCEL
7. Ghosh. Ethics & Mgmt. & Indian Ethos. VIKAS.
8. Pherwani. Business Ethics. EPH
9. Balachandran, Raja & Nair. Ethics, Indian Ethos & Mgmt., Shroff Publishers

ASSAM UNIVERSITY: SILCHAR
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Course Structure of B. Tech Programme under TSSOT

SECOND YEAR

YEAR	SEMESTER	CORE	COMPULSORY FOUNDATION	ELECTIVE	PROJECT,TRAINING, VIVA,SEMINAR	TOTAL
II	**III**	**24**	**4**	**0**	**0**	**28**
	IV	**26**	**4**	**0**	**0**	**30**

Third Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSECC 01	Data Structure	4	2		5
2	CSECC 02	Discrete Mathematics & Graph Theory	4			4
3	CSECC 03	Digital Electronics	4	2		5
4	CSECC 04	Numerical Methods	4			4
5	CSECC 05	Data Structure Lab			4	2
6	CSECC 06	Digital Electronics Lab			4	2
7	CSECC 07	Numerical Methods Lab			4	2
	Total Credits (CORE)					**24**
8	SOT CF18	Operations Research & Industrial Management	4			4
	Total Credits (Compulsory Foundation)					**4**

DETAILED SYLLABUS

CSECC 01: Data Structures **4:2:0[5]**

UNIT I: **8 Hours**

Time and Space analysis of Algorithms: Time Complexity, Space complexity, Order Notations.
Recursion - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion.

UNIT II: **8 Hours**

Linear Data Structures: Sequential representations- Arrays and Lists, Stacks, Queues and Dequeues, strings, application. Link Representation, Linear linked lists, circularly linked lists. Doubly linked lists, application.

UNIT III: **8 Hours**

Non-linear Data Structure: Trees- Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height-balanced and weight-balanced trees, B trees, B+ trees, AVL trees, Application of trees: Graphs Representations, Breadth-first and Depth-first Search.

UNIT IV: **8 Hours**

Sorting algorithms: Bubble sort, Selection Sort, Insertion Sort, Quick sort, Merge Sort, Heap sort, Radix Sort.
Search Techniques: Linear Search, Binary Search.

UNIT V: **8 Hours**

File Structures: Sequential and Direct Access. Relative Files, Indexed Files, Multi-indexed Files, Inverted Files, Hashed Files,
Hashing: Hashing Functions, collision Resolution Techniques.

Textbooks:

1. O.G. Kakde and U.A. Deshpandey,"C and Data Structures"(Revised Ed.),Dreamtech press,2003.
2. A.V. Aho, J. E. Hopcroft, J.D. Ullman, "The Design & Analysis of Computer Algorithms", Addison-Wesley ,2003.

References:

1. Yashavant Kanetkar,"Data Structure through C",(2nd Ed.),BPB Publications,2003.
2. S.K. Srivastava and Deepali Srivastava," Data Structure through C in depth", BPB Publications,2004.

CSECC 02: Discrete Mathematics and Graph Theory **4:0:0[4]**

UNIT I: **8 Hours**

Sets and Relation: Set Basics, Venn Diagram, Counting principles, Inclusion and Exclusion principle, Induction, Mathematical Induction.

Relations: Groups, Monoids, Types of relation, Diagraphs, Inductive form of relations, Congruence relations on Semi groups.

UNIT II: **8 Hours**

Functions and Boolean Algebra: Functions types, mapping in functions, commutative diagrams, monotone functions, Rings, Subrings, morphism of rings, ideals and quotient rings. Euclidean domains. Integral domains and fields.

Boolean Algebra: direct product, Morphisms. Boolean sub-algebra. Boolean Rings. Applications of Boolean algebra in logic circuits and switching functions.

UNIT III: **8 Hours**

Recursion and Recurrence Relation: Basic idea, Sequence and discrete function. Generating functions and applications.

Introduction to Propositional Logic: Propositional logic, First Order Logic: syntax and semantics, deduction, Inference Rules, Unification and SLD-Resolution, Negation as Failure.

UNIT IV: **8 Hours**

Introduction to Graph Theory: Graphs, Digraphs, Isomorphism, Walks, Paths, Circuits, Shortest Path Problem, Dijkstra's Algorithm, Trees, Properties of Trees, Cotrees and Fundamental Circuits, 6L

UNIT V: **8 Hours**

Graph Theoretic Algorithms and Applications: Shortest Spanning Trees - Kruskal's Algorithm, Prims Algorithm, DFS, BFS, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Metric Representation of Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow.

Textbooks:

1. John Riordan, "Introduction to combinatorial analysis(Dover Books on mathematics),Dover Publication, 2002.
2. Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 2004.
3. Kolamn, Busby and Ross, "Discrete mathematical structures"(6th Ed.) PHI, 2008.

References:

1. Tremblay and Manohar, Discrete mathematical structures with applications to computer science, McGraw Hill, 2001.
2. R.Balakrishnan and K. Ranganathan," A Text book of Graph Theory"(2nd Ed.),MH,2013.

CSECC 03: Digital Electronics **4:2:0[5]**

UNIT I: **8 Hours**

Data and number systems, Binary representation, Codes and their conversions: BCD, Octal, Hexadecimal,ASCII, EBDIC, Gray, Signed binary number representation with 1's and 2's complement methods,Binary arithmetic.

UNIT II: **8 Hours**

Boolean algebra, Venn diagram, logic gates and circuits, Minimization of logic expressions by algebraic method, K-map method and Quine Mc Clauskey method.

UNIT III: **8 Hours**

Combinational circuits- adder, subtract or, encoder, decoder, comparator, multiplexer, de-multiplexer, parity generator, etc. Design of combinational circuits-Programming logic devices and gate arrays.

UNIT IV: **8 Hours**

Sequential Circuits- Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology

UNIT V: **8 Hours**

Different types of A/D and D/A converters and conversion techniques.
Different Logic families: TTL, ECL, MOS, CMOS etc. and their operation, design an specifications.
Memory devices: RAM, ROM, PROM, EPROM, EEPROM, basic principles etc.

Text books:

1. Donald D. Givone, "Digital Principles & design", Tata McGraw Hill,2003.
2. Morries Mano, Digital Logic and Computer Design(1st Ed.), Pearson Education India,2016.
3. Saroj Rangnekar and Susmita Mitra, "Digital Electronics",Indian Society for Technical Education, Learning Materials Centre, 2001.

References:

1. H.Taub & D.Shilling, "Digital Integrated Electronics",(1st Ed.) Mc Graw Hill,2010.
2. Arivazhagan S Salivahanan"Digital Circuits and Design"(3rd Ed.), Vikas Publishing House Pvt Ltd,2009.

CSECC 04: Numerical Methods and Programming **4:0:0[4]**

UNIT I: **8 Hours**

Approximation in numerical computation, Truncation and rounding errors.
Algebraic Equation: Bisection method, Secant method, Regular-Falsi method, Newton-Raphson method.

UNIT II: **8 Hours**

Interpolation: Lagrange's Interpolation, Newton forward & backward differences Interpolation, Newton divided difference.

UNIT III: **8 Hours**

Numerical Solution of a system of linear equation: Gauss elimination method, Matrix Inversion, LU Factorization method, Gauss Jacobi method, Gauss Seidal method;

UNIT IV: **8 Hours**

Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, Runge-kutta method, Predictor-Corrector method.

UNIT V: **8 Hours**

Numerical Integration: Trapezoidal, Rule, Simson's 1/3 Rule, Weddle' Rule.

Textbooks:

1. Pradeep Niyogi,"Numerical Analysis and Algorithms", TMH,2003.
2. S.S. Sastry, "Introductory Methods of Numerical Analysis"(5th Ed.),PHI Learning Pvt Ltd,2012.
3. C.Xavier, "C Language and Numerical Methods" New Age International,2007.

References:

1. M.K. Jain,S.R.K Iyengar ,& R.K. Jain "Numerical Methods: Problems and Solution", New Age International Publication,2004.
2. N. Dutta "Computer Oriented Numerical Methods"(1st Ed.), Vikas Publishing House Pvt Ltd,2004.

CSECC 05: Data Structure Lab **0:0:4[2]**

Experiments should include but not limited to:

1. Implementation of array operations
2. Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem: Evaluation of expressions operations on Multiple stacks & queues :
3. Implementation of linked lists: inserting, deleting, and inverting linked list. Implementation of stacks & queues using linked lists
4. Polynomial addition, Polynomial multiplication
5. Sparse Matrices: Multiplication, addition.
6. Recursive and Non-recursive traversal of Trees
7. Threaded binary tree traversal. AVL tree implementation.
8. Application of Trees, Application of sorting and searching algorithms
9. Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

CSECC 06: Digital Electronics Lab **0:0:4[2]**

1. Realization of NOT, OR, AND, XOR, XNOR gates using universal gates
   A. Gray to Binary conversion & vice-versa.
   B. Code conversion between BCD and EXCESS-3
2.
   A. ODD and even parity generation and checking.
   B. 4-bit comparator circuit
3. Design of combinational circuit to drive seven-segment display
4. Design of combinational circuits using multiplexer
5.
   A. Adder/ Substractor circuits using Full-Adder using IC and/ or logic gates.
   B. BCD Adder circuit using IC and/ or logic gates
6. Realization of RS , JK, and D flip flops using Universal logic gates
7. Realization of Asynchronous up/down counter
8. Realization of Synchronous Mod-N counter Digital to Analog conversion

CSECC 07: Numerical Methods Lab **0:0:4[2]**

1. Assignments on Algebric Equation: Bisection, Secant, Regular-falsi, Newton Raphson
2. Assignments on Interpolation: Newton forward & backward, Lagrange
3. Assignments on Numerical solution of a system of linear equation: Gauss elimination, Gauss Jacobi, Matrix Inversion, Gauss Seidal
4. Assignments on Statistical Problem: Mean, Median, Mode, Standard deviation (for simple & frequency type data), Correlation & Regression
5. Assignments on Ordinary Differential Equation: Taylor Series, Euler's method, Runga-Kutta
6. Assignments on Numerical Integration: Trapezoidal Rule, Simson's 1/3 Rule, Weddle's Rule

SOT CF 18: Operations Research and Industrial Management **4:0:0[4]**

UNIT I: **8 Hours**

System concepts, system approach, Linear programming problems, Mathematical formulation, Graphical solution, Simplex method; Degeneracy and Duality in linear programming;

UNIT II: **8 Hours**

Transportation problems, Assignment problems, Decision analysis.

UNIT III: **8 Hours**

Waiting line problems, Project Management by PERT/CPM; Inventory control.

UNIT IV: **8 Hours**

Mathematical models of physical systems. Modeling of systems and Computer Simulation.

UNIT V: **8 Hours**

Advanced Computer Programming Techniques: Integer Programming, Dynamic Programming

Textbooks:

1. L.C.Jhamb,"Industrial Management",(Vol.1), Symbiosis Centre for Distance Learning,2004.
2. Sinha, "Industrial Relations, Trade Unions & Labour Legislation",(2nd Ed.) Pearson Education Asia,2012.
3. S. N. Chary, "Productions and Operations Management",(3rd Ed.) TMH,2006.

References:

1. Phillip Kotler, "Marketing Management",(Student Value Ed.) Prentice Hall/Pearson Education,2016.

Fourth Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSECC 08	Database Management Systems	4	2		5
2	CSECC 09	Computer Organization And Architecture	4	2		5
3	CSECC 10	Object Oriented Programming With C++	4	2		5
4	CSECC 11	Computer Networks – I	4	2		5
5	CSECC 12	DBMS Lab			4	2
6	CSECC 13	OOPS Lab			4	2
7	CSECC 14	Computer Networks – I Lab			4	2
	Total Credits (CORE)					**26**
8	SOT CF 11	Probability And Statistics	4			4
	Total Credits (Compulsory Foundation)					**4**

DETAILED SYLLABUS

CSECC 08: Database Management Systems **4:2:0[5]**

UNIT I: **8 Hours**

Introduction: File & Data Base Concept, Overview of DBMS, Data Models, Database Administrator, Database Users, Schema, Data Independence.

Entity-Relationship Model: Basic concepts , Keys, Entity-Relationship Diagram, Cardinality ratios, Strong & Weak Entity Sets, Specialization, Generalization, Aggregation.

Relational Model: Procedural & Non Procedural Languages, Relational Algebra, Extended Relational Algebra Operations, Views, Modifications Of the Database, Relational Calculus.

UNIT II: **8 Hours**

SQL: Basic Concepts, Set operations, Aggregate Functions, Null Values, assertions, views, Nested Sub-queries, Cursors, Stored procedures and triggers. Integrity Constraints & Introduction to RDBMS: Domain Constraints, Referential Integrity Constraints, Codd's rule.

Functional Dependencies and Normalization: Functional Dependency, Armstrong's axioms, Canonical Cover, Closure, Full and Partial Functional dependencies, Prime & Non Prime attribute, 1NF, 2NF, 3NF, BCNF, Multi valued Dependency, 4NF, 5NF, DKNF.

UNIT III: **8 Hours**

Storage Strategies: Single-Level Index (primary, secondary, clustering), Multi-level Indexes, Dynamic Multi-level Indexes, Hashing Techniques, B tree and B+ tree.

Query Optimization: Full Table scan, Indexed-based scan, Merge join, Nested loop join , Equivalence rules , Heuristic Optimization , Cost Based Optimization.

