COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Computer Science and Engineering

B. Tech Course

COURSE STRUCTURE OF B. TECH IN
COMPUTER SCIENCE & ENGINEERING, HIT

Part-I Course Structure

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

FIRST YEAR
FIRST SEMESTER

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	HMTS1101	Business English	2	0	0	2	2
2	CHEM1001	Chemistry I	3	1	0	4	4
3	MATH1101	Mathematics I	3	1	0	4	4
4	ELEC1001	Basic Electrical Engineering	3	1	0	4	4
5	MECH1101	Engineering Mechanics	3	1	0	4	4
Total Theory						**18**	**18**
B. Laboratory							
1	CHEM1011	Chemistry I Lab	0	0	3	3	2
2	ELEC1111	Basic Electrical Engineering Lab	0	0	3	3	2
3	MECH1012	Engineering Drawing	1	0	3	4	3
4.	HTMS1111	Language Practice(Level 1) Lab	0	0	2	2	1
Total Practical						**12**	**8**
C. Sessional							
2	HMTS1121	Extra Curricular Activity	0	0	2	2	1
Total Sessional						**2**	**1**
Total of Semester						**32**	**27**

SECOND SEMESTER

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	CSEN1201	Introduction to Computing	3	1	0	4	4
2.	PHYS1001	Physics I	3	1	0	4	4
3.	MATH1201	Mathematics II	3	1	0	4	4
4.	ECEN1001	Basic Electronics Engineering	3	1	0	4	4
5.	MECH1201	Engineering Thermodynamics and Fluid Mechanics	3	1	0	4	4
Total Theory						**20**	**20**
B. Laboratory							
1.	CSEN1211	Introduction to Computing Lab	0	0	3	3	2
2.	PHYS1011	Physics I Lab	0	0	3	3	2
3.	ECEN1011	Basic Electronics Engineering Lab	0	0	3	3	2
4.	MECH1011	Workshop Practice	1	0	3	4	3
Total Practical						**13**	**9**
Total of Semester						**33**	**29**

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

SECOND YEAR
THIRD SEMESTER

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1.	CSEN 2101	Data Structures & Algorithms	3	1	0	4	4
2.	CSEN2102	Discrete Mathematics	3	1	0	4	4
3.	CSEN2103	Object Oriented Programming	3	1	0	4	4
4.	ECEN2104	Digital Logic	3	1	0	4	4
5.	HMTS2001	Human Values & Professional Ethics	2	0	0	2	2
6.	CHEM2001	Basic Environmental Engineering and Ecology	3	0	0	3	3
Total Theory						**21**	**21**
B. Practical							
1.	CSEN2111	Data Structures & AlgorithmsLab	0	0	3	3	2
2.	CSEN2112	Software Tools	0	0	3	3	2
3.	CSEN2113	Object Oriented Programming Lab	0	0	3	3	2
4.	ECEN2114	Digital Logic Lab	0	0	3	3	2
Total Practical						**12**	**8**
Total of Semester						**33**	**29**

FOURTH SEMESTER

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1	PHYS2001	Physics II	3	1	0	4	4
2	MATH2201	Number Theory & Algebraic Structures	3	1	0	4	4
3.	MATH2202	Probability & Numerical Methods	3	0	0	3	3
4.	CSEN2201	Design & Analysis of Algorithms	3	1	0	4	4
5.	CSEN2203	Computer Organization	3	1	0	4	4
6.	HMTS 2002	Indian Culture and Heritage	2	0	0	2	1
Total Theory						**21**	**20**
B. Practical							
1	CSEN2211	Algorithm Implementation Lab	0	0	3	3	2
2	PHYS2011	Physics II Lab	0	0	3	3	2
3	MATH2212	Numerical Methods & Programming Lab	0	0	2	2	1
Total Practical						**8**	**5**
C. Sessional							
1	HMTS2011	Language Practice Lab (Level 2)	0	0	3	3	2
Total Sessional						**3**	**2**
Total of Semester						**32**	**27**

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

THIRD YEAR

FIFTH SEMESTER

A. Theory							
Sl.	**Code**	**Subject**	**Contact Periods/Week**			**Total**	**Credits**
			L	**T**	**P**		
1.	CSEN3101	Formal Language & Automata Theory	3	1	0	4	4
2.	CSEN3102	Database Management Systems	3	1	0	4	4
3.	CSEN3103	Operating Systems	3	0	0	3	3
4	CSEN3104	Computer Architecture	3	0	0	3	3
5.	AEIE3105	Microprocessors & Microcontrollers	3	1	0	4	4
6.	HMTS3101	Economics for Engineers	3	0	0	3	3
Total Theory						**21**	**21**
B. Practical							
1.	CSEN3112	Database Management Systems Lab	0	0	3	3	2
2.	CSEN3113	Operating Systems Lab	0	0	3	3	2
3.	CSEN3114	Computer Architecture Lab	0	0	3	3	2
4.	AEIE3115	Microprocessors & Microcontrollers Lab	0	0	3	3	2
Total Practical						**12**	**8**
Total of Semester						**33**	**29**

SIXTH SEMESTER

A. Theory							
Sl..	Code	**Subject**	Contact Periods/Week			Total	Credits
			L	T	P		
1.	CSEN3201	Computer Networks	3	1	0	4	4
2.	CSEN3202	Software Engineering	3	1	0	3	3
3.	CSEN3280 to CSEN3283	Elective I	3	0	0	3	3
4.	HMTS3201	Principles of Management	2	0	0	2	2
5.	ELEC3001	Circuit Theory	3	1	0	4	4
Total Theory						**16**	**16**
B. Practical							
1.	CSEN3211	**Computer Networks** Lab	0	0	3	3	2
2.	CSEN3212	Software Engineering Lab	0	0	3	3	2
3.	CSEN3285 to CSEN3288	Elective I Lab	0	0	3	3	2
4.	CSEN3213	System Administration Lab	0	0	3	3	2
Total Practical						**12**	**8**
C. Sessional							
1.	CSEN3297	Seminar I	0	0	3	3	2
2.	HMTS3221	Personality Development	1	0	0	1	1
Total Sessional						**4**	**3**
Total of Semester						**32**	**27**

OPTIONS FOR ELECTIVE I (Even Semester)

CSEN 3280 Computer Graphics & Multimedia
CSEN 3281 Artificial Intelligence
CSEN 3282 Web technologies
CSEN 3283 Advanced Java Programming

OPTIONS FOR ELECTIVE I Lab* (Even Semester)

CSEN 3285 Computer Graphics & Multimedia Lab
CSEN 3286 Artificial Intelligence Lab
CSEN 3287 Web technologies Lab
CSEN 3288 Advanced Java Programming Lab

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

FOURTH YEAR
SEVENTH SEMESTER

A. Theory							
Sl.	Code	**Subject**	Contact Periods/Week			Tota	Credit
			L	T	P		
1.	CSEN4101	Compiler Construction	3	1	0	4	3
2.	 CSEN4141 CSEN4142 CSEN4143 CSEN4144 CSEN4145	Elective II Information Retrieval Advanced Operating System Computational Geometry Data Mining and Knowledge Discovery Cloud Computing	3	0	0	3	3
3.	 CSEN4161 CSEN4162 CSEN 4163 CSEN 4164 CSEN 4165	Elective III Natural Language Processing Cryptography and Network Security Graph Algorithms Parallel Algorithms Web Intelligence and Big Data	3	0	0	3	3
4.	 MATH4181 / MATH4182 / ECEN4181 / ECEN4182/ ECEN4183/ BIOT4181/ MECH4181/ AEIE4182	Free Elective I Operation Research and Optimization techniques Linear Algebra VLSI Design Automation Control Systems Principles of Communication systems Biosensors Computational Fluid Dynamics Introduction to Embedded System	3	0	0	3	3
Total Theory						**13**	**12**
B. Practical							
1.	CSEN 4111	Compiler Construction Lab	0	0	3	3	2
Total Practical						**3**	**2**
C. Sessional							
1.	HMTS 4121	Group Discussion for Professionals	0	0	3	3	2
2.	CSEN 4131	Industrial Training	-	-	-	-	2
3	CSEN 4132	Seminar II	0	0	3	3	2
4.	CSEN 4191	Project I	-	-	-	6	4
Total Sessional						**12**	**10**
Total of Semester						**28**	**24**

** Free Elective Papers offered by Dept. of CSE

Theory							
Sl. No	**Course Code**	**Course Name**	**Contact Hrs per Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	CSEN4181	Fundamentals of Operating System	3	0	0	3	3
2	CSEN4182	Intelligent Web and Big Data	3	0	0	3	3

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

EIGHTH SEMESTER

A. Theory							
Sl.No	**Code**	**THEORY**	**Contact eriods/Week**			**Total**	**Credits**
			L	T	P		
1.	HMTS4201	Organizational Behaviour	2	0	0	2	2
2.		Elective IV	3	0	0	3	3
	CSEN4241	Distributed Algorithms					
	CSEN4242	Approximation Algorithms					
	CSEN4243	Computational Complexity					
	CSEN4244	Pattern Recognition					
	CSEN4245	Social Network Analysis					
	CSEN 4246	Mobile Computing					
3.		Elective V	3	0	0	3	3
	CSEN 4261	Distributed Databases					
	CSEN4262	Image Processing					
	CSEN 4263	Soft Computing					
	CSEN 4264	Machine Learning					
	CSEN 4265	Real Time & Embedded System					
4.		Free Elective II	3	0	0	3	3
	ECEN4282/	VLSI Design					
	ECEN4283/	VLSI Testing & Verification					
	MATH4281/	Probability and Stochastic Process					
	MATH4282/	Advanced Computational Mathematics and Graph theory					
	BIOT4281/	Computational Biology					
	BIOT4282/	Non-conventional Energy					
	AEIE4281/	Sensor Technology					
	HMTS4283	Elementary Spanish for beginners					
Total Theory						**11**	**11**
B. Practical							
1.		Elective V lab	0	0	3	3	2
	CSEN 4271	Distributed Databases Lab					
	CSEN 4272	Image Processing Lab					
	CSEN 4273	Soft Computing Lab					
	CSEN 4274	Machine Learning Lab					
	CSEN4275	Real Time & Embedded System Lab					
Total Practical						**3**	**2**
C. Sessional							
1.	CSEN 4231	Grand viva	-	-	-	-	3
2.	CSEN 4291	Project II	0	0	9	9	8
Total Sessional						**-**	**11**
Total of Semester						**23**	**24**

**** Free Elective Papers offered by Dept. of CSE**

Theory							
Sl. No	**Course Code**	**Course Name**	**Contact Hrs per Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	CSEN4281	Fundamentals of RDBMS	3	0	0	3	3
2	CSEN4282	Basics of Mobile Computing	3	0	0	3	3

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Part II Detailed Syllabus

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Syllabus of 1st semester:

Course Name : BUSINESS ENGLISH & COMMUNICATION					
Course Code: HMTS1101					
Contact hrs per week:	L	T	P	Total	Credit points
	2	0	0	2	2

Module I – [5L]
Communication Skill
Definition, nature & attributes of Communication
Process of Communication
Models or Theories of Communication
Types of Communication
Levels or Channels of Communication
Barriers to Communication

Module II-[12L]
Business Communication- Scope & Importance
Writing Formal Business Letters
Writing Reports
Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular
Project Proposal
Technical Report Writing
Organizing e-mail messages
E-mail etiquette
Tips for e-mail effectiveness

Module III-[10L]
Language through Literature
Modes of literary & non-literary expression
Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)

Module IV-[3L]
Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) - to be dealt with the help of the given texts.

References

1. Armand Matterlart and Michele Matterlart, Theories of Communication: A Short Introduction, Sage Publications Ltd., 1998.
2. Chan, Janis Fisher, and Diane Lutovich. Professional Writing Skills. San Anselmo, CA: Advanced Communication Designs, 1997.