UNIT IV: **8 Hours**

Transaction & Concurrency Control: Transaction concept, ACID properties, Conflict & View serializabilty, Test for Conflict serializability, Concurrency Control, Lock base protocols, Two phase locking.

Backup & Recovery: Physical & Logical Backup, Transaction logs, Causes of failures, Recovery techniques.

UNIT V: **8 Hours**

Distributed Databases: Basic Concepts, Data Fragmentation, Replication and Allocation Techniques, Types of Distributed Database Systems, Query Processing, Overview of Client-Server Architecture and its relationship to Distributed Databases.

Textbooks:

1. Henry F. Korth, Silberschatz Abraham and S. Sudarshan, "Database System Concepts" (9th Ed.) McGraw Hill Education,2010.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems",(7th Ed) Pearson Education India.2015.
3. C. J. Date, "Introduction to Database Management",(8th Ed.) Pearson,2003.

References:

1. Alexis Leon & Mathews Leon, "Database Management Systems", Leon Vikas,2002.
2. Bipin C Desai, "An Introduction to Database Systems"(Revised Ed.), Galgotia Publication Pvt Ltd,2012.

CSECC 09: Computer Organization & Architecture **4:2:0[5]**

UNIT I: **8 Hours**

Concepts & Terminology: Digital computer concepts; Von-Neumann concept; Hardware & Software and their nature; structure & functions of a computer system, Role of operating system.

UNIT II: **8 Hours**

CPU Design: The ALU- ALU organization, Integer representation, 1s and 2s complement arithmetic; Serial & Parallel Address; implementation of high speed Address Carry Look Ahead & carry Save Address; Multiplication of signed binary numbers-Booth's algorithm;
Divide algorithms- Restoring & Non-Restoring; Floating point number arithmetic; Overflow detection, status flags.
Instruction Set Architecture- Choice of instruction set; Instruction word formats; addressing modes.

UNIT III: **8 Hours**

Control Design: Timing diagrams; T-States, Controlling arithmetic & logic instruction, control structures; Hardwired & Micro programmed, CISC & RISC characteristics.
Input/output Organization: Introduction to Bus architecture, effect of bus widths, Programmed & Interrupt I/O, DMA.

UNIT IV: **8 Hours**

Memory Unit: Memory classification, characteristics; Organization of RAM, address decoding ROM/PROM/EEPROM; Magnetic memories, recording formats & methods, Disk & tape units; Concept of memory map, memory hierarchy, Associative memory organization; Cache introduction, techniques to reduce cache misses, concept of virtual memory & paging.

UNIT V: **8 Hours**

Pipelining-general concept, speed up, instruction & arithmetic pipeline; Examples of some pipeline in modern processors, pipeline hazards; Flynn's classification –SISD, SIMD, MISD, MIMD architectures-Vector and Array processors & their comparison, Concept of Multiprocessor; Centralized & distributed architectures.

Textbooks:

1. John P. Hayes, "Computer Architecture & Organization",(3rd Ed.), McGraw-Hill College,2003.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky "Computer Organization",(5th Ed.), McGraw-Hill Education,2011.
3. M. Morris Mano,"Computer System Architecture",(3rd Ed.),Pearson Education India,2007.

References:

1. Nicholas P Carter, "Computer Architecture (Schaum Series)",(2nd Ed.) McGraw Hill Education,2009.
2. William Stallings, "Computer Organization & Architecture",(10th Ed.),Pearson, 2015.

CSECC 10: Object Oriented Programming with C++ **4:2:0[5]**

UNIT I : **8 Hours**

Introduction: Need of OOP, History, Development, Concepts, and Benefits of OOP. Programming in C++: Structure of a C++ program, tokens, keywords, identifiers, data types, expressions, control structures, declaration and initialization of variables, operators, expressions and implicit conversions. Arrays and pointers. Introduction, Structure Definitions, Accessing Members of Structures,Header Files and Namespaces, library files. Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class's Behaviors.

UNIT II: **8 Hours**

Class Scope and Accessing Class Members, Separating Interface from Implementation, Controlling Access Function And Utility Functions, Initializing.
Class Objects: Constructors, Using Default Arguments With Constructors, Using Destructors,
Classes : Const (Constant) Object And Const Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Function overloading.

UNIT III : **8 Hours**

Fundamentals of Operator Overloading, Restrictions On Operators Overloading, Operator
Functions as Class Members vs. as Friend Functions, Overloading Unary Operators, Overloading Binary Operators.
Introduction to Inheritance, BaseClasses And Derived Classes, Protected Members, Casting Base-Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base –Class Members in a Derived Class, Public, Protected and Private Inheritance,Using Constructors and Destructors in derived Classes,
Introduction to Virtual Functions, Abstract Base Classes And Concrete Classes, Polymorphism, New Classes And Dynamic Binding, Virtual Destructors, Polymorphism, Dynamic Binding.

UNIT IV: **8 Hours**

Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes. Introduction, Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Rethrowing an Exception, Exception specifications,
Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends, Templates and Static Members.

UNIT V: **8 Hours**

Files and Streams, Creating a Sequential Access File, Reading Data From A Sequential Access
File, Updating Sequential Access Files, Random Access Files, Creating A Random Access File, Writing Data Randomly To a Random Access File, Reading Data Sequentially from a Random Access File.

Text Books:

1. H M Deitel and P J Deitel "C++ How to Program",(3rd Ed.), Prentice Hall, 2000.
2. Bjarne Stroustrup "Programming: Principles and Practice Using C++",(2nd Ed.),Addison Wesley,2014.
3. E Balagurusamy "Object oriented Programming with C++"(6th Ed.) ,Tata McGraw-Hill Education,2013.

Reference books:

1. Herbert Schildt "The Complete Reference in C++",(5th Ed.) By,Tata McGraw Hill Education,2014.

CSE CC11: Computer Networks-1 **4:2:0[5]**

UNIT I: **8 Hours**

Overview of data communication and Networking: Introduction, Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (Simplex, Half duplex, Full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology),categories of network (LAN,MAN,WAN);Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

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UNIT II: **8 Hours**

Physical level: Overview of data (analog & digital), signal (analog & digital), Transmission Impairment, Performance, Nyquist rate, Shannon capacity, transmission (analog & digital) & transmission media (guided & non-guided); Transmission Modes, Digital to digital conversion, Analog to digital conversion, Digital to analog conversion, Analog to analog conversion.

UNIT III: **8 Hours**

Multiplexing, Spread Spectrum, Introduction to switching, time division & space division switch, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, SONET, Frame Relay, Telephone Network.

UNIT IV: **8 Hours**

Data link layer: Service, Types of errors, framing (character and bit stuffing), error detection &correction methods; Flow control methods; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC, PPP.

UNIT V: **8 Hours**

Medium access sub layer: Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, fast Ethernet; Token ring, FDDI, WLAN, Bluetooth.

Text Books:

1. A. S. Tanenbaum, Computer Networks (5th Ed.), Pearson Education/PHI,2011.
2. W. Stallings, Data and Computer Communications (10th Ed.), PHI/ Pearson Education,2013.
3. B. A. Forouzan, Data Communications and Networking, (5th Ed.), TMH,2013.

References*:*

1. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India. Leon, Garica, Widjaja, Communication Networks,(7th Ed.)TMH,2016.
2. "Mobile Communication", J. Schiller(2nd Ed.), Pearson Education,2003.

CSECC 12: Database Management Systems Lab **0:0:4[2]**

List of Experiments to be Performed (Not limited to)

Experiment No.	Title
1	Introduction to Oracle 10g through installation and Data Types in SQL
2	Implementing Data Definition Language commands in SQL
3	Implementing Data Manipulation Language commands in SQL
4	Implementation of Data and Built in Functions in SQL
5	Implementing Joins and Set Operations in SQL
6	Implementing Qualified Retrieval queries in SQL
7	Database Design using E-R model and Normalization
8	Implementation of Cursor Programs
9	Implementation of Procedures and Functions
10	Implementation of Embedded SQL

Students (a group of 4 or 5 students) are required to submit a mini project based on DBMS.

CSECC 13: Object Oriented Programming Lab (USING C++) **0:0:4[2]**

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, vectors, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming, handling errors and exceptions, applet programming and graphics programming
6. UML based design using Rational Rose

CSECC14: Networks-1 Lab **0:0:4[2]**

Experiments

1 Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.

2 Study of Network Devices in Detail.

3 Study of network IP.

4 Connect the computers in Local Area Network.

5 Implement the data link layer framing methods such as character stuffing.

6 Implement the data link layer framing methods such as bit stuffing.

7 Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP 15.

List of Experiment to be performed (But not limited to)

SOTCF 11: Probability And Statistics **4:0:0[4]**

UNIT I: **8 Hours**

Sample spaces, events as subsets, probability axioms, sample theorems, finite sample spaces and equiprobable Measure as special cases, binomial coefficients and counting techniques applied to probability problems, conditional probability, independent events, Bayes' formula.

UNIT II: **8 Hours**

Moment –expectation, mean, variance, regression, Random variables(discrete and continuous), probability functions, density and distribution functions, special distributions(binomial, hypergeometric, Poisson, uniform exponential, normal…) mean and variance, Chebychev inequality, independent random variables, functions of random variables their distributions.

UNIT III: **8 Hours**

Poisson and normal approximation to the binomial ,central limit theorem, law of large numbers, some statistical applications.

UNIT IV: **8 Hours**

Theory of sampling- Sampling distribution and standard error.
Theory of estimation-point estimation and interval estimation.

UNIT V: **8 Hours**

Transition Probabilities and matrix, classification of states Ergodic properties,random walks problem. Examples from physical,biological and behavioural science.
Types of processes, Markov process, Application to the theory of queues.

Textbooks:

1. Morris H. DeGroot and Mark J. Schervish"Probabilty and Statistics",(4th Ed.), Pearson,2013.
2. T. Veerarajan, "Probabilty –Statistics and Random Process"(3rd Ed.), McGraw Hill Education, 2008.
3. J. J. Schiller, R. A. Srinivasan, M. R. Spiegel, "Probabilty and Statistics (Schaum's outline)(4th Ed.), McGraw Hill Education, 2013.

References:

1. E. Kreyszig, "Advanced Engineering Mathematics",(10th Ed.),Wiley,2015.
2. B.S. Grewal, "Higher Engineering Mathematics "(43rd Ed.),Khanna Publishers,2014.

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Course Structure of B. Tech Programme under TSSOT

THIRD YEAR

YEAR	SEMESTER	CORE	ELECTIVE	PROJECT,TRAINING, VIVA,SEMINAR	TOTAL
III	**V**	**23**	**5**	**2**	**30**
	VI	**22**	**5**	**2**	**29**

Fifth Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSECC 15	Operating Systems	4	2		5
2	CSECC 16	Microprocessor & Microcontroller	4			4
3	CSECC 17	Formal Languages And Automata Theory	4			4
4	CSECC 18	Computer Graphics & Multimedia	4			4
5	CSECC 19	OS Lab			4	2
6	CSECC 20	Microprocessor & Microcontroller Lab			4	2
7	CSECC 21	Computer Graphics & Multimedia Lab			4	2
	Total Credits (CORE)					**23**
8	CSEELXX*	Elective – I	5			5
	Total Credits (Elective)					**5**
9	**CSE PT 01**	Summer Training				2
	Total Credits (Project, Training, Viva…)					**2**

*** XX REPRESENTS PAPER CODE OF THE APPROPRIATE ELECTIVE GIVEN IN THE LIST OF ELECTIVE COURSES.**

DETAILED SYLLABUS

CSECC 15: Operating System **4:2:0[5]**

UNIT I: **8 Hours**

Introduction: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management: Processes: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads: overview, benefits of threads, user and kernel threads.

UNIT II: **8 Hours**

CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock. Storage Management:

UNIT III: **8 Hours**

Memory Management: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

UNIT IV: **8 Hours**

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management**:** disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.

UNIT V: **8 Hours**

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

Protection & Security: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Textbooks:

1. Andrew S Tanenbaum and A.S. Woodhull, "Operating System Design & Implementation", (3rd Ed.)Prearson, 2006.
2. A. Silberchatz,Peter B. G. and Gerg G. "Operating System Concept,"(9th Ed.)John Wiley,2015.

References:

1. D. M. Dhamdhere, "Operating System: A concept Based Approach", TMH,2008.
2. W. Stallings,"Operating Systems: Internals and Design Principles",(8th Ed.),Pearson International, 2014.

CSECC 16: MICROPROCESSOR & MICROCONTROLLERS **4:0:0[4]**

UNIT I: **8 Hours**

Introduction to microprocessor: Basic features of hardware of 8085 microprocessor, Addressing modes of 8985. 8085 microprocessor architecture– as an 8-bit representative.Memory interfacing: Address decoding, Address aliasing, Memory read and write operations, Timing diagrams I/O Interfacing – Memory mapped I/O and I/O mapped I/O.

UNIT II: **8 Hours**

Instruction Set for 8085: Details of 8085 assembly language programming. Examples of Assembly Language Programming Data Transer Techniques: Synchronous and Asynchronous modes of data transfer, Interrupt driven I/O,Interrupts– Polled interrupts and vector interrupts, priority and masking.

UNIT III: **8 Hours**

Familiarization with peripheral devices: 8255 programmable peripheral interface, 8254 programmable counter, 8251 UART programmable communication interface, 8257 DMA Controller. 8259 Interrupt controller, 8279_ Keyboard & display interface . Signal converter and their interfacing techniques-ADC0809, DAC 0808.