3. Geffner, Andrew P. Business English. Hauppauge, New York: Barron's Educational Series, 1998.
4. Good, Edward C. Mightier Than the Sword. Charlottesville: Word Stone Publications, 1989.
5. Edward P.Bailey, Writing and Speaking at Work: A Practical Guide for Business Communication, Prentice-Hall, 7th edn, 2004.
6. Kitty O. Locker, Business and Administrative Communication, McGraw-Hill/ Irwin, 7th edn, 2004.
7. Lillian Chaney and Jeanette Martin, Intercultural Business Communication, Prentice Hall, 4th edn, 2005.
8. Yudkin, Marcia. Persuading on Course Name. Lansing, IL: Infinity Publishing, 2001.

Course Name : Chemistry 1					
Course Code: CHEM 1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

MODULE I [10 L]: **Thermodynamics & Spectroscopy**

Chemical Thermodynamics & Thermochemistry

Concept of Thermodynamic system, Introduction to first law of thermodynamics, Enthalpy Heat Capacity, Reversible and Irreversible processes, Adiabatic changes, Application of first law of thermodynamics to chemical processes, 2nd law of thermodynamics, Evaluation of entropy, Work function and free energy, Phase Changes, Clausius Clapeyron Equation, Chemical Potential, Gibbs Duhem Relation, Activity and Activity coefficient.

Spectroscopy

Electromagnetic Radiation, Basic idea of UV-visible & IR spectroscopy.

MODULE II [10 L]: **Structure & Bonding**

Chemical Bonding

Covalent bond, VSEPR Theory, Molecular Orbital Theory, Hydrogen bond, Intermolecular forces-vander Waals forces, Ionization energy, Electronegativity, Electron affinity, Hybridisation, Dipole moment

Solid State Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor.

Ionic Equilibria and Redox Equlibria

Acid Base Equilibria in water, Strength of acids and bases, Hydrogen ion exponent, Ionic product of water, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation, Redox Equilibria,

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions.

MODULE III [10 L]: **Electrochemistry & Reaction Dynamics**

Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance, ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs $AgNO_3$.

Electrochemical Cell

Cell EMF and thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell and calomel half cell (construction, representation, cell reaction, expression of potential, discussion, application) Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). Application of EMF measurement on a) the change in thermodynamic function (ΔG, ΔH, ΔS) b) the equilibrium constant of a reversible chemical reaction c) the valency of an ion.

Kinetics

Reaction laws: rate expression, order and molecularity, zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Collision theory and Transition state theory,).

Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

MODULE IV [10 L]: **Industrial Chemistry & Polymerization**

Industrial Chemistry

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Coal analysis: Proximate and ultimate analysis.

Liquid fuel: Petroleum, classification of petroleum, Refining, Petroleum distillation, Thermal cracking, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Bio-diesel. Gaseous fuels: Natural gas, water gas, coal gas, bio gas.

Polymerization

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI). Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of T_m) and amorphicity (Concept of T_g) of polymer. Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE, PVC, Bakelite, PP), rubber (natural rubber, SBR, NBR) and Vulcanization., fibre(nylon 6.6, Nylon 6, Polyester). Conducting and semi-conducting polymers.

TEXT BOOKS

1. Engineering Chemistry, Gourkrishna Dasmohapatra, Vikas Publishing House
2. A Text book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co Pvt Ltd
3. Engineering Chemistry, K. L. Chugh, Kalyani Publishers.

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar, Fuels and Combustion, New Central Book Agency P Ltd
2. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc
3. Organic Chemistry, Morrison & Boyd, Prentice Hall of India
4. Physical Chemistry, K. L. Kapoor, McMillan
5. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).

Course Outcomes:

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.
2. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.for engineering applications.
3. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.
4. Understanding of bulk properties and processes using thermodynamic considerations.
5. 5 Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.
6. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

Course Name : MATHEMATICS I					
Course Code: MATH1101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

MODULE I [10L]

Matrix:

Matrices and their basic attributes, Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, Orthogonal matrix and its properties, Special Complex Matrices: Hermitian, Unitary, Normal(definition only), Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by :Cramer's Rule and Matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Characteristic Equation and computation of eigenvalues and eigenvectors of a square matrix (of order 2 or 3), Cayley-Hamilton theorem and its applications(with special reference to higher power of matrices, e.g. Idempotent and Nilpotent matrices)

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MODULE II [10 L]

Mean Value Theorems & Expansion of Functions:

Rolle's theorem: its geometrical interpretation and its application, Concavity and Convexity of curves, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions: $\sin x, \cos x, e^x, \log(1+x), (a+x)^n, n$ being an integer or a fraction (assuming that the remainder $R_n \to 0$ as $n \to \infty$ in each case).

Infinite Series:

Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test, Proof of e being irrational, Alternating series, Leibnitz's Test (statement, definition) illustrated by simple examples, Absolute convergence and Conditional convergence,

Module III [10 L]

Successive differentiation:

Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders and also to find $(y_n)_0$).

Calculus of Functions of Several Variables:

Recapitulation of some basic ideas of limit and continuity of functions of single variable, Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems.

Module-IV [10 L]

Multiple Integration and Vector Calculus:

Concept of line integrals, Double and triple integrals. Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics, Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications).

Reduction formula:

Reduction formulae both for indefinite and definite integrals of types:

$\int \sin^n x, \int \cos^n x, \int \sin^m x \cos^n x, \int \cos^m x \sin nx, \int \frac{dx}{(x^2+a^2)^n}, m, n$ are positive integers.

References

1. Advanced Engineering Mathematics: Erwin Kreyszig by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
3. Higher Engineering Mathematics: John Bird (Elsevier)
4. Advanced Engineering Mathematics: Wiley and Barrett (Tata McGraw-Hill)

5. Calculus: M. J. Strauss, G. L. Bradley and K. L. Smith (Pearson Education)
6. Engineering Mathematics: S. S. Sastry (PHI)
7. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
8. Linear Algebra(Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)
9. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
10. Introduction to Real Analysis: S.K.Mapa (Sarat Book Distributors)

Course Outcome:- After completing the course the student will be able to:

MATH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.

MATH1101.2 Develop the concept of eigen values and eigen vectors.

MATH1101.3 Use Mean Value Theorems for power series expansions of functions of one variable.

MATH1101.4 Analyze the nature of sequence and infinite series.

MATH1101.5 Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus.

MATH1101.6 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.

Course Name : BASIC ELECTRICAL ENGINEERING					
Course Code: ELEC1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module-I: [12 L]

DC Network Theorem: Kirchhoff's law, nodal analysis, mesh analysis, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, star-delta conversion.

DC Machines: Construction, EMF equation, Principle of operation of DC generator, open circuit characteristics, external characteristics, Principle of operation of DC motor, Speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of dc motor.

Module-II [8L]

Electrostatics: Gauss's law and its applications to electric field and potential calculation. Capacitor, capacitance of parallel plate capacitor, spherical capacitor and cylindrical capacitor.

Electromagnetism: Amperes law, Biot-savart's law, Ampere's circuital law and their applications, Magnetic circuits, analogy between magnetic and electric circuits, Faraday's law, self and mutual inductance. Energy stored in a magnetic field, Hysteresis and Eddy current losses.

Module-III [10L]

AC single phase system: concept of alternating signal, average and RMS values of alternating signal, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, AC series , parallel and series parallel circuits, Active power, Reactive power, power factor, Resonance in RLC series and parallel circuit, Q factor, bandwidth.

Three phase system: balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two wattmeter method.

Module-IV [10L]

Single phase transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, open and short circuit tests, efficiency.

3-phase induction motor: Concept of rotating magnetic field, principle of operation, Construction, equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Course Outcomes

After attending the course, the students will be able to

1. Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.

2. Analyse DC Machines; Starters and speed control of DC motors.

3. Analyse magnetic circuits.

4. Analyse single and three phase AC circuits.

5. Analyse the operation of single phase transformers.

6. Analyse the operation of three phase induction motors.

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Course Name : ENGINEERING MECHANICS					
Course Code: MECH 1101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module-I [10L]
Importance of Mechanics in Engineering ; Definition of Mechanics; Concepts of particles & rigid bodies.

Vector and scalar quantities; Vector algebra –definition and notation; Types of vectors – equal , equivalent , free , bound , sliding ; Addition , subtraction of vectors ; Parallelogram law , triangle law , vector polygon ; Scalar multiplication of vectors ; Resolution of vectors in Cartesian co–ordinate system ; Unit vector, unit co–ordinate vectors ($\hat{i}$, $\hat{j}$, $\hat{k}$) ; Direction cosines ; Addition/ subtraction of vectors in components form.

Definition of force vector ; Dot product , cross product and the application ; Important vector quantities (position vector , displacement vector) ; Moment of a force about a point and about an axis , moment of a couple ; Representation of force and moments in items of $\hat{i}$, $\hat{j}$, $\hat{k}$. Principle of transmissibility of force (sliding vector); Varignon's theorem for a system of concurrent forces with proof; Resolution of a force by its equivalent force-couple system; Resultant of forces.

Module-II [10L]
Type of forces – collinear, concurrent, parallel, concentrated, distributed; Active and reactive forces, different types of reaction forces; Free body concept and diagram; Concept and equilibrium of forces in two dimensions; Equations of equilibrium; Equilibrium of three concurrent forces -- Lami's theorem.

Concept of friction: Laws of Coulomb's friction; Angle of friction, angle of repose, coefficient of friction -- static and kinematic.

Module-III [12L]
Distributed force system; Centre of gravity; Centre of mass & centroid; Centroid of an arc; Centroid of plane areas – triangle, circular sector, quadrilateral and composite area consisting of above figures.

Area moment of inertia: Moment of inertia of a plane figure; Polar moment of inertia of a plane figure; Parallel axes theorem.

Concept of simple stress and strain ; normal stress , shear stress , normal strain, shear strain; hooke's law; poisson's ratio; stress- strain diagram of ductile and brittle material; proportional limit, elastic limit, yield point , ultimate stress, breaking point; modulus of elasticity.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Module-IV [16L]

Introduction to dynamics: Kinematics & kinetics; Newton's laws of motion; Law of gravitation and acceleration due to gravity; Rectilinear motion of particles with uniform & non – uniform acceleration.

Plane curvilinear motion of particles: Rectangular components (projectile motion), normal and tangential components.

Kinetics of particles: D'Alembert's principle and free body diagram; Principle of work & energy; Principle of conservation of energy.

Impulse momentum theory: Conservation of linear momentum

References:

1. Engineering Mechanics:- Statics and Dynamics by Meriam & Kreige , Wiley india
2. Engineering Mechanics:- Statics and Dynamics by I.H. Shames, P H I
3. Engineering Mechanics by Timoshenko , Young and Rao , TMH
4. Element of strength of materials by Timoshenko & Young, E W P
5. Fundamentals of Engineering Mechanics by Nag & Chanda – Chhaya Prakashani.

Course Name : CHEMISTRY I LAB					
Course Code: CHEM 1011					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

List of Experiments:

1. To determine the alkalinity in a given water sample.
2. Estimation of iron using $KMnO_4$: self indicator.
3. Estimation of iron using $K_2Cr_2O_7$: redox sensitive indicator.
4. To determine total hardness and amount of calcium and magnesium separately in a given water sample.
5. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Iodometric estimation of Cu^{2+}.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course outcome:

The subject code CHEM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipments. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are :

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
2. Estimation of ions like Fe2+, Cu2+ and Cl- present in water sample to know the composition of industrial water.
3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

Course Name : BASIC ELECTRICAL ENGINEERING LAB.					
Course Code: ELEC1011					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Outcomes:

The students are expected to

1. Get an exposure to common electrical apparatus and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the application of common electrical measuring instruments.
4. Understand the basic characteristics of different electrical machines.