UNIT IV: **8 Hours**

Introduction to 16-bit microprocessor and its architecture: 8086 as an example,8086Architecture and Internal Resister Set, Brief discussion on Instruction Set, Min-Max mode, Concept of Co-processor and its interfacing.

UNIT V: **8 Hours**

Introduction to micro-controller: 8051 as an example. Micro -controller architecture, bi-directional data ports, internal ROM and RAM, counters/timer s, oscillator and clock, serial communication. 8051-register set, memory organization – internal & external, program memory & data memory, bit addressable memory, and special function registers. Introduction to instruction set of 8051 and assembly language programming. Brief studies on important features of higher processor in the Intel 80X86 family.

Text Books

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085",(6th Ed.), Penram International Publishing, 2013.
2. K. Ayala, "The 8051 Microcontroller ", (3rd Ed.),Cenage Learning,2007.
3. Yu-Cheng Liu and Glenn A. Gibson, "Microcomputer Systems: The 8086/8088 Family",(2nd Ed.), Pearson Education,2006.

Reference Books

1. J. Uffenberk, "Microcomputers and microprocessors"(3rd Ed.), Pearson Education, Asia (LPE), 2002.
2. D.V. Hall and SSSP Rad, "Microprocessors and Interfacing" (3rd Ed.), Tata-McGraw-Hill,2012.

CSECC 17: Formal Language and Automata Theory **4:0:0[4]**

UNIT I: **8 Hours**

Alphabet, languages and grammars. Production rules and derivation of languages. Chomsky hierarchy of languages. Regular grammars, and finite automata (deterministic and nondeterministic),Finite Automata with output.

UNIT II: **8 Hours**

Regular expressions, Kleene's theorem, Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata

UNIT III: **8 Hours**

Left and right linear grammars. Context free grammars and pushdown automata(Deterministic & Nondeterministic),Chomsky and Greibach normal forms. Parse trees, Ambiguity and properties of context free languages. Pumping lemma, Ogden's lemma.

UNIT IV: **8 Hours**

Turing machines and variation of Turing machine model, Turing computability, Type 0 languages.

UNIT V: **8 Hours**

Church Turing hypothesis. Recursive and recursively enumerable sets. Universal Turing machine and undecidable problems. Undecidability of Post correspondence problem.

Text Books:

1. J. E. Hopcroft and J. D Ullman"Introduction to Automata Theory, Languages and Computation",(3rd Ed.) Pearson Education India,2008.
2. H. R. Lewis and C. H. Papadimitriou"Elements of the Theory of Computation",(2nd Ed.) Pearson Education,India,2015.

Reference Books:

1. Michael Sipser "Introduction to the Theory of Computation",(3rd Ed.),Cengage,2014.

CSECC18: Computer Graphics & Multimedia **4:0:0[4]**

UNIT I **8 Hours**

Introduction: Computer graphics and its applications, input and output devices Output primitives: line-drawing algorithms- DDA algorithm and Bresenham's algorithm; Midpoint algorithms for circle & ellipse generation; area-filling algorithms-scan-line polygon-fill, nonzero-winding number rule; scan-line curve filling, boundary-fill algorithm, flood-fill algorithm; Character generation techniques generation of bitmap and outlined font.

UNIT II **8 Hours**

2-D geometric transformations: Basic transformations- translation, rotation and scaling; matrix representations and Homogeneous co-ordinate representations; Composite transformations among translation, rotation and scaling; General pivot-point rotation; General fixed-point scaling; General scaling directions; Other transformations- reflection and shear; Transformation between co-ordinate systems; Definition of Affine transformations.

UNIT III **8 Hours**

3-D geometric transformations: Translation; Rotation- rotations about co-ordinate axes, general 3-D rotation; Scaling; Reflection; Shear. 3-D viewing: viewing transformation pipeline; world co-ordinate to viewing co-ordinate transformation. Window-to-viewport co-ordinate transformation. Clipping operations: definition; point clipping; line clipping- Cohen-Sutherland algorithm; polygon clipping- Sutherland-Hodgeman algorithm; curve clipping, text clipping.

UNIT IV **8 Hours**

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Data and file format standard .Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption. Audio- Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), MIDI. Color models and applications: RGB, YIQ, CMY, HSV, HLS

UNIT V **8 Hours**

Need for data compression, compression techniques for binary image, colour and grey and still video image . Full motion video compression, audio compression. Multimedia authoring system and tools. Animation and virtual reality concepts.

Text Books:

1. Hearn, Baker: Computer Graphics (C version 2nd Ed.), Pearson education,2004.
2. Foley, Vandam, Feiner, Hughes: Computer Graphics principles (2nd Ed.), Pearson Education,2014.

Reference Books:

1. Ranjan Parekh: Principles of multimedia(2nd Ed.), TMH,2012.

CSECC 19: OS Lab **0:0:4[2]**

1. Cell and Socket Programming
2. Packet Monitoring software (**tcpdump, snort, ethereal**)
3. Trace route, Ping, Finger, Nmap
4. Server configuration (FTP, SMTP, DNS)
5. NFS Configuration
6. Firewall Configuration using **iptables/ipchains** (Linux only)

CSECC 20: Microprocessor and Microcontroller Lab **0:0:4[2]**

1) Familiarization with 8085 register level architecture and trainer kit components, including the memory map. Familiarization with the process of storing and viewing the contents of memory as well as registers.
2) Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical)
3) Assignments based on above.
4) Familiarization with 8085 simulator on PC.
5) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.
6) Assignments based on above
7) Programming using kit/simulator for
   a) table look up
   b) Copying a block of memory
   c) Shifting a block of memory
   d) Packing and unpacking of BCD numbers
   e) Addition of BCD numbers
   f) Binary to ASCII conversion
   g) String Matching
   h) Multiplication using Booth's Algorithm
8) Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit eg, subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc
9) Interfacing any 8-bit Latch (eg, 74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding
10) Interfacing with I/O modules:
   a) Speed control of mini DC motor using ADC or DAC
   b) Keyboard
   c) Multi-digit Display with multiplexing
   d) Stepper motor
11) Writing programs for 'Wait Loop (busy waiting)' and ISR for vectored interrupts (eg, counting number of pulses within specified time period)

CSECC 21: Computer Graphics & Multimedia Lab **0:0:4[2]**

1. Sound capturing & editing using tools like SOUNDFORGE.
2. Image editing using tools, like Adobe Photoshop.
3. Creating/editing motion video/animation clips (using tools like Flash / Adobe Premier).
4. Creation of Content using HTML (basic tags, table form, frame, link to other Image).
5. Creating stylesheet using DHTML
6. Homepage creation using HTML, DHTML.
7. Basic alogorithm implementation on primitives, transformation, filling etc.

Sixth Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSECC 22	Design And Analysis Of Algorithms	4	2		5
2	CSECC 23	Computer Networks – II	4	2		5
3	CSECC 24	Web Technology	4			4
4	CSECC 25	Software Engineering	4			4
5	CSECC 26	Computer Networks - II Lab			4	2
6	CSECC 27	Web Technology Lab			4	2
	Total Credits (CORE)					**22**
7	CSEELXX*	Elective – II	5			5
	Total (Elective)					**5**
8	**CSE PT 02**	Group Discussion & Seminar			4	2
	Total Credits (Project, Training, Viva…)					**2**

*** XX REPRESENTS PAPER CODE OF THE APPROPRIATE ELECTIVE GIVEN IN THE LIST OF ELECTIVE COURSES.**

DETAILED SYLLABUS

CSECC 22: Design & Analysis of Algorithm **4:0:0[4]**

UNIT I: **8 Hours**

Models of computation: RAM, TM etc. time and space complexity
Asymptotic Notation: Big-O, omega, theta etc.; finding time complexity of well known algorithms like- heap sort, search algorithm etc.
Algorithm Design techniques: Recursion- Definition, Use, Limitations, Examples: Hanoi problem. Tail Recursion

UNIT II: **8 Hours**

Divide and Conquer: Basic method, use, Examples: Merge sort, Quick Sort, Binary Search
Dynamic Programming: Basic method, use, Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Traveling Salesman problem
Branch and Bound: Basic method, use, Examples: The 15-puzzle problem

UNIT III: **8 Hours**

Backtracking: Basic method, use, Examples: Eight queens problem, Graph coloring problem, Hamiltonian problem
Greedy Method: Basic method, use, Examples: Knapsack problem, Job sequencing with deadlines, minimum spanning tree (Prim's and Kruskal's algorithms)
Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.

UNIT IV: **8 Hours**

Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank, Path compression.
Properties of graphs and graph traversal algorithms: BFS and DFS
Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes

UNIT V: **8 Hours**

Notion of NP-completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.
Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem

Textbooks:

1. A.V. Aho, J. E. Hopcroft, J.D. Ullman, "The Design & Analysis of Computer Algorithms", Addison-Wesley ,2003.
2. D.E.Knuth, "The Art of Computer Programming,"(1st Ed.) Vol 1-4A, Addison-Wesley professional,2011.

References:

1. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein "Introduction to Algorithms", (2nd Edition), PHI,2009.
2. Steven S. Skiena "The Algorithm Design",(2nd Ed.),Springer, 2011.

CSECC 23: Computer Networks-II **4:2:0[5]**

UNIT I: **8 Hours**

Network layer: Internet Protocol(IP),IP Addressing: IPv4 and IPv6 , sub netting; Routing : Routing table , Intra-domain and Inter-domain Routing algorithms, NAT,ARP, ICMP

UNIT II: **8 Hours**

Transport layer: UDP; TCP, SCTP, TCP connection Establishment and release, Congestion control algorithms, Quality of service: techniques to improve Qos.

UNIT III: **8 Hours**

Application layer: Client Server Model, Socket Interface, Domain Name System (DNS), Application layer protocols: HTTP, Telnet, FTP, SNMP, SMTP, VoIP

. **8 Hours**

UNIT IV:

Introduction to mobile systems: Evolution of mobile system, Generations, GSM and CDMA One Architecture, Introduction to Mobile IP & Mobile TCP

8 Hours

UNIT V:

ATM, Frame Relay, Wireless LAN: IEEE 802.11; Bluetooth, VLAN, Cellular telephony & Satellite network

Text Books:

1. A. S. Tanenbaum, "Computer Networks", (5th Ed.), Pearson Education/PHI,2011.
2. W. Stallings, "Data and Computer Communications", (10th Ed.), PHI/ Pearson Education,2013.
3. B. A. Forouzan, "Data Communications and Networking", (5th Ed.), TMH,2013.

References*:*

1. Garica, Widjaja, "Communication Networks",(7th Ed.)TMH,2016.
2. "Mobile Communication", J. Schiller(2nd Ed.), Pearson Education,2003.

CSECC 24: Web Technology **4:0:0[4]**

UNIT I: **8 Hours**

Internet basics: History and basic idea of Internet; Internet services: telnet, e-mail, ftp, WWW.

Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages. Use of Cascading Style Sheet in web pages.

Dynamic Web Pages: Creating interactive and dynamic web pages with JavaScript- JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.

UNIT II: **8 Hours**

Markup language basics: Standard Generalized Markup Language (SGML)- structures, elements, Content models, DTD, attributes, entities.

Extensible Markup Language (XML)- Introduction: using user-defined tags in web pages; displaying XML contents using HTML and JavaScript; XML Document Type Definitions; Extensible Stylesheet Language (XSL) and its use to display XML contents; XSL and basic database queries; brief introduction to other markup languages: VML, MathML, VRML, RELML, HRMML, VoxML, etc.

UNIT III: **8 Hours**

Java environments for Web Technology

UNIT IV: **8 Hours**

Introduction to Client/Server Computing: client-server computing basics

Web Browsers: functions and working principle of web browsers; plug-ins & helper applications; conceptual architecture of typical web browsers (like Mozilla).

Web Servers: Web services and web server functionality; web server composition; registration; HTTP, IP address, DNS & ports; conceptual architecture of a typical web server (like Apache).

UNIT V: **8 Hours**

Introduction to Advanced web technologies.

Web Security: Firewalls- definition and uses, network layer firewalls and application layer firewalls; Proxy servers.

Textbooks:

1. Godbole A. S. & Kahate A.”Web Technologies”,(3rd Ed.) Tata McGraw Hill Education Pvt Ltd,2013.
2. Xavier C. “Web Technology & Design”, New Age Publication,2007.
3. Kogent Learning Solution Inc.”Java Server Programming,Java EE7(Black Book)”, (J2EE 1.7 Ed.) Dreamtech Press,2014.

References:

1. Dick Oliver, “SAMS Teach Yourself Html and CSS in 24 Hours”,(9th Ed.),Sams Publishing,2013.
2. Brad Dayley,”SAMS Teach Yourself JavaScript in 24 Hours”, Sams Publishing,2013.

CSECC 25 :Software Engineering **4:0:0[4]**

UNIT I: **8 Hours**

Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model, Function Point Analysis(FPA).

UNIT II: **8 Hours**

System Requirement Specification, System analysis- DFD, Data Dictionary, ER diagram, Process Organization & Interactions.

System Design- Problem Partitioning, Top-Down & Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

UNIT III: **8 Hours**

Coding & Documentation- Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation.

UNIT IV: **8 Hours**

Testing- Levels of Testing, White & Black box testing, Integration Testing, structural testing Test case Specification, Reliability Assessment. , Validation & Verification Metrics, Monitoring & Control.

UNIT V: **8 Hours**

Software Project Management- Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.

CASE TOOLS: Concepts, use and application.

Textbooks:

1. "Fundamentals of software engineering."(4th Ed.)Mall, Rajib. PHI Learning Pvt. Ltd., 2014.
2. "Software engineering: a practitioner's approach." Pressman, Roger S. Palgrave Macmillan, 2005.

References:

1. "An integrated approach to software engineering."(2nd Edition) Jalote, Pankaj. Springer Science & Business Media, 2012.
2. "Essentials of software engineering."(4th Ed.) Tsui, Frank, Orlando Karam, and Barbara Bernal. Jones & Bartlett Publishers, 2016.

CSECC 26: Computer Networks-II Lab **0:0:4[2]**

List of Experiments to be Performed (Not limited to)

Experiment No.	Title
1	Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2	Study of Socket Programming and Client – Server model
3	Write a code simulating ARP /RARP protocols.
4	Write a code simulating PING and TRACEROUTE commands
5	Create a socket for HTTP for web page upload and download.
6	Write a program to implement RPC (Remote Procedure Call)
7	Implementation of Sub netting
8	Applications using TCP Sockets like a. Echo client and echo server b. Chat c. File Transfer
9	Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
10	Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
11	Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Link State routing ii. Flooding iii. Distance vector

Students (a group of 4 or 5 students) are required to submit a mini project based on DBMS.

CSECC 27: Web Technology Lab **0:0:4[2]**

1. Case studies and Assignments based on the theory

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Course Structure of B. Tech Programme under TSSOT

FOURTH YEAR

YEAR	SEMESTER	CORE	ELECTIVE	PROJECT,TRAINING, VIVA,SEMINAR	TOTAL
IV	**VII**	**10**	**15**	**11**	**36**
	VIII	**0**	**10**	**15**	**25**

Seventh Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSECC28	Compiler Design	5			5
2	CSECC29	Cryptography & Network Security	5			5
	Total Credits (CORE)					**10**
3	CSEELXX*	Elective – III	5			5
4	CSEELXX*	Elective – IV	5			5
5	CSEELXX*	Elective – V	5			5
	Total (Elective)					**15**
6	CSE PT 03	Project – I			14	7
7	CSE PT 04	Industrial Training			4	4
	Total Credits (Project, Training, Viva…)					**11**

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DETAILED SYLLABUS

CSECC 28: Compiler Design **5:0:0[5]**

UNIT I: **6 Hours**

The Structure of a Compiler. Applications of Compiler Technology.
Lexical Analysis: The Role of the Lexical Analyzer, Specification and recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT II: **10 Hours**

Syntax Analysis: Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc,bison)

UNIT III: **6 Hours**

Syntax-Directed Translation: Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.
Symbol Table**:** Its structure, symbol attributes and management. [6L]

UNIT IV: **8 Hours**

Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.
Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

UNIT V: **10 Hours**

Code Improvement (optimization**):** Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Register allocation and target code generation .

Text book

1. Alfred V. Aho, Ravi Sethi, Monica S. Lam and J.D. Ullman, "Compilers: Principles, Techniques and Tools",(2nd Ed.),Pearson Education Ltd.,2013.
2. Alfred V. Aho and J.D. Ullman, "Principles of Compiler Design", Narosa Publication,2002.

Reference Books

1. Andrew W. Appel, "Modern Compiler Implementation in C/Java", Cambridge University Press,2003.
2. K. D. Cooper and L. Torczon "Engineering a Compiler"(2nd Ed.),Morgan Kaufmann,2011.

CSECC 29: Cryptography and Network Security **5:0:0[5]**

UNIT I: **8 Hours**

Introduction and Mathematical Foundations: Overview on Modern Cryptography ,Ciphers and Secret Messages, Security Attacks and Services. Number Theory , Probability and Information Theory, Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms. Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems

UNIT II: **8 Hours**

Conventional Symmetric Encryption Algorithms: Theory of Block Cipher Design, Feistel Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength (or Not) of DES.

Modern Symmetric Encryption Algorithms: IDEA, CAST, Blowfish, Twofish, RC2, RC5, Rijndael (AES), Key Distribution. Stream Ciphers and Pseudo Random Numbers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher, One Time Pad, Cryptanalysis of Symmetric Key Ciphers.

UNIT III: **8 Hours**

Public Key Cryptography: Prime Numbers and Testing for Primality, Factoring Large Numbers, RSA, Diffie-Hellman, ElGamal, Key Exchange Algorithms, Public-Key Cryptography Standards.

Hashes and Message Digests: Message Authentication, MD5, SHA, RIPEMD, HMAC, Cryptanalysis of Asymmetric Key Ciphers, Modern Trends in Asymmetric Key Cryptography.

UNIT IV: **8 Hours**

Digital Signatures, Certificates, User Authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls, Elliptic Curve Cryptosystems. Authentication of Systems: Kerberos V4 and V5, X.509 Authentication Service. Digital Watermarking and Steganography.

UNIT V: **8 Hours**

Network Security: Secret Sharing Schemes, Network Protocols, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls, IPSEC, Private networks access security (L2F, PPTP, L2TP), Web Security, privilege management infrastructure (PMI) and Access Control, security in e-commerce, smart cards.

Textbooks:

1. William Stallings"Cryptography and network security: principles and practices",(7th Ed.),Pearson Education India, 2016.

2. Schneier, Bruce, John Wiley & Sons, "Applied cryptography: protocols, algorithms, and source code in C"(20th Anniversary Ed.), 2015.

References:

1. Mollin, Richard A. "An introduction to cryptography."(2nd Ed.) CRC Press, 2006.

2. Spillman, Richard J. "Classical and contemporary cryptology", Prentice-Hall, Inc., 2007.

Eighth Semester

Sl. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	CSEELXX*	Elective – VI	5			5
2	CSEELXX*	Elective – VII	5			5
	Total Credits (Elective)					**10**
3	**CSE PT 05**	Project – II			40	20
4	**CSE PT 06**	Grand Viva				5
	Total (Project, Training, Viva)					**25**

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ELECTIVES (DISCIPLINE) SYLLABUS

CSEEL 01: Cryptography and Information Security **5:0:0[5]**

UNIT I: **8 Hours**

Introduction and Mathematical Foundations: Overview on Modern Cryptography ,Ciphers and Secret Messages, Security Attacks and Services. Number Theory , Probability and Information Theory, Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms. Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems

UNIT II: **8 Hours**

Conventional Symmetric Encryption Algorithms: Theory of Block Cipher Design, Feistel Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength (or Not) of DES.

Modern Symmetric Encryption Algorithms: IDEA, CAST, Blowfish, Twofish, RC2, RC5, Rijndael (AES), Key Distribution. Stream Ciphers and Pseudo Random Numbers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher, One Time Pad, Cryptanalysis of Symmetric Key Ciphers

UNIT III: **8 Hours**

Public Key Cryptography: Prime Numbers and Testing for Primality, Factoring Large Numbers, RSA, Diffie-Hellman, ElGamal, Key Exchange Algorithms, Public-Key Cryptography Standards.

Hashes and Message Digests: Message Authentication, MD5, SHA, RIPEMD, HMAC, Cryptanalysis of Asymmetric Key Ciphers, Modern Trends in Asymmetric Key Cryptography

UNIT IV: **8 Hours**

Digital Signatures, Certificates, User Authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls, Elliptic Curve Cryptosystems. Authentication of Systems: Kerberos V4 and V5, X.509 Authentication Service. Digital Watermarking and Steganography.

UNIT V: **8 Hours**

Network Security: Secret Sharing Schemes, Network Protocols, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls, IPSEC, Private networks access security (L2F, PPTP, L2TP), Web Security, privilege management infrastructure (PMI) and Access Control, security in e-commerce, smart cards.

Textbooks:

1. "Cryptography and network security: principles and practices." Stallings, William(7th Ed.). Pearson Education India, 2016.

2. "Applied cryptography: protocols, algorithms, and source code in C(20th Anniversary Ed.)." Schneier, Bruce. John Wiley & Sons, 2015.

References:

1. "An introduction to cryptography."(2nd Ed.)Mollin, Richard A. CRC Press, 2006.

2. "Classical and contemporary cryptology." Spillman, Richard J. Prentice-Hall, Inc., 2007.

CSEEL 02: Distributed Database **5:0:0[5]**

UNIT I: **8 Hours**

What is Distributed Database System (DDBS), Features of DDBS, promises of DDBS, Design issue in DDBS, Types of distributed database, Distributed DBMS architecture: Client/server System, Peer-to-Peer, Mutli-Database system.

UNIT II: **8 Hours**

Distributed database design concept, objective of Data Distribution, replication, Data Fragmentation, The allocation of fragment , Transparencies in Distributed Database Design.

UNIT III: **8 Hours**

Basic concept of Transaction management, objective Distributed transaction management, Model for Transaction management, Distributed Concurrency control: Objective, concurrency control anomalies, Distributed Serializability, Locking based algorithm, Timestamp based algorithm.

UNIT IV: **8 Hours**

Introduction to Deadlock, Distributed Deadlock prevention, avoidance, detection and recovery, Two-Phase and Three-Phase Commit Protocol, checkpoint.

UNIT V: **8 Hours**

Concept, objective, and phases of distributed query processing; join strategies in fragment relation Global query optimization.

Textbooks:

1. Özsu, M. Tamer, and Patrick Valduriez,"Principles of distributed database systems" (3rd Ed.),Springer Science & Business Media, 2011.
2. Ray and Chhanda"Distributed database systems", Pearson Education India, 2009.
3. Silberschatz, Abraham, Henry F. Korth, and Shashank Sudarshan,"Database system concepts." Vol. 6. New York: McGraw-Hill, 2006.

Reference:

1. Elmasri, Ramez."Fundamentals of database systems",(7th Ed.), Pearson Education India, 2015.

CSEEL 03: Graph Theory **[5:0:0][5]**

UNIT I: **8 Hours**

Basics – Graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties. Structure and Symmetry – Cut vertices, bridges and blocks, auto-morphism groups, reconstruction problem

UNIT II: **8 Hours**

Trees and connectivity – Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem. Eulerian and Hamiltonian graphs – Characterization of Eulerian graphs - Sufficient conditions for Hamiltonian graphs.

UNIT III: **8 Hours**

Colouring and planar graphs – vertex and edge colouring, perfect graphs, planar graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness.

UNIT IV: **8 Hours**

Shortest Spanning Trees - Kruskal's Algorithm, Prims Algorithm, DFS, BFS, Cut Sets, Planar and Dual Graphs, Metric Representation of Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow.

UNIT V: **8 Hours**

Matching, factors, decomposition and domination. Extremal Graph theory – Turan's theorem, Ramsay's theorem, Szemeredi's regularity lemma, applications.

Textbooks:

1. J. A. Bondy and U. S. R. Murthy,"Graph Theory",Springer Verlag,2008.
2. D. B. West, "Introduction to Graph Theory",(2nd Ed.), PHI, 2004.

References:

1. R. Diestel "Graph Theory", Springer Verlag (5th Ed.)(Free Download available),2016.

CSEEL 04: Artificial Intelligence **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction :Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac – Toe problem. Intelligent Agents : Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving :Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. Search techniques :Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

UNIT II: **8 Hours**

Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT III: **8 Hours**

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation. Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules: Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT IV: **8 Hours**

Probabilistic reasoning :Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics. Planning : Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Natural Language processing : Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning :Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

UNIT V: **8 Hours**

Expert Systems :Architecture of expert systems, Roles of expert systems, representing and using domain knowledge, expert system shells, knowledge acquisition- Meta Knowledge, Heuristics. Typical expert systems- MYCIN, DART, XOON, expert system shells. Basic knowledge of programming language like Prolog & Lisp.

Text Books:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, " Artificial Intelligence",(3rd Ed.), McGraw Hill Education, 2008.

2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence : A Modern Approach",(3rd Ed.),Pearson Education India, 2015.

Reference Books:

1. David Poole, Alan Mackworth and Randy Goebel "Computational Intelligence", Oxford University Press, 2006.

CSEEL 05: Computer Graphics & Multimedia **5:0:0[5]**

UNIT I: **8 Hours**

Introduction: Computer graphics and its applications, input and output devices Output primitives: line-drawing algorithms- DDA algorithm and Bresenham's algorithm; Midpoint algorithms for circle & ellipse generation; area-filling algorithms-scan-line polygon-fill, nonzero-winding number rule; scan-line curve filling, boundary-fill algorithm, flood-fill algorithm; Character generation techniques generation of bitmap and outlined font.

UNIT II: **8 Hours**

2-D geometric transformations: Basic transformations- translation, rotation and scaling; matrix representations and Homogeneous co-ordinate representations; Composite transformations among translation, rotation and scaling; General pivot-point rotation; General fixed-point scaling; General scaling directions; Other transformations- reflection and shear; Transformation between co-ordinate systems; Definition of Affine transformations.

UNIT III: **8 Hours**

3-D geometric transformations: Translation; Rotation- rotations about co-ordinate axes, general 3-D rotation; Scaling; Reflection; Shear. 3-D viewing: viewing transformation pipeline; world co-ordinate to viewing co-ordinate transformation. Window-to-viewport co-ordinate transformation. Clipping operations: definition; point clipping; line clipping- Cohen-Sutherland algorithm; polygon clipping- Sutherland-Hodgeman algorithm; curve clipping, text clipping.