Course Name : Engineering Drawing					
Course Code: MECH 1018					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	1	**0**	**3**	**4**	**3**

1. Importance of engineering drawing; Acquaintance with different drafting equipment & accessories;
2. Introduction to lines : Practising different types of lines; Basic concepts in Lettering : Practising vertical & inclined letters (Practice Sheet 1)
3. Different systems of dimensioning with practice.Introduction to the concept of scale of drawing. (Practice Sheet 2)
4. Introduction to concept of orthographic projection: 1st angle and 3rd angle projection method; Symbols; projection of points. (Practice Sheet 3)
5. Projection of straight lines for different orientation including inclined to both the planes. (Practice Sheet 4)
6. Projection of plane surfaces inclined to HP and parallel to VP; Inclined to VP and Parallel to HP (Practice Sheet 5)
7. Projection of solids: Cube, rectangular prism, Hexagonal prism, Cylinder, Pyramid, Cone. (Practice Sheet 6)
8. Section of solids and their projections on principal and auxiliary planes for true shape: Cylinder, hexagonal pyramid. (Practice Sheet 7)
9. Isometric projections: Basic concepts, isometric scale; Isometric projection and view.
10. Practice with simple laminar and solid objects. (Practice Sheet 8)

References:

1. "Elementary Engineering Drawing" by Bhatt, N.D; Charotan Book Stall, Anand
2. "Engineering Graphics" by Narayana, K.L. and Kannaaiah P; TMH
3. "Engineering Graphics" by Lakshminarayanan, V. and Vaish Wanar, R.S, JainBrothers.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Communication Practice I Lab [Sessional]					
Course Code: HMTS 1191					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Module I [3P]: Introduction to Linguistics (Phonology)
Phonetics-Vowel and Consonant Sounds (Identification &articulation)
Word- stress
Intonation (Falling and rising tone)
Voice Modulation
Accent training

Module II [3P]: Listening Skills
Principles of Listening
Approaches to listening
Guidelines for Effective Listening
Listening Comprehension
Audio Visual (Reviews)

Module III [2P]: Discourse Analysis-
Spoken Discourse
Conversational Skills/Spoken Skills
Analysing Speech dynamics
(Political Speeches
Formal Business Speeches)

Module IV [9P]: Writing Skill-
Descriptive, narrative and expository writing
Writing with a purpose---Convincing skill, argumentative skill/negotiating Skill (These skills will be repeated in oral skills).
Writing reports/essays/articles—logical organization of thoughts Book review.

References

1. Munter, Mary. Guide to Managerial Communication. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1999.
2. Cypres, Linda. Let's Speak Business English. Hauppauge, NY: Barron's Educational Series, 1999. Crystal, David. 1971. Linguistics. Baltimore: Penguin Books.
3. Larsen-Freeman, D. (1986). "Techniques and principles in language teaching." Oxford: Oxford University Press.
4. Littlewood, W. (1981). "Language teaching. An introduction." Cambridge: Cambridge University Press.
5. Savignon, S. J., & Berns, M. S. (Eds.). (1983). "Communicative language teaching: Where are we going? Studies in Language Learning," 4(2). (EDRS No. ED 278 226, 210 pages).

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Extra Curricular Activities					
Course Code: HMTS 1192					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Objective: This course aims at instilling a sense of social responsibility. This objective can be achieved by bringing in awareness about the contemporary issues relevant to the GenX and Gen Y through enlightened discussions and active participation. Since the course has 1 credit detailed planning regarding the area of activities and method of evaluation should be charted at the start of the semester.

Module I:
Project Work
Development of projects based on integral and holistic developmental models to be implemented in rural areas or underdeveloped areas in the peripheral areas of cities. This could include a wide area of activity –
from taking up a research projects to analyse the need of a particular under-developed area to trying to implement a project already formulated. This could also relate to mobilizing funds for a specific project.

Module II:
Action-oriented schemes
e.g.Organising Blood –donation camps
Conducting child –healthcare services
Helping the old and sick
(in coordination with NGOs and other institutes)

Module III:
Society and Youth
Developing Awareness among the youth about social issues both local and global for e.g. Eradication of social evils like drug abuse, violence against women and others.

Module IV:
Youth and Culture
Generating new ideas and help the participants to be creative and innovative for e.g.Enacting street plays, encouraging creative writing by organizing workshops and competitions. Active participation of the students in the nation building process by making positive changes in the social and individual space.

Mode of Evaluation
Total marks allotted -100. In a semester each student should take part in at least four activities. Group activity method is to be followed.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Syllabus of 2nd Semester

Course Name : Introduction to Computing					
Course Code: CSEN 1201					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Learning Objective: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I: [13L]
Fundamentals of Computer
History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Assembly language, high level language, compiler and assembler (basic concepts).

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit). Binary Arithmetic & logic gates. Boolean algebra – expression, simplification, Karnaugh Maps.

Basic concepts of operating systems like MS WINDOW, LINUX. How to write algorithms & draw flow charts.

Module II: [5L]
Basic Concepts of C
C Fundamentals: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions: Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Module III: [8L]
Program Structures in C
*Flow of Control:*Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.

C preprocessor (macro, header files), command line arguments.

Module IV: [14L]
Data Handling in C
Arrays and Pointers: One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality. String and character arrays; C library string functions and their use.

User defined data types and files: Basic of structures; structures and functions; arrays of structures.
Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs();

Text Books
1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books
1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

Course Outcomes: (CSEN1201)
CO 1: Understand and remember functions of the different parts of a computer.
CO 2: Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
CO 3: Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
CO 4: Understand how code can be optimized in high-level languages.
CO 5: Apply high-level language to automate the solution to a problem.
CO 6: Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : PHYSICS 1					
Course Code: PHYS 1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I: [22 L]
Optics
1.Interference :
The principle of superposition of waves, Superposition of waves: Two beam superposition, Multiple-beam superposition, coherent and incoherent superposition. Two source interference pattern (Young's double slit), Intensity distribution. Interference in thin films, wedge shaped films and Newton's rings, applications of interference. Newton's rings: Determination of wavelength of light, refractive index of liquid.

2 Diffraction:
Diffraction of light waves at some simple obstacles. Fraunhoffer diffraction through double slit and diffraction grating, grating spectra, resolving power of grating.

3. Polarisation & Fibre Optics:
Elementary features of polarization of light waves.Production and analysis of linearly, elliptic and Circularly polarized light, polaroids and application of polarizations. fibre optics - principle of operation, numerical aperture, acceptance angle

4 Laser
Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Module II : [8L]
Waves & Oscillation
Superposition of two linear SHMs (with same frequency), Lissajous' figures. Damped vibration – differential equation and its solution, Critical damping, Logarithmic decrement, Analogy with electric circuits. Forced vibration – differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance and Quality factor. Progressive wave- Wave equation and its differential form, Difference between elastic (mechanical) and electromagnetic waves.

Module III : [9L]
Quantum Mechanics
Need for Quantum physics-Historical overviews, Particle aspects of radiation-Black body radiation, Compton scattering, pair production., Origin of X-ray spectrum. Wave aspect of particles- matter wave, de Broglie Hypothesis, Heisenberg Uncertainty principles-Statement, Interpretation and application.

Module IV: [6L]

Introduction of Crystallography

Space Lattice**,** Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Miller Indices and its applications, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC. Bragg's law and its applications.

Text Books

1. Atomic Physics Vol 1 – S.N. Ghoshal
2. Optics – Ajoy Ghak
3. Waves & Oscillation – N.K. Bajaj
4. Quantum Physics of Atoms , Molecules, Solids, Nuclei and particles – Eisberg and Resnick

Reference Books

1. Introduction to Special Relativity – Robert Resnick
2. Prespective on Modern Physics - Arthur Beiser
3. Optics – Jenkins and White
4. University Press – Sears & Zemansky
5. Introduction to modern Physics – Mani and Meheta
6. Optics – Brijlal and Subrahmanyam

Course Name : Mathematics II					
Course Code: MATH1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I [10 L]

Ordinary differential equations (ODE)-

First order and first degree: Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear and non-linear differential equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation).

Second order and first degree:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations.

Module II:[10L]

Basics of Graph Theory

Graphs, Digraphs, Weighted graph, Connected and disconnected graphs,Complement of a graph, Regular graph, Complete graph, Subgraph,; Walks, Paths, Circuits, Euler Graph,Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph,Graph isomorphism, Bipartite graph.

Tree:

Definition and properties, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms.

Module III [10L]

Improper Integral:

Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.

Laplace Transform:

Introduction to integral transformation, functions of exponential order, Definition and existence of LT (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions Definition and properties of inverse LT Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Module IV [10L]

Three Dimensional Geometry

Equation of a plane. General form. Transformation to the normal form. Intercepts. Equation of the plane through three given points. Equation of a plane passing through the intersection of two planes. Angle between two intersecting planes. Bisectors of angles between two intersecting planes. Parallelism and perpendicularity of two planes.

Canonical equation of the line of intersection of two intersecting planes. Angle between two lines. Shortest distance between two lines. Condition of coplanarity of two lines. Length of the perpendicular from a point to a given line.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern)
2. Graph Theory: V. K. Balakrishnan, (Schaum's Outline, TMH)
3. A first course at Graph Theory: J. Clark and D. A. Holton (Allied Publishers LTD)
4. Introduction to Graph Theory: D. B. West (Prentice-Hall of India)
5. Graph Theory: N. Deo (Prentice-Hall of India)
6. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)

7. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
8. Calculus: Strauss, Bradley and Smith (3PrdP edition, Pearson Education)
9. Engineering Mathematics (Volume 2): S. S. Sastry (Prentice-Hall of India)
10. Introductory Course in Differential Equations: Daniel A. Murray (Longmans & Green).
11. Co-ordinate Geometry – S. L. Loney.
12. Analytical Geometry And Vector Algebra- R M Khan

Course Outcomes:

MATH1201.1 Construct differential equation as a mathematical model of a physical phenomena.
MATH1201.2 Choose proper method for finding solution of a specific differential equation.
MATH1201.3 Discuss the elementary concepts of graph theory, for example, walk, path, cycle, Eulerian graph, Hamiltonian graph and tree.
MATH1201.4 Apply basic graph algorithms for searching and finding minimal spanning tree and shortest path.
MATH1201.5 Solve improper integrals and initial value problems with the help of Laplace transformation.
MATH1201.6 Evaluate distance, angle between planes and shortest distance between two skew lines in three dimension.

Course Name : Basic Electronics Engineering					
Course Code: ECEN1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I [10 L]

Semiconductors:

Crystalline material, Energy band theory, Fermi levels; Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Diodes and Diode Circuits:

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener Diode and its Application, Zener and Avalanche breakdown.
Simple diode circuits, load line, piecewise linear model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

Module II [10 L]

Bipolar Junction Transistors:

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off, active and saturation modes of operation, transistor action, input & output characteristics, load line & amplifier operation and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

Module III [9 L]

Field Effect Transistors:

Junction field effect transistor (JEET): Principle of operation, JFET parameters, eqv. Circuit, JFET biasing, self bias, design of bias circuits, load line, amplifier characteristics.

MOSFETs:

Construction & principle of operation of p- & n-channel enhancement & depletion mode MOSFETs, drain & transfer characteristics, threshold voltage & its control.

Cathode Ray Osilloscope:

Construction and working principle of CRO, Lissajous pattern.

Module IV [9 L]

Feed Back Amplifier:

Concept-block diagram, properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, condition of oscillation, Barkhausen criteria.

Operational Amplifier:

Introduction to integrated circuits, operational amplifier and its terminal properties; Application of operational amplifier; Concept of op-amp saturation, inverting and non-inverting mode of operation, Adders, Subtractors, Voltage follower, Integrator, Differentiator, Basic Comparator Circuit.

References:

1. Boylestad & Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad:Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

Course Outcomes:

After going through this course, the students will be able to

1. Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.
2. Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.

3. Design different application specific circuits associated with diodes operating both in forward and reverse bias.
4. Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.
5. Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.
6. Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and anlayze their performance depending on the type of required output and subsequently the applied input.

Course Name : Engineering Thermodynamics & Fluid Mechanics					
Course Code: MECH1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I [10 L]

Basic concepts of Thermodynamics:

Introduction; Macroscopic and microscopic concept; Definition of Thermodynamic systems; Surrounding, universe; Open, closed and isolated systems; Concept of control volume; Thermodynamic properties: intensive, extensive & specific properties; state.

Thermodynamic equilibrium; Change of state; Thermodynamic processes and cycles; Quasi-static processes; Reversible processes; Zeroth law of Thermodynamics -concept of temperature.

Heat & Work:

Definition of Thermodynamic work; Work transfer-displacement work for a simple compressible system, path function, PdV work in various quasi-static processes(isothermal, isobaric, adiabatic, polytropic, isochoric); Free expansion; Indicated diagram (P-V diagram) .

Definition of heat; Heat transfer-a path function; Similarities and dissimilarities between heat and work.

Module II [8 L]

First law of Thermodynamics: Statement; 1^{st} law for a closed system executing a cycle; Concept of stored energy; Energy as a property, different forms of stored energy, internal energy, first law for a non-flow process; Flow work; Definition of enthalpy, C_p, C_v; Energy of an isolated system; Flow energy; First law for an open system - steady flow energy equation; Examples of steady flow devices(nozzle and diffuser, turbine, pump, compressor, boiler, condenser and throttling device); PMM-I

Module III [10 L]

Second law of Thermodynamics:

Qualitative difference between heat and work; Definition of source & sink: cyclic heat engine, heat pump and refrigerator, thermal efficiency of heat engine, C.O.P of heat pump and refrigerator; Kelvin-Plank and Clausius statements of second law; Equivalence of the two statements.

Reversible process; Irreversible process; Factors for irreversibility; Carnot cycle and Carnot efficiency; Reversible heat engine and heat pump; PMM-ll

Entropy: Mathematical statement of Clausius Inequality: Entropy as a property; Entropy principle; T-s plot for reversible isothermal, adiabatic, isochoric & isobaric processes.

Air standard Cycles:

Otto cycle & Diesel cycle, P-V & T-s plots, Net work done and thermal efficiency.

Module IV [10 L]

Properties & Classification of Fluid:

Definition of fluid; Concept of Continuum; Fluid properties- density, specific weight, specific volume, specific gravity; Viscosity : definition , causes of viscosity , Newton's law of viscosity, dimensional formula and units of viscosity, kinematic viscosity; Variation of viscosity with temperature. Ideal and Real fluids; Newtonian and Non-Newtonian fluids; No-slip condition.

Compressibility and Bulk modulus of elasticity.

Difference between compressible and incompressible fluids.

Fluid Statics:

Introduction; Pascal's Law--statement and proof; Basic Hydrostatic Law and its proof; Variation of pressure with depth in incompressible fluid, piezometric head, pressure head; Unit and scales of pressure measurement.

Measurement of fluid pressure: Piezometer, Manometers -Simple and Differential U-tube manometer, Inverted tube manometer, Inclined tube manometer.

Characteristics and choice of manometric fluid.

Module V [10 L]

Fluid Kinematics:

Definition; Flow field and description of fluid motion(Eulerian & Lagrangian method), steady and unsteady flow, uniform and non-uniform flow-examples.

Acceleration of a fluid particle-local acceleration, convective acceleration. Stream line, Stream tube, Path line and Streak line; Laminar and Turbulent flow, Reynolds Number. Equations of streamlines and path lines.

Continuity equation for unidirectional flow and for differential form in 3-D Cartesian coordinate system.

Dynamics of Ideal fluids:

Introduction, Euler's equation of motion along a streamline; Bernoulli's equation-assumptions and significance of each term of Bernoulli's equation.

Application of Bernoulli's equation-problem on pipe line. Measurement of flow rate: Venturimeter and orificemeter .

Static pressure, Dynamic pressure, Stagnation pressure-measurement of velocity by Pitot tube.

References:

1. Engineering Thermodynamics- Nag, P.K. - T. M.H
2. Fundamentals of Thermodynamics- Sonntag, Borgnakke & Van Wylen, Wiley India
3. Thermodynamics- an Engineering approach - 6e, Cengel & Boles, TM
4. Fluid Mechanics & Hydraulic Machines – R.K. Bansal, Laxmi Publications Ltd, India
5. Introduction to Fluid Mechanics and Fluid Machines- S.K. Som, G. Biswas, & S. Chakraborty , T.M.H
6. Fluid Mechanics – A.K. Jain, Khanna Publishers.

Course Name : Introduction to Computing Lab					
Course Code: CSEN1211					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

Basic Computation & Principles of Computer Programming Lab
Softwares to be used: Cygwin and notepad++, Tiny C

Day 1: LINUX commands and LINUX based editor
Day 2: Basic Problem Solving
Day 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Day 4: Loops - Part I (for, while, do-while)
Day 5: Loops - Part II
Day 6: One Dimensional Array
Day 7: Array of Arrays
Day 8: Character Arrays/ Strings
Day 9: Basics of C Functions
Day 10: Recursive Functions
Day 11: Pointers
Day 12: Structures and Unions
Day 13: File Handling

Course outcomes:

After completion of this course the students should be able:

1. To interpret and understand syntax errors reported by the compiler.
2. To debug errors.
3. To implement conditional branching, iteration (loops) and recursion.
4. To implement modularity in a program.
5. To use arrays, pointers, and structures to store different type of data.
6. To be able to create, read from and write into simple text files.

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Course Name : PHYSICS I Lab					
Course Code: PHYS 1011					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**3**

1. Determination of Young's modulus by Flexure Method and calculation of bending moment and shear force at a point on the beam.
2. Determination of modulus of rigidity by Static/Dynamic Method.
3. Determination of thermal conductivity of a good conductor by Searle's Method.
4. Determination of thermal conductivity of a bad conductor by Lee's and Chorlton's Method.
5. Determination of dielectric constant of a given dielectric material.
6. Use of Carey Foster's bridge to determine unknown resistance.
7. Determination of wavelength of light by Newton's ring method.
8. Determination of wavelength of light by Fresnel's biprism method.
9. Determination of wavelength of light by Laser diffraction method.
10. Determination of dispersive power of the material of a given prism.
11. Determination of co-efficient of viscosity of a liquid by Poiseulle's capillary flow method.

Course Name : Basic Electronics Engineering Lab					
Course Code: ECEN1011					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**3**

List of Experiments

1. Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and

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Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPs.

Course Name : Workshop Practice					
Course Code: MECH1019					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	1	**0**	**3**	**4**	**3**

Job 1: General awareness of a typical workshop.

Theory requirements: Workshop definition, various shops in a typical workshop, Carpentry, Fitting, Foundry; Sheet Metal Shop, Welding and Brazing Shop, Machine Shop , Forging & Blacksmithy, Safety precautions to be followed in a workshop, Familiarization of Various safety devices and their uses.

Job 2: Making of a wooden pattern.

Theory requirements: Market forms of converted Timber ,eg, log, balk, plank,batten, beam ,Types of Wood, Hard Wood, Soft Wood, particle board; Seasoning of wood, Natural seasoning, Artificial seasoning, Carpentry Tools-Marking Tools, Cutting Tools, Planing Tools, Boring Tools, Striking Tools , Holding & Misc. Tools, Carpentry Processes (marking, sawing, planning, chiselling, boring, grooving, joining etc.), Safety precautions in Carpentry Shop.

Job 3: Making of a matched profile form MS plate.

Theory requirements: Work Bench, Fitting Tools (Bench Vice,Chisel,Hammer,Different types of Files, (Rough,Bastard, Second Cut, Half Round, Triangular File),Saw(Hack saw etc.), Scriber, Punch, Try Square, Angle Plate, caliper (outside & inside), Universal Surface Gauge, Centre Punch, Prick Punch, Drill (Flat,straight fluted, taper shank twist drill).

Fitting Operations,Filing, Marking, Drilling, Tapping (Rougher,Intermediate, Finisher taps), Tap Drill size (D=T-2d), Sawing, Dieing . Safety precautions in Fitting Shop.

Job 4: Making of an internal and external thread.

Theory requirements : Thread standards and thread classifications, Internal Thread,External Thread, Thread Nomenclature (Major dia, Minor dia, Pitch dia, pitch, Lead, TPI, Metric, BSP , Nominal size), Specifications of threaded fasteners (in Metric System). Safety precautions in Dieing and Tapping.

Job 5: Making of a green sand mould using the pattern made under Job no. 2.

Theory requirements: Mould making, Preparation of sand, (silica, clay, moisture, and misc items and their functions), Properties of a good sand mould, General procedure for making a good sand mould, Different tools used for preparation of a mould, Explanation of various terms , Cope and Drag Box, Runner, Riser, Gating and its utility, Parting sand, Vent holes.

Job 6: Demonstration of metal melting and casting

Theory requirements: Metal melting furnaces: Ladles, Using of Tongs, Molten metal pouring procedure, Safety precautions in pouring molten metal in a mould.

Job 7. Making of a stepped pin in a centre lathe. (2 Classes)

Theory requirements: Machining and common machining operations , Lathe M/c and its specifications, Head stock, Tailstock, Chuck-Self centering chuck , 4 jaw chuck, Bed, Carriage, Feed mechanism, Screw cutting mechanism, various lathe operations like turning, facing, grooving, chamfering, taper turning ,Thread cutting, Knurling, Parting, Cutting speed, Feed, Depth of cut , Different types of cutting tools-Safety precautions in a machine shop.

Job 8: Making of square prism from a round shaft by Shaping Machine

Theory requirements: Description of a Shaping machine, Base , Column, Saddle, Clapper box, Quick return mechanism, Feed Mechanism, Table, Rotation of table, Adjustment of stroke length, Adjustment of starting point of cut. Safety Precautions while working in Shaping Machine.

Job 9: Making of square prism from a round shaft by Milling Machine

Theory requirements: Description of a milling machine, Specification of a Milling machine, Types of Milling-Up Milling, Down Milling, Vertical Milling Machine, Horizontal Milling Machine , Safety precautions while working in Milling Machine.

Job 10 : Arc Welding practice and making of a welded joint

Theory requirements: Welding, Weldability, Types of Welding, MMAW, Gas Welding, Electrode , Functions of Flux, Equipment for MMAW, Different types of Flames in Gas Welding and Gas Cutting (Neutral-Oxidising-Reducing Flames), Different types of welding joints, AC Welding , DC Welding; Safety precautions in Welding Shop.

Job 11 : Sheet Metal forming & Brazing

Theory requirement: Specification of sheet metal, SWG vs. mm, HR sheet, CR sheet, GI Sheet, Stainless Steel Sheet, Aluminum sheets, Tin Plates, Sheet metal working Tools, Micrometer, Chisels, Punches, Hammers, Mallets, Hand Shear or Snippets, Various sheet metal forming operations, Shearing, Marking, Punching, Drilling, Bending, Drawing, Brazing, Safety precautions in Sheet Metal Working Shop.

References:

1. Elements of Workshop Technology (Vol- I and II)- Hajra Choudhury, Media Promoter &Publishers Privet Limited.
2. Workshop Technology (Vol- I and II) – Chapman , Viva Books Privet Limited.

Course Outcomes:

Upon completion of this course

1. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
2. The students will be able to fabricate components with their own hands.

3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
4. By assembling different components, they will be able to produce small devices of their interest.
5. The students will be able to describe different components and processes of machine tools.
6. The students will be able to apply the knowledge of welding technology and they can perform arc and gas welding to join the material.

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Detailed Syllabus of 3rd Semester:

Subject Name: Data Structures & Algorithms					
Paper Code: CSEN 2101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Pre-requisites:
Introduction to Computing, Mathematics, Set theory

Module -I. [8L] Linear Data Structure I

Introduction (2L):

Why we need data structure?

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.

Algorithms and programs, basic idea of pseudo-code.Algorithm efficiency and analysis, time and space analysis of algorithms – Big O, Ω, Θ notations.