UNIT IV: **8 Hours**

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Data and file format standard .Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption. Audio- Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), MIDI. Color models and applications: RGB, YIQ, CMY, HSV, HLS

UNIT V: **8 Hours**

Need for data compression, compression techniques for binary image, colour and grey and still video image . Full motion video compression, audio compression. Multimedia authoring system and tools. Animation and virtual reality concepts.

Text Books:

1. Hearn and Baker," Computer Graphics" (C version 2nd Ed.), Pearson education,2004.
2. Foley, Vandam, Feiner and Hughes" Computer Graphics principles" (2nd Ed.), Pearson Education,2014.

Reference Books:

1. Ranjan Parekh,"Principles of multimedia",(2nd Ed.), TMH,2012.

CSEEL 06: Data Mining **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction to Data Mining :What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals , Stages of the Data Mining Process , Data Mining Techniques , Knowledge Representation Methods . Applications ,Example: weather data

Data Warehouse and OLAP : Data Warehouse and DBMS , Multidimensional data model , OLAP operations , Example: loan data set

Data preprocessing :Data cleaning , Data transformation , Data reduction, Discretization and generating concept hierarchies , Installing Weka 3 Data Mining System , Weka - filters, discretization

UNIT II: **8 Hours**

Data mining knowledge representation : Task relevant data, Background knowledge , Interestingness measures , Representing input data and output knowledge, Visualization techniques , Experiments with Weka - visualization

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT III: **8 Hours**

Data mining algorithms: Association rules-Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis, Experiments with Weka - mining association rules

Data mining algorithms: Classification-Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm, Decision trees , Covering rules.

Data mining algorithms: Prediction-The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models

UNIT IV: **8 Hours**

Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb

UNIT V: **8 Hours**

Advanced techniques, Data Mining software and applications: Text mining- extracting attributes (keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text.

Web mining-classifying web pages, extracting knowledge from the web, Temporal and Spatial Data Mining, Data Mining software and applications, security and Ethical Issues in Data Mining.

Text Books:

1. Jiawei Han, Micheline Kamber," Data Mining- Concepts and Techniques",(3rd Edition), Morgan Kaufmann Publishers,2011.
2. Arun K Pujari "Data Mining Techniques",(2nd Ed.), Universities press.2013.

Reference Books:

1. Pang-Niag Tan, Vipin Kumar, Michael Steinbach,"Introduction to Data Mining", Pearson,2006.

CSEEL 07: Advanced Computer Architecture **5:0:0[5]**

UNIT I: **8 Hours**

Instruction set principles and examples- classifying instruction set- memory addressing- type and size of operands- addressing modes for signal processing-operations in the instruction set- instructions for control flow- encoding an instruction set.-the role of compiler measuring and reporting performance- Quantitative principles of computer design-Instruction set principles and examples- classifying instructions- set architectures-memory addressing-addressing modes for signal processing-type and size of operands.

UNIT II: **8 Hours**

Instruction Level Parallelism**:**Concepts and challenges – overcoming data hazards with dynamic scheduling –examples- reducing branch costs with dynamic hardware prediction- high performance instruction delivery- taking advantages of ILP with multiple issues limitations of ILP.

UNIT III: **8 Hours**

ILP with Software Approaches **:**Basic compiler techniques for exposing ILP- static branch prediction- static multiple issues: VLIW approach- Advanced compiler support for exposing and exploiting ILP-Hardware support-cross cutting issues- Intel IA64 architecture.

UNIT IV: **8 Hours**

Memory Hierarchy Design:Introduction- review of caches- cache performance- reducing cache miss penalty-reducing miss rate- miss rate via parallelism –reducing hit time – main memory and organizations for improving performance- memory technology- virtual memory.

UNIT V: **8 Hours**

Multiprocessors And Thread Level Parallelism :Symmetric shared memory architectures-performance of symmetric shared memory multiprocessors – Distributed shared memory architectures-synchronization-storage systems – types of storage devices- buses- reliability-availability and dependability-RAID – errors and failures in real systems- IO performance measures- Introduction to queuing theory.

Textbook:

1. John L. Hennessey and David A. Patterson,"Computer Architecture: A Quantitative Approach."(5th Ed.), Morgan Kaufmann, 2011.
2. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability"(3rd Ed.), Tata McGraw Hill Edition, 2011.

Reference:

1. Kai Hwang and Faye A. Briggs ,“Computer Architecture and Parallel Processing”, Tata McGraw Hill Edition, 2012.

CSEEL 08:Mobile Computing **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc. Cellular architecture, co-channel interference, frequency reuse, capacity increase by cell splitting.

UNIT II: **8 Hours**

Telecommunication Systems : GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode .

UNIT III: **8 Hours**

Mobile Network Layer: Mobile IP: Goal assumptions and requirements, Entities and Terminology, IP packet delivery, Agents advertisement and discovery, Registration , Tunneling and Encapsulation, Optimization and Reverse Tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing.

UNIT IV: **8 Hours**

Mobile Transport Layer : Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction oriented TCP. Data Dissemination and Management: Challenges, Data dissemination, Mobile data replication, Mobile data caching, Mobile cache maintenance, mobile web caching, caching in ad hoc networks.

UNIT V: **8 Hours**

Context Aware Computing: Ubiquitous computing, concept of context, context aware computing and applications, middleware support. Mobile Middleware: Service discovery, adaptation, mobile agents. Wireless security: Traditional security issues, mobile and wireless security issues, Problems in ad hoc networks.

Text Books

1. Adelstein, S.K.S. Gupta, Golden G. Richard IIIand Loren Schwiebert, Frank, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Professional,2015.
2. D.P. Agrawal and Q.-A. Zeng,”Introduction to Wireless and Mobile Systems”,(4th Ed.) Thomson Brooks/Cole,2015.

Reference Books

1. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall,2001.
2. Jochen Schiller,”Mobile Communications”,(2nd Ed.), 2008.

CSEEL 09: Pattern Recognition **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Examples; The nature of statistical pattern recognition; Three learning paradigms; The sub-problems of pattern recognition; The basic structure of a pattern recognition system; Comparing classifiers. Bayes Decision Theory: General framework; Optimal decisions; Classification; Simple performance bounds.

UNIT II: **8 Hours**

Learning - Parametric Approaches: Basic statistical issues; Sources of classification error; Bias and variance; Three approaches to classification: density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE; Parametric Discriminant Functions : Linear and quadratic discriminants; Shrinkage; Logistic classification; Generalized linear classifiers; Perceptrons; Maximum Margin; Error Correcting Codes.

UNIT III: **8 Hours**

Error Assessment: Sample error and true error; Error rate estimation; Confidence intervals; Resampling methods; Regularization; Model selection; Minimum description length; Comparing Classifiers Nonparametric Classification: Histograms rules; Nearest neighbor methods; Kernel approaches; Local polynomial fitting; Flexible metrics; Automatic kernels methods.

UNIT IV: **8 Hours**

Feature Extraction: Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR.

UNIT V: **8 Hours**

Margins and Kernel Based Algorithms: Advanced algorithms based on the notions of margins and Kernels Applications of PR: Speech and speaker recognition, Character recognition, Scene analysis.

Text Books:

1. Sergios Theodoridis,"Pattern Recognition", (4th Ed.)- Elsevier ,2014.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2013.

Reference Books:

1. Tom M. Mitchell (Indian Edition),"Machine Learning ",McGraw Hill Education ,2013.
2. M Narasimha Murty and V Susheela Devi, "Pattern Recognition: An Algorithmic Approach"Universities Press ,2011.

CSEEL 10: Information Retrieval **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Goals and history of IR. The impact of the web on IR. Basic IR Models: Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.

UNIT II: **8 Hours**

Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval: Simple tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors; Java implementation. Experimental Evaluation of IR: Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.

UNIT III: **8 Hours**

Query Operations and Languages: Relevance feedback; Query expansion; Query languages. Text Representation: Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and markup languages (SGML, HTML, XML). Text Categorization: Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization.

UNIT IV: **8 Hours**

Web Search: Search engines; Spidering; Metacrawlers; directed Spidering; link analysis (e.g. hubs and authorities, Google PageRank); shopping agents.

Language-Model Based Retrieval : Using naïve Bayes text classification for ad hoc retrieval. Improved smoothing for document retrieval.

UNIT V: **8 Hours**

Text Clustering: Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to web search and information organization.

Information Extraction and Integration: Extracting data from text; semantic web; collecting and integrating specialized information on the web.

Text Books:

1. Manning, Prabhakar, Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Ricardo Baeza-Yate, Berthier Ribeiro-Neto,"Modern Information Retrieval",(2nd Ed.),Pearson Education Asia, 2011.

Reference Books:

1. G.G. Chowdhury, "Introduction to Modern Information Retrieval",(3rd Edition) ,Neal-Schuman Publishers, 2010.
2. David A. Grossman, Ophir Frieder,"Information Retrieval: Algorithms, and Heuristics",(2nd Ed.)-Academic Press, 2012.

CSEEL 11:VLSI Design & Algorithms **5:0:0[5]**

UNIT I: **8 Hours**

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NOT Gate, NAND gate, NOR gate, Compound gates, Multiplexers, Memory- latches and registers.

Circuits and system representation: Behavioural representation, Structural representation, Physical representation.

UNIT II: **8 Hours**

CMOS processing technology: Silicon semiconductor technology- An overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS technology, Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, Circuit elements, 3-D CMOS.

UNIT III: **8 Hours**

Layout design rule: Layer representations, CMOS n-well rules, Design rule of background scribe line, Layer assignment, SOI rule. Switching characteristics: Analytic delay models, Empirical delay model, Gate delay. Power dissipation: Static dissipation, Dynamic dissipation, Short-circuit dissipation, Total power dissipation.

UNIT IV: **8 Hours**

CMOS design methods: Design strategies, Structural design strategies, Hierarchy, Regularity, Locality. Programmable logic and its structure, Programmable interconnect, Programmable gate array, Concurrent logic, Full custom mask design, Gate array design. Stick representation.

UNIT V: **8 Hours**

Design Methods: Behavioural Synthesis, RTL synthesis, VLSI design cycle, Physical design cycle, Design styles, Partitioning, Floor-planning and Placement, Routing, Compaction. Design tools: HDL design, Schematic, Layout design, Floor-planning, Chip composition. Design Verification: Simulation, Timing verifier, Netlist comparisons.

Textbooks:

1. Neil, H. E. Weste, and Kamran Eshraghian,"Principles of CMOS VLSI Design: A Systems Perspective",(4th Edition) Addison-Wesley, 2010.

2. Pucknell Douglas A., and Kamran Eshraghian,"Basic VLSI design",(3rd Ed.), Prentice-Hall, Inc., 2011.

References:

1. Rabaey, Jan M., Anantha P. Chandrakasan, and Borivoje Nikolic,"Digital integrated circuits."(2nd Ed.), Vol. 2. Englewood Cliffs: Prentice hall, 2016.

CSEEL 12: Soft Computing **5:0:0 [5]**

UNIT I: **8 Hours**

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and Reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT II: **8 Hours**

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT III: **8 Hours**

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information: Information & Uncertainty, Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

UNIT IV: **8 Hours**

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks Application of Fuzzy Logic: Medicine, Economics etc. Genetic algorithms(GAs), Evolution strategies(ESs), Evolutionary programming(EP), Genetic Programming(GP), schema analysis, analysis of selection algorithms; convergence; Markov & other stochastic models.

UNIT V: **8 Hours**

Soft computing approaches: Simulated Annealing, Tabu Search, Ant colony based optimization. A fusion Approach of multispectral images with SAR, Optimization of travelling Salesman problem using genetic algorithm approach, Soft computing based hybrid fuzzy controllers.

Text Books:

1. Jang, Sun, Mizutani, "Neuro-Fuzzy and Soft computing: A Computational Approach to Learning and Machine Intelligence", Pearson Education ,2004.

2. S.N. Sivanandam and S. N. Deepa, "Principles of Soft Computing",(2nd Ed.), Wiley India Pvt Limited ,2011.

Reference Books:

1. S. Rajasekaran and G.A Vijayalakshmi pai,"Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications",Prentice-Hall of India Pvt Limited,2011.

2. Martin T. Hagan, Howard B. Demuth, Mark Hudson Beale and Ornaldo De Jesus, "Neural Network Design"(2nd Ed.),Martin Hagan Publication,2014.

CSEEL 13: Computer Vision **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: The Marr paradigm and scene reconstruction. Other paradigms for image analysis. Fundamental of Image Formation, Transformation: Orthogonal, Euclidean Affine, Projective etc; Fourier Transformation, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT II: **8 Hours**

Binary Image Analysis and Segmentation: Properties. Digital geometry. Image Segmentation methods: Region growing, Edge Based approaches to segmentation , Graph-cut, Mean Shift, MRFs, Texture Segmentation; Object detection. Depth estimation and Multi-camera views: Perspective, Binocular stereopsis, camera and Epipolar Geometry, Homoghraphy, Rectification, DLT,RANSAC,3-D reconstruction framework; Auto calibration,apparel.

UNIT III: **8 Hours**

Feature Extraction: Edge canny, LOG, DOG; Line detectors(Hough Transform),Corners-Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOP, Scale-Space Analysis- Image pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT IV: **8 Hours**

Pettern Analysis: Clustering methods like K-means, K-Medoids, Misture of Gaussian, Classification: Discriminant Function, Supervised, Un-supervised, Semi-Supervised; Classifiers; Bayes, KNN, ANN, models; Dimensionality, Reduction: PCA, LDA, ICA: Non-parametric methods.