Array (2L):

Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials.

Linked List (4L):

Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module -II: [7L] Linear Data Structure II

Stack and Queue (5L):

Stack and its implementations (using array, using linked list), applications.

Queue, circular queue, deque. Implementation of queue- both linear and circular (using array, using linked list), applications. Implementation of deque- with input and output restriction.

Recursion (2L):

Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle (Concept of Backtracking).

Module -III. [14L] Nonlinear Data structures

Trees (9L):

Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only).

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Graphs (5L):
Graph definitions and Basic concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, path, shortest path, isomorphism).
Graph representations/storage implementations – adjacency matrix, adjacency list, Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.

Module - IV. Searching, Sorting (11L):
Sorting Algorithms (6L):
Bubble sort and its optimizations, Cocktail Shaker Sort, Insertion sort, Shell sort, Selection sort, Quicksort (Average Case Analysis not required), heap sort (concept of max heap, application – priority queue), Counting Sort, Radix sort.
Searching (2L):
Sequential search, Binary search, Interpolation search.
Hashing (3L):
Hashing functions, collision resolution techniques (Open and closed hashing).
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Recommended books:
1. “Data Structures And Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
2. “Fundamentals of Data Structures of C” by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. “Data Structures in C” by Aaron M. Tenenbaum.
4. “Data Structures” by S. Lipschutz.
5. “Introduction to Algorithms” by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Course outcomes:
CO 1: Understand and remember the basics of data structures and how time complexity analysis is applicable to different types of algorithms.
CO 2: Understand the significance and utility of different data structures and the context of their application. (For example, the queue in front of ticket counters uses first-in-first-out paradigm in a linear data structure)
CO 3: Apply different types of data structures in algorithms and understand how the data structures can be useful in those algorithms.
CO 4: Analyze the behavior of different data structures in algorithms. (For example, given an algorithm that uses a particular data structure, how to calculate its space and time complexity.)
CO 5: Evaluate solutions of a problem with different data structures and thereby understand how to select suitable data structures for a solution. (For example, what are the different ways to find the second largest number from a list of integers and which solution is the best.)
CO 6: Evaluate different types of solutions (e.g. sorting) to the same problem.

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Subject Name: Discrete Mathematics					
Paper Code: CSEN 2102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module I: 10L

Introduction to Propositional Calculus: Propositions, Logical Connectives, Truth Tables; Conjunction, Disjunction, Negation, Implication, Converse, Contrapositive, Inverse, Biconditional Statements; Logical Equivalence, Tautology, Normal Forms, CNF and DNF; Predicates, Universal and Existential Quantifiers, Bound and Free Variables, Examples of Propositions with Quantifiers.

Module II: 12L

Counting Techniques: Permutations and Combinations, Distinguishable and Indistinguishable Objects, Binomial Coefficients, Generation of Permutations and Combinations; Pigeon-hole Principle, Generalized Pigeon-Hole Principle, Principle of Inclusion and Exclusion; Generating Functions and Recurrence Relations, Solving Recurrence Relations Using Generating Functions and Other Methods; Solving the Recurrence Relation for the Fibonacci Sequence; Divide-and-Conquer Methods, Formulation and Solution of Recurrence Relations in Computer Sorting, Searching and Other Application Areas.

Module III: 18L

Graphs and Trees: Directed and Undirected Graphs, Review of Basic Concepts and Definitions; Connectivity of Graphs, Point and Edge Connectivity, 1- and 2-Connectivity, Examples; Planarity: Examples of Planar and Non-planar Graphs, Kuratowski's Theorem (Statement and Discussion, omit proof); Colorability: Chromatic Numbers, Heuristic Methods for Determining Chromatic Numbers, Independence and Clique Numbers, Chromatic Polynomials, Applications of Graph Coloring; Kempe Chains, Five Colour Theorem for Planar Graphs; Four Colour Theorem (Statement and Discussion, omit proof).

Matchings: Definition and Examples, Perfect Matchings, Maximal Matchings, Hall's Theorem, Applications.

References:

1. K Rosen. Discrete Mathematics and Its Applications (7^{th} Ed), McGraw-Hill
2. Douglas B. West, Introduction to Graph Theory (2^{nd} Ed), PHI.

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After successfully completing this course the students will be able to:

CSEN2102. 1. Interpret the problems that can be formulated in terms of graphs and trees.
CSEN2102. 2. Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.
CSEN2102. 3. Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.
CSEN2102. 4. Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
CSEN2102. 5. Analyze the logical fundamentals of basic computational concepts.
CSEN2102. 6. Compare the notions of converse, contrapositive, inverse etc in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

Subject Name: Object Oriented Programming					
Paper Code: CSEN 2103					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module 1:

- **Overview of Object Oriented Programming Concepts [1L]**
  - Difference between OOP and procedural programming – advantages & disadvantages. class, object, message passing, inheritance, encapsulation, polymorphism
- **OOP with C++: [21L]**
  - Basic Programming Concepts: **[2L]**
    - Data Types, Operators, Control Statements & Loops, Functions & Parameters, Arrays, Pointers & References
  - Class & Object, Abstraction / Encapsulation, Access Specifier **[3L]**
  - Static Member, Friend Function **[2L]**
  - Constructor and Destructor **[2L]**

Module 2:

- **OOP with C++:**
  - Function and Operator Overloading **[2L]**
  - Inheritance and Derived Class **[3L]**
  - Abstract Class, Runtime Polymorphism, Virtual Base Class, Overriding **[2L]**
  - Exception Handling **[1L]**
  - Namespaces, Class Template and Function Template **[2L]**

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Module 3:

- **OOP with Java: [21L]**
  - Features of Java, Byte Code & JVM, Concepts of Java Application and Applet **[1L]**
  - Basic Programming Concepts: **[3L]**
    - Data Types, Operators, Control Statements & Loops, Functions & Parameters, Array
    - String Handling Concepts & related Functions, Command Line Arguments
    - User Input through Scanner
  - Class & Object, Access Specifier, Static Members, Constructor, Garbage Collector, Nested & Inner Class **[3L]**
  - Function Overloading, Inheritance, Runtime Polymorphism, Abstract Class **[3L]**

Module 4:

- Package and Interface **[2L]**
- Exception Handling: **[2L]**
  - Types of Exception Classes, Use of Try & Catch with Throw, User-defined Exceptions Classes
- Threads, Communication and Synchronization of Threads: **[3L]**
  - Multithreading, Thread Lifecycle, Thread Priorities, Inter-thread Communication
- Applet Programming (using Swing): **[4L]**
  - Applet Lifecycle, Application & Applet, Parameter Passing, Event Model & Listener, I/O

References:

1. The C++ Programming Language by Stroustrup, Adisson Wesley
2. Object Oriented Programming in C++ by R. Lafore, SAMS
3. Java 2.0 Complete Reference by H. Schildt, McGrawHill
4. JAVA How to Program by Deitel and Deitel, Prentice Hall
5. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH
6. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcome:

Students who complete the course will demonstrate the ability to do the following:

1. *Learn* the features of C++ and Java supporting object oriented programming
2. *Understand* the relative merits of C++ and Java as object oriented programming language
3. *Apply* the features learned to design object-oriented software template using C++ and Java
4. *Estimate* the performance of the software written in C++ and Java
5. *Evaluate* the performance of the software and compare the effectiveness of two different language (C++ and Java)
6. *Develop* the object oriented software using C++ and Java.

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Subject Name: Digital Logic and Computer Organization					
Paper Code: ECEN 2104					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Outcomes:

1. Students will learn Binary Number system
2. Student should be able to do logic design using combinational gates
3. Student should be able to design Sequential Circuits
4. Student should be able to do design of Finite State Machine
5. Students will learn Memory classifications
6. Students will learn basic CMOS logic
7. Students will prepare to learn various digital component design as used in VLSI applications.

Lecture hours: 40

Module 1: Binary System, Boolean Algebra and Logic Gates [10L]:

Data and number systems; Binary, Octal and Hexadecimal representation and their conversions, BCD, Gray codes, excess 3 codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. Boolean algebra, De-Morgan's theorem, Various Logic gates - their truth tables and circuits, universal logic gates, Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, Karnaugh-map method, Quine-McCluskey method.

Module 2: Combinational Logic [12L]:

2.1 **Arithmetic Circuits**: Adder circuit – Ripple Carry Adder, CLA Adder, CSA, and BCD adder, subtractor circuit, Fixed point multiplication - Booth's algorithm, Fixed point division – Restoring and non-restoring algorithms.

2.2 **Combinational Circuit:** Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator. Shannon's Expansion Theorem, Realization of logic using Mux, Parity Generators.

Module 3: Sequential Logic [10L]:

Basic memory elements, S-R, J-K, D and T Flip Flops, Sequential circuits design methodology: State table and state diagram, State Reduction Method, Circuit Excitation and Output tables, Derivation of Boolean functions; Finite State Machine Design using Sequential circuit design methodology (Mealy and Moore machine), various types of Registers (with Parallel load, shift Registers) and Counters (asynchronous ripple counters, synchronous counters: binary, BCD, Johnson)

Module 4: Memory Design and Logic Families [8L]:

4.1 **Memory Systems:** Concepts and basic designs of RAM (SRAM & DRAM), ROM, EPROM, EEPROM, Programmable logic devices and gate arrays (PLAs and PLDs)

4.2 **Logic families:** TTL, ECL, NMOS and CMOS, their operation and specifications. Realization of basic gates using above logic families, Open collector & Tristate gates, wired-AND and bus operations. 4.3 Analog digital interfacing: Different A/D and D/A conversion techniques, sample-hold units and analog multiplexers in multichannel data acquisition.

Text Books:

1. Digital Logic and Computer Design, Morris M. Mano, PHI.
2. Digital Principles & Applications, 5th Edition, Leach & Malvino, Mc Graw Hill Company
3. Modern Digital Electronics, 2nd Edition, R.P. Jain. Tata Mc Graw Hill Company Limited
4. Digital Logic Design, Fourth Edition - Brian Holdsworth & Clive Woods (free download)
5. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill Company Limited

Reference Books:

1. **Digital Design: Principles and Practices: John F. Wakerly.**
2. Fundamental of Digital Circuits, A. Anand Kumar, PHI

Subject Name: Human Values and Professional Ethics					
Paper Code: HMTS 2001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	**0**	**0**	**2**	**2**

Module I

Human society and the Value System
Values: Definition, Importance and application.
Formation of Values: The process of Socialization,
Self and the integrated personality
Morality, courage, integrity
Types of Values:
Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life
Value Crisis in Contemporary Society
Value crisis at----
Individual Level
Societal Level

Cultural Level
Value Crisis management --- Strategies and Case Studies

Module II

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism,Utilatirianism, Kant's theory and other non-consequential perspectives

Ethics of care, justice and fairness, rights and duties
Ethics-- Standardization
Codification
Acceptance
Application
Types of Ethics--- Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work
Professional Ethics
Ethics in Engineering Profession;
moral issues and dilemmas, moral autonomy(types of inquiry)
Kohlberg's theory, Giligan's theory(consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE,Institute of Engineers,Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals
social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies
Ethics and Industrial Law
Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III

Science, Technology and Engineering
Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization

Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module IV

Environment and Eco- friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment
Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends
Appropriate technology movement by Schumacher and later development
Reports of Club of Rome.