UNIT V: **8 Hours**

Motion Analysis: Back ground Subtraction and Modeling, Optional Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo: Motion parameter estimation; Shape from X: Light at surfaces: Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Text Books:

1. David A. Forsyth, Jean Ponce, "Computer Vision: A modern Approach",(2nd Ed.), Prentice Hall, 2015.
2. Luciano da Fontoura Costa, Roberto Marcond Cesar,Jr, "Shape Analysis and Classification: Theory and Practice", Prentice –hall, 2010.
3. Alan V. Oppenheim, Alan S. Willsky and S. Hamid,"Signal and Systems"(2nd Ed.),Pearson ,2013.

Reference Books:

1. Linda G. Shapiro & George Stockman "Computer Vision", Prentice Hall,2001.
2. Emanuele Trucco & Alessandro Verri, "Introductory technique for 3D computer vision", Prentice-Hall,2005.

CSEEL 14: Cloud Computing **5:0:0 [5]**

UNIT I: **8 Hours**

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages

UNIT II: **8 Hours**

Management of Cloud services: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs Abstraction and Virtualization: Virtualization Technologies, Load balancing and virtualization, Understanding Hypervisors, SOA, SOA Communications, Managing SOA, Relating SOA and Clod Computing.

UNIT III: **8 Hours**

Abstraction and Virtualization: Virtualization Technologies, Load balancing and virtualization, Understanding Hypervisors, SOA, SOA Communications, Managing SOA, Relating SOA and Clod Computing.

Cloud Computing Risk Issues: The CIA, Privacy and Compliance risk, Common Threats and vulnerabilities, Cloud Access Control Issues, Cloud Service Provider risk.

UNIT IV: **8 Hours**

Information Storage Security & Design and Optimization: Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments. Monitoring and management; security auditing and SIEM.

Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.

UNIT V: **8 Hours**

Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems-Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL. Incident Response, Layered security and IDS, Encription and Key Mangement.

Text Books:

1. Ronald L. krutz and Russel dean Vines"A comprehensive Guide to Secure Cloud computing", Wiley India Pvt. Ltd,2010.
2. Barrie Sosinky,"Cloud computing Bible",(1st Ed.) Wiley India Pvt. Ltd,2010.

Reference Books:

1. Anthony T. Velte, Toby J. Velte"Cloud Computing: A Practical Approach", Tata McGraw Hill Pvt.Ltd,2010.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Dr. Fern Halper "Cloud Computing For Dummies", Wiley India Pvt. Ltd,2009.

CSEEL 15: Web Service & Service oriented Architecture **5:0:0 [5]**

UNIT I: **7 Hours**

Introduction: Introduction Distributed computing in the large, Motivations for composition, Challenges for composition, Web Services Architectures and Standards, Computing with Services, W3C, Fundamental SOA, Common characteristics of contemporary SOA, Common misperceptions about SOA, Common tangible benefits of using SOA, Common pitfalls of adopting SOA, Comparing SOA to client-server and distributed internet architectures, Anatomy of SOA, How components in an SOA interrelate.

UNIT II: **8 Hours**

Enterprise Architectures and SOC Principles: Introduction, Integration versus interoperation , Model Driven Architecture , Concepts of Distributed Computing, XML, Use cases: Intra-enterprise and Inter-enterprise Interoperation, Application, Configuration, Dynamic Selection, Software Fault Tolerance,

Service Oriented Analysis: Business-centric SOA – Deriving business, Services, Service modeling, Service Oriented Design; WSDL Basics, SOAP Basics, UDDI Basics, REST Basics, Difference between SOAP v/s REST

UNIT III: **8 Hours**

Web Service Basics: Service Description, Messaging with SOAP, Message Exchange pattern, Coordination, Transaction, Business Activities, Orchestration, Choreography. Service layer Abstraction - Application Service Layer, Business Service Layer, Orchestration Service Layer

Service Composition: Service composition guidelines – Entity-centric business service design, Application service design, Task centric business, service design.

UNIT IV: **9 Hours**

SOA Platform basics: SOA support in J2EE- Java API for XML based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), Java API for XML based RPC (JAXRPC), Web Services Interoperability Technologies (WSIT). SOA support in .NET: Common Language Runtime, ASP.NET web forms, ASP.NET web services, Web Services Enhancements (WSE).

UNIT V: **8 Hours**

Specifications and WS-BPEL WS-Addressing, WS-ReliableMessaging, WS-Policy (including WSPolicy Attachments and WS-PolicyAssertions), WS-Metadata Exchange, WS-BPEL basics, WS-Coordination overview, WS-Choreography, WS-Security (including XML-Encryption, XML-Signature, and SAML)

Text Books:

1. Munindar Singh & Michael Huhns “Service Oriented Computing: Semantics, Processes, Agents”, Wiley Publication, 2006.
2. Thomas Erl“Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2016.

Reference Books:

1. Thomas Erl, “SOA Principles of Service Design” (The Prentice Hall Service-Oriented Computing Series from Thomas Erl), 2007.
2. Mark D Hansen, “SOA using Java™ Web Services”, Prentice Hall Publication, 2007.

CSEEL 16: Script Programming **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction to Programming Languages: What is program and programming paradigms, Programming languages-their classification and characteristics, language translators and language translation activities, Use of Algorithms/Flow Charts for problem solving Introduction to Python Programming: Features, basic syntax, Writing and executing simple program, Basic Data Types such as numbers, strings, etc. Declaring variables, Performing assignments, arithmetic operations, Simple input-output

UNIT II: **8 Hours**

Sequence Control – Precedence of operators, Type conversion Conditional Statements: if, if-else, nested if – else Looping: for, while, nested loops Control statements: Terminating loops, skipping specific conditions String Manipulation: declaring strings, string functions Manipulating Collections Lists, Tuples, Sets Dictionaries – Concept of dictionary, techniques to create, updates & delete dictionary items. OOP Using PYTHON- Class, Object, self, init() function.

UNIT III: **8 Hours**

Functions: Defining a function, calling a function, Advantages of functions, types of functions, function parameters, Formal parameters, Actual parameters, anonymous functions, global and local variables Modules: Importing module, Creating & exploring modules, Math module, Random module, Time module Python File Input-Output: Opening and closing file, Various types of file modes, reading and writing to files, manipulating directories Exception Handling – What is exception, Various keywords to handle exception such try, catch, except, else, finally, raise Regular Expressions – Concept of regular expression, various types of regular expressions, using match function

UNIT IV: **8 Hours**

Linux Usage Basics Starting X from the Console- Changing your Password- The root User- Elevating your Privileges, Running Commands and Getting Help- Reading Usage Summaries- man, info, & whatis Commands

Filesystem- Linux File Hierachy Concepts- Current Working Directory Files & Directory Name- Absolute and Relative Pathnames- Create, remove, change, list, copy, move Files & Directories- Determining File Content, Viewing Files- Partitions, Filesystem and checking free space

- cp, mv, rm, & inodes- Symbolic Links and Hard Links

Standard I/O & Pipes- Standard Input and Output, Pipes to connect Processes- Overwriting vs Appending - Redirecting both standard Output and Error

UNIT V: **8 Hours**

Shells, Types of Unix Shells, Advantages of Shell Scripts, Initialization Files, Login Shells, Non Login Shells, Aliases, Variables, Working with Variables, Important Internal Bash Variables, Command History, Input and Output Channels, Redirection to Files, The here Operator, Feeding Output to Another Process, Duplicating the Output with tee, Types of Commands, Quoting, Substitution and Expansion, Variable Substitution

Text books:

1. Paul Gries , Jennifer Campbell, Jason Montojo, *Practical Programming: An Introduction to Computer Science Using Python 3*, Pragmatic Bookshelf, 2/E 2014.

2. James Payne , *Beginning Python: Using Python 2.6 and Python 3*, Wiley India, 2010.

3. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and shell Programming" (1st Ed.), Cengage Learning India, 2003.

Reference Books:

1. Lukaszewski, *MySQL for Python: Database Access Made Easy*, Pact Publisher, 2010 .

2. Sumitabha Das, "Unix Concepts And Applications"(4th Ed.) TMH, 2006.

CSEEL 17 :Software Engineering **5:0:0[5]**

UNIT I: **8 Hours**

Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model, Function Point Analysis(FPA).

UNIT II: **8 Hours**

System Requirement Specification, System analysis- DFD, Data Dictionary, ER diagram, Process Organization & Interactions.

System Design- Problem Partitioning, Top-Down & Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

UNIT III: **8 Hours**

Coding & Documentation- Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation.

UNIT IV: **8 Hours**

Testing- Levels of Testing, White & Black box testing, Integration Testing, structural testing Test case Specification, Reliability Assessment. , Validation & Verification Metrics, Monitoring & Control.

UNIT V: **8 Hours**

Software Project Management- Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.

CASE TOOLS: Concepts, use and application.

Textbooks:

1. "Fundamentals of software engineering."(4th Ed.)Mall, Rajib. PHI Learning Pvt. Ltd., 2014.
2. "Software engineering: a practitioner's approach." Pressman, Roger S. Palgrave Macmillan, 2005.

References:

1. "An integrated approach to software engineering."(2nd Edition) Jalote, Pankaj. Springer Science & Business Media, 2012.
2. "Essentials of software engineering."(4th Ed.) Tsui, Frank, Orlando Karam, and Barbara Bernal. Jones & Bartlett Publishers, 2016.

CSEEL 18: Image Processing **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display. Digital Image Formation : A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

UNIT II: **8 Hours**

Mathematical Preliminaries: Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

UNIT III: **8 Hours**

Image Enhancement : Spatial Domain Method, Frequency Domain Method, Contrast Enhancement - Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

UNIT IV: **8 Hours**

Image Restoration: Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

UNIT V: **8 Hours**

Image Segmentation: Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books:

1. Digital Image Processing (3rd Ed.)- Rafael C. Gonzalez, Pearson, 2007.
2. Digital Image Processing(7th Ed.)- Bernd Jahne, Springer,2017.
3. Digital Image Processing & Analysis(2nd Ed.)- Scott E Umbraugh, CRC press,2010.

Reference Books:

1. Image Processing, Analysis & Machine Vision(4th Ed.)- Milan Sonka, Vaclav Hlavac and Roger Boyle, Cengage Learning, 2014.

CSEEL 19:Advance Operating Systems **5:0:0[5]**

UNIT I: **6 Hours**

Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Concept of a Process, Concurrent Processes –The Critical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs.

UNIT II: **6 Hours**

Theoretical Foundations - inherent limitations of a distributed system – lamport's logical clocks – vector clocks – casual ordering of messages – global state – cuts of a distributed computation – termination detection. Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms – a comparative performance analysis.

UNIT III: **10 Hours**

Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.

UNIT IV: **8 Hours**

Distributed shared memory-Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithm – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues.

UNIT V: **10 Hours**

Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of check points – synchronous and asynchronous check pointing and recovery – check pointing for distributed database systems- recovery in replicated distributed databases.
Multi – Processor operating system Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory Management – Reliability / Fault Tolerance; Database Operating Systems – Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control Algorithms.

Textbook:

1. Mukesh Singhal, Niranjan G.Shivaratri,"Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", (Indian Ed.)Tata McGraw Hill Education, 2001.

Reference:

1. Andrew S Tanenbaum and A.S. Woodhull, "Operating System Design & Implementation", (3rd Ed.)Prearson, 2006.
2. Pradeep K.Sinha ,"Distributed operating system-Concepts and design", PHI, 2003.

CSEEL 20:Quantum Computing **5:0:0[5]**

UNIT I: **8 Hours**

Introduction to quantum mechanics; postulates of quantum mechanics; Qubit and quantum states: The Qubit, Vector Spaces, Single-Qubit Gates, multiple Qubit Gates, Controlled Gates, Gate Decomposition; Matrix and operators

UNIT II: **8 Hours**

Density operators; ; The Density Operator for a Pure State, The Density Operator for a Mixed State, Properties of a Density Operator, Characterizing Mixed States, Completely Mixed States, The Partial Trace and the Reduced Density Operator; quantum measurement theory: Distinguishing Quantum States and Measurement ,Projective Measurements, Measurements on Composite Systems, Generalized Measurements, Positive Operator-Valued Measures; Introduction to quantum automata

UNIT III: **8 Hours**

Entanglement: quantum state entanglement ,Bell's Theorem, The Pauli Representation, Using Bell States For Density Operator Representation, Quantum gates and circuits: Single-Qubit Gates, The Z–Y Decomposition ,Basic Quantum Circuit Diagrams, Controlled Gates, Application of Entanglement in teleportation and supper dense coding., Distributed quantum communication

UNIT IV: **8 Hours**

Quantum Algorithm: Hadamard Gates, The Phase Gate, Matrix Representation of Serial and Parallel Operations, Quantum Interference, Quantum Parallelism and Function Evaluation, Deutsch-Jozsa Algorithm, Quantum Fourier Transform, Phase Estimation, Shor's Algorithm ,Quantum Searching and Grover's Algorithm

UNIT V: **8 Hours**

Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

Textbook:

1. Nielsen, M. A., & Chuang I., "Quantum computation and quantum information", Cambridge University Press, 2015.
2. McMahon, David, "Quantum computing explained", John Wiley & Sons, 2007.

Reference

1. Preskill, John,"Lecture notes for physics 229: Quantum information and computation." California Institute of Technology 2015.