References:

1)Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2)Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996.
3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008.
4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008.
5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
6)Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
7) Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

COURSE OUTCOME:

The student will

1. be aware of the value system and the importance of following such values at workplace
2. learn to apply ethical theories in the decision making process
3. follow the ethical code of conduct as formulated by institutions and organizations
4. Implement the principles governing work ethics
5. Develop strategies to implement the principles of sustainable model of development
6. Implement ecological ethics wherever relevant and also develop eco-friendly technology

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Subject Name:	**Basic Environmental Engineering & Ecology**				
Paper Code:	**CHEM 2001**				
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module 1 9L: Environment & Ecology (General discussion)

Basic ideas of environment and its component 1L

Mathematics of population growth: exponential and logistic and associated problems, definition of resource, types of resource, renewable, non-renewable, potentially renewable, Population pyramid and Sustainable Development. 2L

General idea of ecology, ecosystem – components, types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphorus, Sulphur]. 2L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 1L

Module 2 9L: Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Acid rain: causes, effects and control. Earth's heat budget, carbon capture, carbon footprint 2L

Lapse rate: Ambient lapse rate, adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion, Maximum mixing depth 2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 1L

Smog: Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification 1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module 3: 9L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Unseeded and Seeded BOD test, BOD reaction rate constants, COD. 1L

Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] 2L

Water pollution due to the toxic chemicals effects: Lead, Mercury, Cadmium, Arsenic 1L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index), effective perceived noise level. Noise pollution control. 2L

Module 4: 9L: Land Pollution

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, electronic waste 2L

Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. 2L

Social Issues, Health and Environment

Environmental disasters: Bhopal gas tragedy, Chernobyl disaster, Three Mile Island disaster, cancer and environment: carcinogens, teratogens and mutagens (general aspect) 2L

Environmental impact assessment, Environmental audit, Environmental laws and protection act of India. 1L

Energy audit, Green building, Green sources of energy, Concept of Green Chemistry, Green catalyst, Green solvents (replacement of VOC) 2L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.
3. Asim K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd
4. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
5. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Data Structure &Algorithms Lab					
Paper Code: CSEN 2111					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

Introduction, Arrays, Linked Lists:

Day 1: Time and Space Complexity

Create three different 10,000 x 10,000 matrices matrixOne, matrixTwo and result-Matrix, using dynamic memory allocation. Initialize matrixOne and matrixTwo by using rand() or srand() function, limit the values from 0 to 9. Multiply matrixOne and matrixTwo into resultMatrix.

While execution, open another terminal and use top command to see the usage of memory by the process. Calculate the time taken for the execution of the program.

Home Assignment

1. Write a program (WAP) to check whether a matrix is i) identity, ii) diagonal.
2. WAP to reverse the elements of an array without using any other variable.

Day 2: Array

1. WAP to add two polynomials using array. Minimize the memory usage as much as you can.
2. Write a program to convert a matrix into its sparse representation (triple format). Once represented in sparse format, do not revert back to the matrix format any-more. Manipulate the sparse representation to find the transpose of the matrix (which should also be in sparse representation). Calculate and find out whether using triple format for your example is advantageous or not.

Home Assignment

1. WAP to add two matrices using sparse representation. Manipulation of data should be done in sparse format.

Day 3: Singly Linked List

Write a menu driven program to implement a singly linked list with the operations:
i) create the list
ii) insert any element in any given position (front, end or intermediate)
iii) delete an element from any given position (front, end or intermediate)
iv) display the list v) reverse the list

Home Assignment

1. Represent a polynomial as a linked list and write functions for polynomial addition.

Day 4: Doubly Linked List
i) create the list
ii) insert any element in any given position (front, end or intermediate)
iii) delete an element from any given position (front, end or intermediate)
iv) display the list

Home Assignment
Implement a double-ended queue (dequeue) where insertion and deletion operations are possible at both the ends.

Linear Data Structures

Day 5: Stack, Queue - with array

1. Write a menu driven program to implement stack, using array, with i) push, ii) pop, iii) display, iv) exit operations
2. WAP to evaluate a postfix expression.
3. Write a menu driven program to implement a queue, using array, with i) insert, ii) delete, iii) display, iv) exit operations.

Home Assignment
WAP to convert an infix expression to its corresponding postfix operation.

Day 6: Stack, Queue - with linked list
Write a menu driven program to implement a stack, using linked list, with
i) push, ii) pop, iii) display, iv) exit operations
Write a menu driven program to implement a queue, using linked list, with
i) insert, ii) delete, iii) display, iv) exit operations

Home Assignment
Write a menu driven program to implement a circular queue, using linked list, with
i) insert, ii) delete, iii) display, iv) exit operations.

Non-linear Data Structures

Day 7: Binary Search Tree (BST)
Write a program, which creates a binary search tree (BST). Also write the functions to insert, delete (all possible cases) and search elements from a BST.

Home Assignment
Write three functions to traverse a given BST in the following orders:
i) in-order, ii) pre-order, iii) post-order. Display the elements while traversing.

Algorithms:

Day 8: Searching, hashing
WAP to implement,
i) Linear Search, ii) Binary Search (iterative), iii) Interpolation Search. Plot their running time for different size of input to compare their performance.

NB: As a pre-processing step, use bubble-sort to sort the elements in the search space. Implement hashing with open addressing or closed hashing.

Home Assignment

WAP to generate integers from 1 to n (input parameter) in random order and guarantees that no number appears twice in the list. While the number sequence is being generated, store it in a text file.

Day 9: Sorting

Write different functions for implementing,
i) Cocktail shaker sort,
ii) Heap sort,
iii) Merge Sort.
Plot a graph of n vs. time taken, for n = 100, 1000, 10,000 and 100,000 to compare the performances of the sorting methods mentioned above.

Home Assignment

Write different functions for implementing, i) Insertion sort, ii) Quick sort.

Graph Algorithms:

Day 10: DFS BFS

Read a graph (consider it to be undirected) from an edge-list and store it in an adjacency list.
Use the adjacency list to run DFS algorithm on the graph and print the node labels. Detect and count the back-edges.

Home Assignment

WAP to implement BFS algorithm of a given graph (similarly as described for DFS, instead of back-edges count cross-edges).

Course Outcome:

The objectives of this course are:
CO1. To understand linear and non-linear data structures.
CO2. To understand different types of sorting and searching techniques.
CO3. To know how to create an application specific data structures.
CO4. To solve the faults / errors that may appear due to wrong choice of data structure.
CO5. To analyze reliability of different data structures in solving different problems.
CO6. To evaluate efficiency in terms of time and space complexity, when different data structures are used to solve same problem.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Software Tools					
Paper Code: CSEN 2112					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

CodeLite IDE

Learn to use CodeLite IDE for wrtiing C/C++ programming languages

Compiling with gcc

Learn all the command line options for compiling C programs in the unix environment using gcc

Git for sharing files and version control

Learn how to setup a repository so that it will be easy to sync your local with that on the server. Learn to use cvs for version controlling

Debugging with gdb

gdb is the standard C/C++ debugger to debug your code. Learn to interact with gdb directly via a shell, or use a graphical interface provided by CodeLite IDE.

Makefiles

Learn how you use makefile on Unix to properly build an executable.

Code coverage testing with gcov

Learn about good testing using gcov is used to make sure the tests are exercising all the branches in the code .

Runtime profiling with gprof

Learn about using gprof which is a very useful *profiling* tool for speeding up execution speed of a program: it will show where your program is spending most of its time, so one can know about the most important code to optimize.

Memory profiling with valgrind

Learn to use valgrind which is a critical tool for helping one to find memory leaks in the program: malloc without free, accessing an array outside its bounds, etc.

Course Outcomes:

CO 1. Understand the importance of knowing various tools to make programs more effective.
CO 2. Learn the concept and use of integrated development environment.
CO 3. Analyze the errors in a code using debugging methods in both Windows and Linux environment.
CO 4. Understand the need for version control and learn effective methods to do the same.
CO 5. Analyze a code with code coverage testing and know how to speed up execution using profiling tools.
CO 6. Demonstrate the utility of effectively using software tools to minimize memory leaks and bad memory manipulations in programs.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Object Oriented Programming Lab					
Paper Code: CSEN 2113					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

- Assignments on C++: [based on Lectures]
  1. Basic Programming
  2. Class
  3. Overloading
  4. Inheritance
  5. Polymorphism
  6. Templates
- Assignments on Java: [based on Lectures]
  1. Basic Programming
  2. Class
  3. Overloading
  4. Inheritance
  5. Interfaces and Packages
  6. Exception Handling
  7. Threads
  8. Applets

Course Outcomes:

Students who complete the course will demonstrate the ability to do the following:

1. *Learn* the characteristics and the behaviors of object oriented programming and implement them in C++ and Java.
2. *Understand* any given code written in C++ and Java and also write programs in these languages.
3. *Explain and analyze* the building blocks of OOPs (Encapsulation, Overloading, Inheritance and Abstraction) in any real world problem and *design* the solution accordingly.
4. *Defend and argue* the application of the specific tool to solve a given problem.

Subject Name: Digital Logic Lab					
Paper Code: ECEN 2114					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

Choose any Ten

1. Realization of basic gates using Universal logic gates.
2. Four-bit parity generator and comparator circuits.

3. Code conversion circuits BCD to Excess-3 & vice-versa.
4. Construction of simple 3 to 8 Decoder circuit by 2 to 4 Decoders using logic gates.
5. Design a 4 to 1 Multiplexer using logic gates and use it as a Universal logic module.
6. Realization of RS-JK and D flip-flops using Universal logic gates.
7. Construction of simple arithmetic logic circuits-Adder, Subtractor.
8. Realization of Asynchronous Up/Down Counter (Count up to 7) using logic gates.
9. Realization of Synchronous Up/Down Counter (Count up to 7) using logic gates.
10. Realization of Shift Registers using logic gates (Serial in Serial out and Parallel in Serial out)
11. Construction of Serial adder circuit using a D Flip-Flop and a Full adder.
12. Design a combinational circuit for BCD to Decimal conversion to drive 7-Segment display using logic gates.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Detailed Syllabus of 4th Semester:

Subject Name: Physics II					
Paper Code: PHYS 2001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module 1 :

Classical Mechanics : 4L

Constraints. Generalised coordinates. Lagrange's equation of motion. Hamiltonian formulation, Hamilton's equation of motion.

Course should be discussed along with simple physical problems.

Quantum Mechanics: 6L

Physical interpretation of wave function Ψ(normalization and probability interpretation). Concept of probability and probability density. Operator. Commutator. Formulation of quantum mechanics and basic postulates . Operator correspondence . Time dependent Schrödinger's equation . Formulation of time independent Schrödinger's equation by method of separation of variables. Expectation values. Application of Schrödinger equation-Particle in an infinite square well potential (1-D and 3-D potential well), discussion on degenerate energy levels.

Module 2 :

Statistical Mechanics: 6L

Concept of energy levels and energy states. Macrostates. Microstates and thermodynamic probability. Equilibrium macrostate. MB, FD and BE statistics (no deduction necessary). Fermions, Bosons (definitions in terms of spin, examples). Physical significance and application. Classical limit of quantum statistics. Fermi distribution at zero and non –zero temperature. Fermi Level.

Applications of Statistical Mechanics : 4L

Planck's Black body radiation. Fermi level in intrinsic and extrinsic semiconductors. Intrinsic semiconductors and carrier concentration. Extrinsic semiconductors and carrier concentration. Equation of continuity. Direct & indirect band gap semiconductors.

Module 3 :

Dielectric Properties: 5L

Electric dipole moment. Dielectric constant. Polarizability. Electric susceptibility. Displacement vector. Electronic, ionic and orientation polarizations. Calculation of polarizabilities - Internal fields in solids. Piezo-electricity, pyro-electricity and ferro-electricity.

Magnetic Properties: 5L

Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility. Origin of magnetic moment, Bohr magneton. Classification of dia, para

and ferro magnetic materials on the basis of magnetic moment. Domain theory of ferro magnetism. Explanation of hysteresis curve. Soft and hard magnetic materials. Properties of anti-ferro and ferri magnetic materials. Ferrites and their applications. Concept of perfect diamagnetism.

Module 4 :

Band Theory of Solids: 6L

Electron in a periodic potential. Bloch theorem. Kronig-Penny model (qualitative treatment). Origin of energy band formation in solids. Classification of materials into conductors, semi conductors & insulators. Concept of effective mass of an electron and hole.

Super Conductivity: 4L

Introduction (experimental survey). General properties of super conductivity. Effect of magnetic field. Meissner effect . Explanation in view of wave mechanical property. Hard and soft superconductors. Thermal properties of superconductor. London equations and penetration depth.

References:

Subject Name: Number Theory And Algebraic Structures					
Paper Code: MATH 2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

MODULE-I - NUMBER THEORY, POSETS AND LATTICES (12L)

Well Ordering Principle, Divisibility theory and properties of divisibility, Fundamental Theorem of Arithmetic, Euclidean Algorithm for finding greatest common divisor (GCD) and some basic properties of GCD with simple examples.

Congruences , Residue classes of integer modulo n (Z_n) and its examples.

Order , Relation and Lattices, POSET , Hasse Diagram. Minimal, Maximal, Greatest and Least elements in a POSET, Lattices and its properties, Principle of Duality, Distributive and Complemented Lattices.

MODULE-II- GROUP THEORY I (12L)

Cartesian Product , Binary operation , Composition Table.

Group , Elementary theorems on groups, Quasi group and Klein's 4 group.

Permutations , Product of permutations, Group property of permutations, Cyclic permutation , Transposition , Even and Odd permutations, Proposition regarding permutations , Alternating Groups , Dihedral groups.

Discussion on some physical examples e.g. the motion group of a cube.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

MODULE-III – GROUP THEORY II (12L)

Order of an element of a group , Properties of the order of an element of a group , Subgroups , some basic theorems on subgroups, Cyclic group , Cosets , Lagrange's theorem, Fermat's Little Theorem(statement only).

Normal subgroup, some basic theorems on Normal subgroup, Quotient group , some applications in algebraic coding theory e.g. Block codes , Linear codes , Coset decoding etc.

MODULE-IV- MORPHISMS, RING AND FIELD (12L)

Homomorphism and Isomorphism of groups, some basic theorems.

Rings , some elementary properties of a ring, Ring with unity , Characteristic of a ring, Ring with zero divisors, Subring , Integral domain, Field , Division Ring or Skew Field.(Emphasis should be given on examples and elementary properties.)

References:

1. Higher Algebra, S.K.Mapa, Sarat Book Distributors
2. Advanced Higher Algebra, J.G. Chakravorty and P.R. Ghosh, U.N. Dhur and Sons
3. A First course in Abstract Algebra, J.B.Fraleigh, Narosa
4. Algebra, M.Artin, Pearson
5. Discrete Mathematics and its Applications, Kenneth H Rosen, McGraw Hill
6. Discrete Mathematics For Computer Scientists And Mathematicians Joe R. Mott , Abraham Kandel and Theodore P. Baker, Prentice-Hall Of India
7. A Friendly Introduction to Number Theory, Joseph H Silverman, Pearson
8. Topics in Algebra, I.N.Herstein, Wiley India
9. Advanced Algebra, Samuel Barnard and James Mark Child, Macmillian

Course Outcome:

After successfully completing this course the students will be able to:

1 Describe the basic foundation of computer related concepts like sets, POsets, lattice and Boolean Algebra.

2.Analyze sets with binary operations and identify their structures of algebraic nature such as groups, rings and fields.

3. Give examples of groups, rings, subgroups, cyclic groups, homomorphism and isomorphism, integral domains, skew-fields and fields.

4. Compare even permutations and odd permutations, abelian and non-abelian groups, normal and non-normal subgroups and units and zero divisors in rings.

5. Adapt algebraic thinking to design programming languages.

6. Identify the application of finite group theory in cryptography and coding theory.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Probability and Numerical Methods					
Paper Code: MATH 2202					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

MODULE-I – NUMERICAL METHODS (16L)

SOLUTION OF NON-LINEAR ALGEBRAIC EQUATIONS AND TRANSCENDENTAL EQUATIONS:

Bisection Method, Newton-Raphson Method, Regula-Falsi Method.

SOLUTION OF LINEAR SYSTEM OF EQUATIONS:

Gauss elimination method, Gauss-Seidel Method, LU Factorization Method.

INTERPOLATION AND INTEGRATION:

Newton's Forward and Backward Interpolation Method, Lagrange's Interpolation, Trapezoidal and Simpson's 1/3rd Rule.

SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:

Euler's and Modified Euler's Method , Runge-Kutta Method of 4th order.

MODULE-II – FUNDAMENTALS OF PROBABILITY (5L)

Prerequisites- Set Theory.

Random experiment, Sample space , Events .

Definition of Probability ,

Addition law of probability, Multiplication law and Conditional Probability.

Bayes' Theorem (Statement only)

MODULE-III – PROBABILITY DISTRIBUTIONS AND STATISTICS (15L)

Random Variables – Discrete and Continuous, Probability Mass Function, Probability Density and Cumulative Distribution Functions, Mathematical Expectation and Variance.

Special Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

Measures of Central Tendency and Dispersion – Mean, Median, Mode and Standard Deviation for grouped and ungrouped frequency distribution.

Simple Correlation and Regression.

MODULE –IV- MARKOV CHAINS AND JOINT PROBABILITY DISTRIBUTION (12L)

Definition of Discrete Time Markov Chain. Examples Including Random Walk, Ehrenfest Chain and Birth-Death Chain, Transition Matrix, Chapman-Kolmogorov Equation and its application.

Joint distribution using joint probability mass/density function. Finding marginal pmf/pdf from joint. Multiplicative property of joint pmf/pdf in case of independent random variables.

References:

1. Miller & Freund's Probability and Statistics for Engineers, R.A.Johnson, Prentice Hall of India
2. Numerical Mathematical Analysis, J.B.Scarborough, Oxford and IBH Publishing Co. Pvt. Ltd.
3. Numerical Methods (Problems and Solution), Jain, Iyengar , & Jain, New Age International Publishers
4. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons
5. A First course in Probability, Sheldon Ross, Pearson
1. Introduction to Stochastic Processes, Paul G. Hoel, Sidney C. Port & Charles J. Stone University Bookstall, New Delhi (Houghton Pliffin Company, 1972)
6. Introduction to Probability Models, Sheldon Ross, Elsevier India

Course Outcome:

After successfully completing this course the students will be able to:

1. Articulate the axioms (laws) of probability.
2. Compare and contrast different interpretations of probability theory and take a stance on which might be preferred.
3. Formulate predictive models to tackle situations where deterministic algorithms are intractable.
4. Summarize data visually and numerically
5. Assess data-based models.
6. Apply tools of formal inference.

Subject Name: Design & Analysis of Algorithms					
Paper Code: CSEN 2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module I

1. Algorithm Analysis (7 Lectures)

Time and space complexity. Asymptotic Notations and their significance. Asymptotic Analysis. Finding time complexity of well known algorithms like-mergesort, heapsort, quicksort. Randomized Quicksort. Average Case Analysis. Asymptotic solution to recurrences. Master Theorem.

2. Medians and Order Statistics. (3 Lectures)

Module II

3. Dynamic Programming (6 Lectures)

Basic method, use, Examples: Matrix-chain multiplication, All pair shortest paths, LCS Problem. Optimal Binary Search Trees: Algorithm and speedup using quadrangle inequality.

4. Greedy Method (6 Lectures)
Elements of the greedy strategy. Huffman codes. Matroids and the greedy methods. Minimum cost spanning trees: Prim's and Kruskal's algorithms and their correctness proofs.

Module III
5. Amortized Analysis (2 Lectures)
Aggregate, Accounting and Potential methods.
6. Disjoint Set Manipulation (2 Lectures)
UNION-FIND with union by rank, Path compression.
7. Graphs Algorithms (6 Lectures)
Topological Sorting. Strongly Connected Components. Shortest Path Algorithms: Dijkstra's and Bellman Ford with correctness proofs.

Module IV
8. Lower Bound Theory (1 Lecture)
Bounds on sorting and searching techniques.
9. NP-completeness (4 Lectures)
P class, NP-hard class, NP-complete class. Relative hardness of problems and polynomial time reductions. Satisfiability problem, Vertex Cover Problem, Independent Sets, Clique Decision Problem.
10. Approximation algorithms (3 Lectures)
Necessity of approximation scheme, performance guarantee. Approximation algorithms for 0/1 knapsack, vertex cover, TSP. Polynomial time approximation schemes: 0/1 knapsack problem.

TEXTBOOKS:
1. Introduction To Algorithms by Cormen, Leiserson, Rivest and Stein. Third Edition, 2009. Prentice Hall.
2. Algorithm Design by Jon Kleinberg and Eva Tardos. Addison Wesley, 2005.REFERENCE:
3. Computer Algorithms: Introduction to Design and Analysis by Sarah Basee and Allen van Gelder. 3rd Edition, Addison Wesley.

COURSE OUTCOMES
After completion of the course, students would be able to:
1. Remember time complexities of various existing algorithms in different situations.
2. Understand the basic principles of different paradigms of designing algorithms.
3. Apply mathematical principles to solve various problems.
4. Analyze the complexities of various algorithms.
5. Evaluate the performance of various algorithms in best case, worst case and average case.
6. Create/ Design a good algorithm for a new problem given to him/ her.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Computer Organization					
Paper Code: CSEN 2203					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module No-1: Basics of Computer Organization: (10L)
Basic organization of the stored program computer and operation sequence for execution of a program,
Von Neumann & Harvard Architecture. RISC vs. CISC based architecture. (4L)
Fetch, decode and execute cycle, Concept of registers and storage, Instruction format, Instruction sets and
addressing modes. (6L)
Module No-2: Basics of ALU Design: (10L)
Binary number representation; Fixed and Floating point representation of numbers. (2L)
Adders: Serial and Parallel adders, Ripple Carry / Carry Lookahead / Carry Save; (4L)
Multipliers & Divider Circuits: Multiplication of signed binary numbers Booth Multipliers; (4L)
Module No-3: Basics of Control Unit Design and Pipelining: (12L)
Design of a control unit: Data path design. (8L)
Single Cycle Datapath for : ALU design / Data Movement Instructions / Control Unit Design;
Multi cycle microarchitecture; concept of states and transitions;
Hardwired and Microprogrammed control. The state machine;
Horizontal and Vertical micro instruction, Microprogrammed control design techniques;
Pipelining: (4L)
Basic concepts, Instruction and arithmetic pipeline; Elementary concepts of hazards in pipeline and techniques for their removal.
Module No-4: Memory and I/O Organization: (10L)
Memory system overview, Cache memory organizations, Techniques for reducing cache misses, Hierarchical memory technology: Inclusion, Coherence and locality properties, Virtual Memory, Memory mapped IO. (6L)
Introduction to I/O interfaces. Interrupts, Interrupt hardware, Enabling and Disabling interrupts, Concept of handshaking, Polled I/O, Priorities, Daisy Chaining. Vectored interrupts;
Direct memory access, DMA controller. Instruction sequencing with examples. (4L)

Text Books:
1. Computer Organization, 5th Edition, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, MGH
2. Computer System Architecture, 3rd Edition, Morris M. Mano, Pearson
3. Computer Organization and Design: The Hardware/Software interface, David A. Patterson and John L. Hennessy, 3rd Edition, Elsevier, 2005.
4. NPTEL materials on Computer Organization.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Indian Culture and Heritage					
Paper Code: HMTS 2002					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	**0**	**0**	**2**	**1**

Module I
Indian Religion &Philosophy
1. Orthodox Indian Philosophy:
2. Unorthodox Indian philosoph:
3. Essentials of Hinduism
4. An overview of Jainism, Buddhism, Sikhism, Islam, Christianity religions

Module II
Values and Personality
1. Aspects of Indian Values
2. Essentials of Personality Building
3. Ethics at work place
4. Aspects of Leadership qualities

Module III
Indian Scriptures
1. Selections from the Vedas
2. Select verses from Upanishad
3. An overview of Gita
4. XVI the chapter of Gita

Module IV
Indian Psychology
1. Aspects of Yoga Philosophy
2. Mind and its workings according to Yoga
3. Law of Karma
4. Selections from Manusmriti

References:

1. Indian Philosophy by S.C. Chatter and D. M. Dutta, Calcutta University Press
2. Spiritual Heritage of India, Swami Prabhavananda, Sri Ramakrishna Math, Chennai
3. Raja Yoga by Swami Vivekananda, Advaita Ashrama, Mayavati
4. Vedic Selection, Calcutta University Press
5. Gita by Swami Swarupananda, Advaita Ashrama, Kolkata
6. Upanishads by any press
7. Carving a Sky (MSS) by Samarpan
8. Essentials of Hinduism (MSS) by Samarpan
9. The Call of the Vedas — Bharatiya Vidya Bhavan

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Algorithm Implementation Lab					
Paper Code: CSEN 2211					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

In this laboratory Students should run all the programs using C programming language on LINUX platform and then estimate the running time of their programs in best & worst case situations for large dataset.