CSEEL 22: Advanced Algorithm Design **5:0:0 [5]**

UNIT I: **8 Hours**

Review of various Design and Analysis Techniques and their comparisons: Overview of Divide-and-Conquer, Dynamic Programming and Greedy Algorithms, Comparison of dynamic programming and Greedy algorithm with Knapsack as case studyTheoretical foundation of greedy algorithm, Matroids and Greedy methods, A Task Scheduling problem as a Matroid.Comparisons of all techniques with reference to their time complexity, space complexity, guaranteed optimization and Stability

UNIT II: **8 Hours**

Review of Graph Theory, Internal Representations, Traversal algorithms, Tree, Spanning tree generation. Maximum Flow: Flow networks, The ford-fulkerson method, Maximum bipartite matching, Push -Rebel Algorithms, The relable-to-front algorithms. Computational Geometry: Line segments properties, determining whether any pair of segment intersects, Finding a convex hull, finding the closest pair of points.

UNIT III: **8 Hours**

Matrix Operations: Solving system of linear equation, Inverting Matrices, Symmetric positive-definite matrices and least square approximation Polynomial and FFT: Representation of polynomials, The DFT and FFT, efficient FFT implementation Number–Theoretic.

8 Hours

UNIT IV:

Algorithm: Elementary number-theoretic notion, Greatest common divisor, modular arithmetic, solving modular linear equation, the Chinese remainder theorem, Power of an element, The RSA public-key cryptosystem, Primality testing, Integer Factorization.

UNIT V: **8 Hours**

NP-Completeness, Polynomial time, Polynomial time verification, NP completeness and reducibility, NP-Completeness proofs. Few examples NP complete problems. Approximation Algorithms- the vertex-cover problem, The Traveling-Salesman Problem, The set covering problem, Randomization and linear programming, Subset-sum problem.

Text Books:

1. T. H. Cormen, C. E. Leiserson, R.L. Rivest, C. Stein, "Introduction to Algorithms", (2nd Ed.), PHI,2009.
2. Steven S. Skiena,"The Algorithm Design",(2nd Ed.), Springer, 2011.

Reference Books

1. A.V. Aho, J. E. Hopcroft, J.D. Ullman, "The Design & Analysis of Computer Algorithms", Addison-Wesley, 2003.

CSEEL 23: Natural Language Processing **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction to NLP:Definition, issues and strategies, application domain, tools for NLP, Linguistic organisation of NLP, NLP vs PLP. Word Classes:Review of Regular Expressions, CFG and different parsing techniques Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules Phonology: Speech sounds, phonetic transcription, phoneme and phonological rules, optimality theory, machine learning of phonological rules, phonological aspects of prosody and speech synthesis. Pronunciation.

UNIT II: **8 Hours**

Spelling and N-grams: Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT III: **8 Hours**

Syntax:POS Tagging: Tagsets, concept of HMM tagger, rule based and stochastic POST, algorithm for HMM tagging, transformation based tagging Sentence level construction & unification: Noun phrase, co-ordination, sub-categorization, concept of feature structure and unification.

UNIT IV: **8 Hours**

Semantics:Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, basics of FOPC Semantic Analysis: Syntax driven, attachment & integration, robustness Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words, metaphor and metonymy and their computational approaches Word Sense Disambiguation: Selectional restriction based, machine learning based and dictionary based approaches.

UNIT V: **8 Hours**

Pragmatics:Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Dialogues: Turns and utterances, grounding, dialogue acts and structures. Natural Language Generation: Introduction to language generation, architecture, dicourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin ,"Speech and Language Processing:An introduction to Language processing, Computational Linguistics, and Speech Recognition", (2nd Ed.), Prentice Hall,2013.

2. Pushpak Bhattacharyya,"Machine Translation", Chapman and Hall/CRC publication,2015.

Reference Books:

1. Steven Bird,Ewan Klein and Edward Loper,"Natural Language Processing with Python",O'Reilly,2009.

CSEEL 24: Theory of Computation **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Alphabet, languages and grammars. Production rules and derivation of languages. Chomsky hierarchy of languages. Regular grammars, Finite Automata- DFA and NFA, conversion of NFA to DFA, NFA with null move, conversion of NFA with Null move to DFA without Null move, Equivalence of DFA and NFA, Finite Automat with output- Mealy Machine and Moore Machine, Conversion to one machine to another.

UNIT II: **8 Hours**

Basic of Regular expressions, Basic Operation on RE- Kleene's theorem, Identities of RE, The Arden's theorem, Construction of Finite Automata from RE, NFA to DFA conversion using ε-Closure method, Construction of Regular Grammar from RE, Construction of FA from Regular Grammar, Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata

UNIT III: **8 Hours**

Definitions of Context free Grammar-Backus Naur Form (BNF), Derivation and Parse Tree, Ambiguity in CFG. Simplification of CFG- Removal of Useless Symbols, Unit Production and Null Production. Left and right linear grammars, Equivalence of Left and right linear grammars. Normal Form-Chomsky and Greibach normal forms, Closure properties of context free languages. Pumping lemma, Ogden's lemma. Introduction to Push Down Automata, Acceptance by a PDA, Deterministic Push Down Automata and Non-deterministic Automata.

8 Hours

UNIT IV:

Two-stack PDA, Construction of PDA from CFG and Construction of CFG equivalent to PDA. Turing machines-Transitional representation, Conversion of RE to TM, Two-stack and TM, Turing machines and variation of Turing machine model, Turing computability, Type 0 languages.

8 Hours

UNIT V:

Church Turing hypothesis.TM languages, Unrestricted grammar, Recursive and recursively enumerable sets and its properties, Universal languages, Reducibility and Undecidable problems, Rice Theorem, Post correspondence problem and modified PCP. Types of computational complexity- Time and space complexity, The Classes P, NP. P=NP? – The million Dollar question, NP-complete, NP-Hard

Text Books:

1. J. E. Hopcroft and J. D Ullman,"Introduction to Automata Theory, Languages and Computation", Addison Wesley Publ., New York,2006.
2. Poonam Sinha,Sunita, A Saxena,"Theory of Computation", Laxmi Publication,2014.

Reference Books:

1. H. R. Lewis and C. H. Papadimitriou,"Elements of the Theory of Computation",(2nd Ed.), Prentice Hall, Englewood Cliffs,2005.

CSEEL 25: Advanced Java Programming **5:0:0 [5]**

UNIT I: **7 Hours**

Introduction: Client & server side programming. Enterprise architecture styles: Single tier , 2-tier , 3-tier, n-tier; Relative comparison of the different layers of architectures.

MVC Architecture: Explanation, Need, Drawbacks, J2EE WEB SERVICES, Different components & Containers.

Servlet: Introduction, Advantages over CGI, How it works?, Servlet life cycle, Servlet API (Different interfaces & classes of generic servlet & HTTP servlet), Accessing user information by means of Request & Response, Servlet session management techniques and relative comparison.

UNIT II: **7 Hours**

JSP: Introduction, Comparison between JSP & servlet., Architecture/Life cycle, Different types of JSP architectures and relative comparison.; JSP tags ,Directives, Scripting elements, Actions; JSP Implicit objects, Accessing user information using implicit objects. Beans- useBeans, setProperty, getProperty, Session Tracking, User Passing Control and Data Between Pages, Shareing Session and application data.

UNIT III: **8 Hours**

JDBC: Introduction, Database driver ,Different approaches to connect an application to a database server, Establishing a database connection and executing SQL statements, JDBC prepared statements, JDBC data sources.

9 Hours

UNIT IV:

Hibernate: Introduction, Installing Hibernate, writing POJO classes, Creating Table, Hibernate application- writing, compiling and running, Annotations, Object life cycle, Hibernate Query languages, Using native SQL Query, Named queries, Generating DDL, Syntax of O/R Mapping File, Generator Class, Hibernate Tools.

UNIT V: **9 Hours**

Introduction: J2EE, JavaBeans- Bean Builder, advantages, Design Patterns, Properties- Simple, Bound, Constrained, BeanInfo interface, Persistence, Customizer, JavaBean API, EJB- Architecture, Usage, Benefits, Beans- Sessions, Stateless, Statefull, Entity and Message driven, Introduction to Struts-Basic Idea.

Text Books:

1. Uttam K. Roy,"Advanced Java Programming", Oxford University Press., Inc.,2015.
2. Ivor Horton,"Beginning J2EE 1.4", SPD Publication,2008.

Reference Books:

1. Austin and Pawlan,"Advanced Programming for JAVA 2 Platform", Pearson,2000.

CSEEL 26: Enterprise Resource Planning **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: ERP as Integrated Management Information System - Evolution of ERP – Benefits of ERP. ERP vs Traditional Information Systems.

UNIT II: **8 Hours**

Business Process Reengineering:Business Process Reengineering- need and challenges, - Management concerns about BPR. - BPR to build business Model for ERP. ERP & Competitiveadvantage, - Basic Constituents of ERP, Selection criteria for ERP Packages. Procurement process for ERP Package.

UNIT III: **8 Hours**

ERP Packages:Overview of ERP packages – PEOPLE SOFT, SAP-R/3, BAAN IV, MFG/PRO,IFS/AVALON, ORACLE- FINANCIAL, Survey of Indian ERP Packages regardingtheir Coverage, performance & cost.

UNIT IV: **8 Hours**

ERP Implementation:ERP Implementation- issues, Role of Consultants, Vendors, Users, - Need for training, customization. ERP implementation methodology and post implementation issues and options.

UNIT V: **8 Hours**

ERP Case Studies:ERP Case Studies InHrm, Finance, Production, Product Database, Materials, Sales & Distribution.

Text Books:

1. Bret Wagner, Ellen Monk, "Concepts in Enterprise Resource Planning", Cengage Learning, 2012.

2. Bret Wagner, Ellen Monk, "Enterprise Resource Planning",(3rd Ed.) Cengage Learning,2008.

References

1. M.Sumna, "Enterprise Resource Planning", Pearson,2007.

CSEEL 27: Fuzzy Systems **5:0:0 [5]**

UNIT I: **8 Hours**

Introduction: Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, chance versus ambiguity, classical set- operations on classical set to functions, fuzzy sets-fuzzy set operations, properties of fuzzy sets .sets as points in hypercube.

UNIT II: **8 Hours**

Classical relations and fuzzy relations: Cartesian product, Crisp relations-cardinality of crisp relations, Operations on crisp relations, Properties of crisp relations, Compositions, Fuzzy relations-cardinality of fuzzy relations, Operations on fuzzy relations, Properties of fuzzy relations, , Non interactive fuzzy sets, Tolerance and equivalence relations-crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance, Max-min Method, other similarity methods.

UNIT III: **8 Hours**

Membership functions: Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments-intuition, Inference, Rank ordering, Angular fuzzy sets ,Neural networks, Genetic algorithms, Classical logic and fuzzy logic: Classical predicate logic-tautologies, Contradictions, Equivalence, Exclusive or , exclusive nor, Logical proofs, Fuzzy tautologies, Contradictions, Equivalence and logical proofs.

UNIT IV: **8 Hours**

Fuzzy rule-based systems: Natural language, Linguistic hedges, Rule-based system-canonical rule forms, fuzzy classification: Classification by equivalence relations-crisp relations, Fuzzy relations cluster analysis, Cluster validity, c-Means clustering-hard c-Means (HCM), Fuzzy c-Means (FCM).

UNIT V: **8 Hours**

Applications: Fuzzy system & neural networks, fuzzy automata , fuzzy pattern recognition, fuzzy image processing: Measures of Fuzziness and Information, Fuzzy Interface Systems Mamdani, Sugeno.

Text Books:

1. Timothy J. Ross, "Fuzzy logic with Engineering applications", McGraw Hill Education,2009.
2. B.Kosko, "Neural Network and Fuzzy Systems: A Dynamic Systems Approch to Machine Intelligence", PHI publication,2007.

Reference Books:

1. Limin Fu,"Neutral Networks in Computer Intelligence", McGraw Hill International,2003.

CSEEL 28:Neural Networks **5:0:0 [5]**

UNIT I: **8 Hours**

Basics of ANN: Models to Neuron; Basic learning laws. Activation and Synaptic Dynamics: Activation dynamics models; Synaptic dynamics models; Stability and Convergence.

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UNIT II: **8 Hours**

Analysis of Feed forward Neural Networks:Linear associative networks for pattern association; Single layer and Multilayer Perception network for pattern classification; Multilayer feed forward neural networks for pattern mapping.

UNIT III: **8 Hours**

Analysis of Feedback Neural Networks:Linear auto associative networks; Hopfield model for pattern storage; stochastic networks; Boltzmann machine for pattern environment storage.

UNIT IV: **8 Hours**

Competitive Learning Neural Networks:Basic competitive learning laws; Analysis of pattern clustering networks; Analysis of self-organizing feature mapping networks.

UNIT V: **8 Hours**

Applications of ANN:Pattern classification problems; Optimization; Control.

Text Books :

1. Haykin, S. "Neural Networks: A Comprehensive Foundation", (2nd Ed.),Prentice Hall,2001.

2. S.Haykin,"Neural Networks and Learning Machines",(3rd Ed.),Pearson, 2011.

Reference Books

1. Churchland, P.S., "Brain-Wise Studies in Neurophilosophy", A Bradford Book,2002.

CSEEL 29:Network – On – Chip **5:0:0[5]**

UNIT I: **8 Hours**

Introduction to Interconnection Networks: Uses of Interconnection Networks - Processor-Memory Interconnect, I/O Interconnect, Packet Switching Fabric.

Network Basics: Topology, Routing, Flow Control, Router Architecture, Performance of Interconnection Networks: Case study with a simple interconnection network.

UNIT II: **8 Hours**

Topology Basics: Channels and Nodes, Direct and Indirect Networks, Cuts and Bisections, Paths, Symmetry.

Traffic Patterns, Performance: Throughput and Maximum Channel Load, Latency, Path Diversity

Case Study: Butterfly and Torus Networks.

UNIT III: **8 Hours**

Non-Blocking Networks: Non-Blocking vs. Non-Interfering Networks, Crossbar Networks, Clos Networks, Beneˇs Networks, Sorting Networks

Slicing and Dicing: Concentrators and Distributors, Bit Slicing, Dimension Slicing, Channel Slicing, Slicing Multistage Networks.

UNIT IV: **8 Hours**

Routing Basics: A Routing Example, Taxonomy of Routing Algorithms, The Routing Relation, Deterministic Routing, Oblivious Routing, Adaptive Routing, Routing Mechanics.

UNIT V: **8 Hours**

Flow Control Basics: Resources and Allocation Units, Buffer less Flow Control, Circuit Switching, Buffered Flow Control.

Deadlock and Livelock: Deadlock, Deadlock Avoidance, Adaptive Routing, Deadlock Recovery.

Quality of Service.

Textbook:

1. William James Dally, Brian Towles, "Principles and Practices of Interconnection Networks", Morgan Kaufmann Publishers,2004.
2. Benini, Luca. "Networks on chips. Ed. Luca Benini." Vol. 1. Morgan Kaufmann, 2006.

Reference Books:

1. De Micheli, G., & Benini, L."Networks on chips: technology and tools." Academic Press,2006.

CSEEL 30:Formal System Verification **5:0:0[5]**

UNIT I: **8 Hours**

Verification process: Verification plan, Debug Cycle, Simulation and Output data, Test bench development.

Current verification techniques: HDL Software simulator, Accelerated simulation, ProcessBased Accelerator techniques, Hardware emulation, FPGA prototyping

UNIT II: **8 Hours**

Introduction to formal techniques and property specification: Reachability analysis, Elements of property languages, Property language layers, PSL basics, Formal test plan process

UNIT III: **8 Hours**

Techniques for proving properties: Abstraction reduction, Compositional reasoning, Counter abstraction, Gradual Exhaustive formal verification

UNIT IV: **8 Hours**

Final system simulation: Module verification, Full simulation from a simulation, Full Simulation from a formal verification

UNIT V: **8 Hours**

IEEE 1850 PSL Property specifications and IEEE 1800 Verilog assertions: Introduction, operations and keywords, PSL Boolean and temporal layer, Introduction to IEEE 1800 System Verilog, Sequence and property, BNF 185 and BNF 223

TextBooks:

1. Douglas L Perry Harry D Foster, "Applied Formal Verification", McGraw Hill, 2005.

2. William K Lam, "Hardware Design Verification: Simulation and Formal Method-based Approaches", Prentice Hall, 2008.

CSEEL 31: System software **5:0:0 [5]**

UNIT I: **7 Hours**

Introduction: Machine structure; System Software and Application Software; components of a programming system- Assemblers, Loaders, Macros, Compilers; Evolution of Operating Systems. Machine Structure, Machine Language, and Assembly Language: General Approach to a New Machine, Machine Language- No looping, Address Modification using Instructions as Data and Index Registers, Looping. Assembly Language- Assembly Language programs, examples using Literals.

UNIT II: **8 Hours**

Assemblers: General design procedures, Design of Assemblers- problem statement, data structures, format of databases, algorithms. Design of two pass assemblers, Cross Assemblers.
Macro Processors: Macro Instructions, Features of a macro facility- macro instruction arguments, conditional macro expansion, macro calls within macros, macro instruction defining macros. Implementation- Two-pass algorithm, Single pass algorithm, Macro calls within Macros. Macro Assemblers.

UNIT III: **8 Hours**

Loader schemes: Compile and go loaders, general loader schemes, absolute loaders, relocating loaders- static & dynamic linking, Direct linking loaders, Binders, Overlays, dynamic binders; Working principle of Editors, Debuggers.

UNIT IV: **8 Hours**

Compilers: General model of a compiler. Phases of a compiler- Lexical phase, Syntax phase, Interpretation phase, Optimization phase, Storage assignment, Code generation, Assembly phase. Passes of a Compiler. Compiler Design Options.

UNIT V: **8 Hours**

Operating System: Basic Operating System Functions, Machine-Dependent and Independent Operating System Features, Operating System Design Options. Other System Software: Text Editors, Debuggers.

Text Books:

1. J. J. Donvan,"Systems Programming",(Indian Ed.), TMH,2001.
2. G.Riley,"Expert system",(4th Ed.),2004.

Reference Books:

1. Carter,"Computer Architecture (Schaum Series)",(2nd Ed.) TMH,2009
2. William Stallings,"Computer Organization & Architecture",(10th Ed.), MH,2015.

CSEEL 32: Java Programming **5:0:0 [5]**

UNIT I: **7 Hours**

Introduction: Java as Programming Platform, Common Misconception about Java. Fundamental Programming Structures in Java- Data types, Variables, Operators, Strings, Formatting Input and Output, Control Flow, Big Numbers, Arrays. Objects and Classes- Introduction, using Predefine Classes, Defining Own Classes, Static Fields and Methods, Method Parameters, Object Construction, Packages, Documentation and Comments. Inheritance: Classes, Super Classes and Sub Classes, Inheritance hierarchies, Polymorphism, Dynamic Binding, Preventing inheritance, Casting, Abstract classes, Protected Access, Object: The Cosmic Super Classes, Generic Array lists, Object Wrapping and Autoboxing, Reflection, Enumeration Classes.

UNIT II: **7 Hours**

Interfaces and Inner Classes: Properties of interfaces, Interfaces and Abstract Classes, Object Cloning, Inner Classes, Proxies. Graphics Programming- introduction to Swing, Creating and Positioning a Frame, Displaying information in a Panel, working with 2D shape, Using colors and Special Fonts. Basic of Event Handling, AWT event hierarchy, Low level events, Actions, Multicasting.

UNIT III: **9 Hours**

User interface using Swing- Layout Management, Text Inputs, Choice Component, Menus, Sophisticated Layout Management, Dialog Boxes. Deploying Applets and applications- Applets Basics, The Applet HTML tags and attributes, Multimedia, Applet Context, JAR files, Application Packaging.

8 Hours

UNIT IV:

Exceptions and Debugging: Dealings with Error, Catching Exceptions, The Finally Clause, Logging, Using Assertions, Debugging Techniques, Debuggers. Streams and Files- reading and writing bytes, use of Stream, Object Stream, File Management- I/O File, Memory mapped, Buffer Data structure, File Locking. Generic Programming- Generic Class and Methods, Restrictions and Limitations, Inheritance rules, Reflection and Gemerics.

9 Hours

UNIT V:

Collection Framework: Benefits, Collection Interfaces, Collection Implementation- Set, HashSet, LinkedHashSet, SortedSet, TreeSet, List, ArrayList, Queue, Priority queue, Map, HasMap, LinkedHashMap, SortedMap, TreeMap, Algorithms- Sorting, Custom Sort, Shuffling, Manipulation, Shuffling, Reversing, Swapping, Copying, Filling, Adding, Searching, Finding Extreme values, Counting frequency.

Text Books:

1. Cay S. Horstmann and Gary Cornell"Core Java 2",(7th Ed.), Pearson Education, Inc,2007.
2. Herbert Schildt,"The Complete Reference – Java", Tata McGraw Hill Education.Inc,2007.

Reference Books:

1. Kogent Learning Solutions,"Java Programming Black Book",(7th Ed.), Dreamtech Press,2013.

CSEEL 33: Engineering Statistics **5:0:0[5]**

UNIT I: **8 Hours**
Introduction, Random sampling, sampling distribution, standard error, point estimation of parameters. Markov process.

UNIT II: **8 Hours**
Level of significance, Test of significance for large samples, Test concerning the mean of a normal population, Testing the equality of Means of two normal populations, Hypothesis Tests concerning the variance of a normal population, Hypothesis Tests in Bernoulli populations.

UNIT III: **8 Hours**
Regression, Least squares estimators of the regression parameters, Statistical Inference about Regression parameters, the coefficient of determination and the sample correlation coefficient, polynomial Regression, Multiple Linear Regression.

UNIT IV: **8 Hours**
Introduction to analysis of variance, one way analysis of variance, two factor analysis of variance, Goodness of fit Tests and categorical data analysis.

UNIT V: **8 Hours**
Quality Control: control charts for average values, S-control Charts, Control charts for the fraction defective, Control charts number of defects, other control charts for detecting changes in the population mean.
Life Testing: Hazard rate functions, the exponential distribution in life testing, the Weibull distribution in life testing.

Textbooks:

1. Sheldon M. Ross, "Introduction to probability and statistics for engineers and scientists",(4^{th} Ed.),2009.

2. Miller & Freund's,"probability and statistics for engineers",(8^{th} Ed.),Prentice Hall India Learning Pvt.Ltd,2015.

References:

1. Grewal B S, "Higher Engineering Mathematics",(43^{rd} Edition),Khanna Publishers,2014.

CSEEL 34: Game Theory with Engineering Application **5:0:0[5]**

UNIT I: **8 Hours**

Introduction-What is Game Theory? Definition of Games. Actions, Strategies, Preferences, Payoffs. Examples. Strategic form games and examples: Prisoner's Dilemma, Bach or Stravinsky, Matching Pennies. Notion of Nash Equilibrium. Examples of Nash Equilibrium. Best Response Functions. Dominated Actions. Symmetric Games and Symmetric Equilibria. Case Studies of Nash Equilibrium in popular games

UNIT II: **8 Hours**

Mixed Strategy Nash Equilibrium- Randomization of Actions, Mixed strategy Nash equilibrium, Dominated actions, Pure strategy equilibria in the presence of randomization, Illustrations: (1) expert diagnosis (2) reporting a crime. Finding all mixed strategy Nash equilibria of some representative games.

UNIT III: **8 Hours**

Extensive games with Perfect Information- Extensive games, Strategies and outcomes, Nash equilibrium, Subgame perfect equilibrium, finding subgame perfect equilibria using backward induction. Allowing for simultaneous moves in extensive games with perfect information. Example of committee decision making. Two Player Zerosum Games: Maxminimization and Nash Equilibrium. Strictly competitive games. Nash equilibrium in strictly competitive games. Minimax theorem. Solution via linear programming. Examples.

UNIT IV: **8 Hours**

Bayesian and Repeated Games- Motivational Examples. Definition of a Bayesian Game and Bayesian Nash Equilibrium and examples. Auctions: Independent private values, Nash equilibrium of first price auction and second price auction, common valuations, revenue equivalence of auctions. Idea of repeated games. Finitely repeated prisoner's dilemma, infinitely repeated prisoner's dilemma, strategies in a repeated prisoner's dilemma, Nash equilibria and equilibria payoffs in infinitely repeated prisoner's dilemma, sub-game perfect equilibria and equilibria payoffs in infintely repeated prisoner's dilemma.

UNIT V: **8 Hours**

Coalitional Games- Coaltional games. The Core. Illustrations: (1) Ownership and distribution of wealth (2) exchanging homogeneous items (3) exchanging heterogeneous items (4) voting (5) matching. Shapley value and examples.

Textbooks:

1. Martin Osborne," An Introduction to Game Theory",(International Ed.), Oxford University Press,2009.
2. P.Morris,"Introduction to game theory",Springer,2013.

References:

1. Ken Binmore, "Fun and Games : A Text On Game Theory", D. C. Heath & Company, 2003.
2. Y. Narahari,"Essentials of Game Theory and Mechanism Design", IISc Press, 2014.

CSEEL 35: Digital Signal Processing **5:0:0[5]**

UNIT I: **8 Hours**

Introduction to signals and systems Discrete time signals and systems, Ztransforms, structures for digital filters, design procedures for FIR and IIR filters. Frequency transformations: linear phase design; DFT. Methods for computing FFT. Noise analysis of digital filters, power spectrum estimation. Signals and signal Processing: characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signal Processing applications.

UNIT II: **8 Hours**

Time Domain Representation of Signals & Systems- Discrete Time Signals, Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals

UNIT III: **8 Hours**

Transform-Domain Representation of Signals-The Discrete-Time Fourier Transform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse ztransform, properties of z-transform, transform domain representations of random signals. Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals.

UNIT IV: **8 Hours**

Digital Processing of Continuous-Time Signals - sampling of Continuous Signals, Analog Filter Design, Anti-aliasing Filter Design, Sample-and Hold circuits, A/D & D/A converter, Reconstruction Filter Design.

UNIT V: **8 Hours**

Digital Filter Structure and Design- Block Diagram representation, Signal Flow Graph Representation, Equivalent Structures, bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters. cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator. Digital Filter Design: Impulse invariance method of IIR filter design, Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, FIR filter Design based on truncated fonner sens, FIR filter design based on Frequency Sampling
approach.

Textbooks:

1. Proakis J.G., and Manolakis, "Introduction to DSP",(4th Ed.), PHI, 2013.
2. Sanjit K. Mitra, "Applications DSP a Computer based approach",(4th Ed.), TMH, 2011.

References:

1. A. Antonioo, "Digital Signal Processing",McGraw-Hill Education,2006.