A tentative outline of the laboratory is given below:

- Implement Heapsort algorithm, where heap is implemented using priority queue
- Divide and Conquer: Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
- Divide and Conquer: Implement Quick Sort using Divide and Conquer approach. Check the running time for different positions of pivot elements. Implement the randomized version of quick sort
- Dynamic Programming: Find the minimum number of scalar multiplication needed for chain of Matrices
- Dynamic Programming: Implement Single Source shortest Path for a graph (Dijkstra and
  Bellman Ford Algorithm)
- Dynamic Programming: Implement all pair of Shortest path for a graph (Floyd-Warshall
- Algorithm)
- Greedy method: implement fractional Knapsack Problem, MST by Prim's algorithm
- Greedy method: Implement MST by Kruskal's algorithm by using Union operation on Disjoint data Structures.
- Graph Traversal Algorithm: Implement Depth First Search (DFS), application of DFS (do
- topological sorting, identify strongly connected components)
- Implement KMP algorithm for string matching
- Implement Ford-Fulkerson algorithm to get maximum flow of a given flow network.

Course Outcomes/Learning Objectives:

- On completion this course, students are expected to be capable of understanding basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
- Beside this students should be able to understand basic features of different algorithm design paradigms like divide and conquer, greedy, dynamic programming etc.
- Last but not the least, students will be able to apply and implement learned algorithm design techniques and data structures to solve various real life problems.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Physics II Lab					
Paper Code: PHYS 2011					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

Group 1: Experiments on Electricity and Magnetism

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Determination of specific charge (e/m) of electron.

Group 2: Quantum Physics

5. Determination of Planck's constant.
6. Determination of Stefan's radiation constant.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

9. Determination of Hall co-efficient of semiconductors.
10. Determination of band gap of semiconductors.
11. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Note: A candidate is required to perform at least 5 experiments taking one from each group. Emphasis should be given on the estimation of error in the data taken.

Recommended Text Book:

Quantum Physics

- Atomic Physics – S.N. Ghoshal – S Chand
- Quantum Physics– Eisberg and Resnick – Wiley
- Quantum Mechanics – A.K. Ghatak and S. Lokenathan –Springer

Classical Mechanics

- Introduction to Classical Mechanics – R.G Takwale & P S Puranik –Tata MaGraw Hill
- Classical Mechanics – N C Rana & P S Joag – Tata MaGraw Hill

Solid State Physics

- Atomic Physics – S.N Ghoshal
- Elementary Solid State Physics – M.Ali Omar – Pearson Education
- Solid State Physics – A.J Dekkar – Macmillan
- Introduction to Solid state Physics – C.Kittel

Statistical Mechanics

- Thermodynamics, Kinetic Theory, and Statistical Mechanics–Sears and Salinger–Narosa

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Subject Name: Numerical Methods & Programming Lab					
Paper Code: MATH 2212					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Development of computer programs in C for the following problems:
1. Regula-Falsi Method
2. Newton-Raphson Method
3. Gauss-elimination Method
4. Gauss-Seidel Method
5. Newton's Forward Interpolation
6. Lagrange's Interpolation
7. Trapezoidal and Simpson's 1/3rd rule
8. Euler's and Modified Euler's Method
9. Runge-Kutta method of 4th order
10. Computation of Mean , Median , Mode and Standard Deviation for grouped and ungrouped frequency distribution
11. Computation of Correlation coefficient and Regression equation for Bivariate data.

Subject Name: Language Practice Lab (Level 2)					
Paper Code: HMTS 2011					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

Module 1

Formal verbal communication:

- Introduction to formal verbal communication, Interpersonal Skills & Public Speaking: Building Positive Relationships, Focusing on Solving Problems, Time Management, Dealing with Criticism: Offering Constructive Criticism, Responding to Criticism – Managing Conflict: Approaches to Conflict, Resolving Conflict
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module II

Presentation skills

- Speech Purposes - General: Informative Speeches, Persuasive Speeches, Entertaining Speeches, Methods of Speaking: Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation

- Organising the Presentation: the Message Statement, Organising the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium, Post-presentation Discussion

Module III
Group Discussion

- Introduction to Group Communication
  Factors in Group Communication, Status – Group Decision Making: Reflective Thinking, Brainstorming, Body Language, Logical Argument, The Planning Process, Strategies for Successful GDs, Role of Social Awareness (Newspapers, Magazines, Journals, TV News, Social Media), Practice GDs

Module IV
Job Application and Personal Interview

- **Job Application** Letter: Responding to Advertisements and Forced Applications, Qualities of Well-Written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

- **Resume and CV:** Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination Chronological and Functional Resume – Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honours and Achievements, Personal Profile, Special Interests, References

- **Interviewing**
  Types of Interviews, Format for Interviews: One-to-one and Panel Interviews, Employment Interviews, Frequently Asked Questions, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Detailed syllabus of 5th semester:

Course Name : Formal Language & Automata Theory					
Course Code: CSEN3101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module-1: [**9L**]
Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, Design of sequence detector (Application of concept of Automata to sequential circuit design), Introduction to finite state model [2L]
Finite state machine: Definitions, capability & state equivalence, kth- equivalence concept[1L]
Deterministic finite automaton and non deterministic finite automaton. Transition diagrams and Language recognizers. [1L]
Finite Automata: NFA with ϵ transitions - Significance, acceptance of languages. [1L]
Conversions and Equivalence: Equivalence between NFA with and without ϵ transitions. NFA to DFA conversion. [1L]
Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L]
Application of finite automata, Finite Automata with output- Moore & Mealy machine. [2L]

Module-2: [10L]
Introduction to Formal Languages and Grammars [1L]
Chomsky Classification of grammar: unrestricted, context sensitive, context free grammar [1L]
Grammar Formalism: Right linear and left linear grammars, Regular grammar, Regular Languages, Regular sets [1L]
Regular expressions, identity rules. [1L]
Arden's theorem statement, proof and applications [1L]
Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L]
Pumping lemma of regular sets.[1L]
Closure properties of regular sets (proofs not required). [2L]
Equivalence between regular grammar and FA. [1L]

Module-3: [10L]
Context free grammar: Introduction to Context free grammars, Derivation trees, Sentential forms, Right most and leftmost derivation of strings, basic applications of the concept of CFG [1L]
Ambiguity in context free grammars. [1L]
Minimization of Context Free Grammars : Removal of useless, null and unit productions [1L]

Chomsky normal form and Greibach normal form. [1L]
Pumping Lemma for Context Free Languages. [1L]
Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L]
Push Down Automata: Push down automata, Definition and design of PDA [1L]
Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L]
Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L]
Introduction to DCFL and DPDA. [1L]

Module-4: [11L]
Turing Machine : Introduction to Turing Machine, Definition, Model [1L]
Design of TM, TM as language accepter[1L]
TM as transducers [1L]
Computable functions [1L]
Languages accepted by a TM, recursively enumerable and recursive languages [1L]
Church's hypothesis, counter machine [1L]
Types of Turing machines (proofs not required) [1 L]
Universal Turing Machine [1L]
Decidability, Undecidability, Various Undecidable problems like Post's Correspondence Problem (PCP), Turing Machine Halting Problem, Ambiguity of Context Free Grammars etc. [3L]

Course Outcome:
1. Students will be able to design Turing machine as language accepter as well as a transducer.
2. Students will be able to classify a grammar and a language, design a Finite Automata for a regular expression and derive the regular expression for a FA. Students will be able to check equivalence between regular grammar and FA.
3. Students will be able to minimize context free grammar, derive it's normal forms and recognize a CFG. They will be able to design a PDA for a given CFL. Student will be able to check equivalence of CFL and PDA.
4. The student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.

TEXT BOOKS:
1."Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.
2."Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.
3."Formal Languages and Automata Theory", C.K.Nagpal, Oxford.
4. "Introduction to the Theory of Computation", Sipser Michael. Cengage Learning.

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REFERENCES:
1 "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
2 "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
3 "Introduction to languages and the Theory of Computation", John C Martin, TMH
4 "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

Course Name : Database Management Systems					
Course Code: CSEN3102					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

MODULE-I

Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Role of database administrator and database Users, Three Tier architecture of DBMS.

Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

MODULE-II

Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Relational Database Design [9L]

Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF.

MODULE-III

SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

MODULE-IV

Internals of RDBMS [7L]

Physical data structures, Query optimization: join algorithm, statistics and cost based optimization.

Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

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Course outcomes:

1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
2. Define the terminology, features, classifications, and characteristics embodied in database systems.
3. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
4. Demonstrate an understanding of the relational data model.
5. Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
6. Formulate, using relational algebra, solutions to a broad range of query problems.
7. Formulate, using SQL, solutions to a broad range of query and data update problems.
8. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
9. Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
10. Use a desktop database package to create, populate, maintain, and query a database.
11. Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.

Text Books:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing Company.
3. Ramakrishnan: Database Management System , McGraw-Hill.
4. Gray Jim and Reuter Address, “Transaction Processing: Concepts and Techniques”, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech.
6. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
7. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

References:

1. James Martin, “Principles of Database Management Systems”, 1985, Prentice Hall of India, New Delhi
2. “Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition.
3. “Database Management Systems”, Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : OPERATING SYSTEMS					
Course Code: CSEN3103					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I:

Introduction [4L]

Introduction to Operating System. Operating system functions, OS Architecture (Monolithic, Microkernel, Layered, Hybrid) , evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure [3L]

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.

Module II:

Process Management [17L]

Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads [2L]: overview, benefits of threads, user and kernel threads.

CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Module III:

Storage Management [19L]

Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems [4L]: 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.

I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Module IV:

Protection & Security [4L]

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

Course Outcomes:

1. Master functions, structures and history of operating systems.
2. Master understanding of design issues associated with operating systems.
3. Master various process management concepts including scheduling, synchronization, deadlocks.
4. Be familiar with multithreading.
5. Master concepts of memory management including virtual memory.
6. Be familiar with issues related to file system interface and implementation, disk management, protection and security.

References :

1. Milenkovie M., "Operating System : Concept & Design", McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
4. Dhamdhere: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Course Name : Computer Architecture					
Course Code: CSEN3104					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module 1:

Introduction: (2L)

Review of basic computer architecture;

Pipelining: (9L)

Basic concepts,

Instruction and arithmetic pipeline,

Scheduling in Pipeline;

Data hazards, control hazards and structural hazards, techniques for handling hazards.

Module 2:

Instruction-level parallelism: (6L)

Basic concepts,

Array and vector processors.

Superscalar, Superpipelined and VLIW processor architectures.
Interconnection networks: (4L)
Crossbar, Delta, Omega, Shuffle-Exchange, Banyan , Hypercube, Butterfly Networks.

Module 3:

Measuring and reporting performance: (2L)
CPI,MIPS etc**.** Amdahl's Law & Gustafson's Law.
Hierarchical memory technology: (4L)
Inclusion, Coherence and locality properties;
Cache memory organizations, Techniques for reducing cache misses;
Virtual memory organization, mapping and management techniques, memory replacement policies.
Multiprocessor architecture: (6L)
Taxonomy of parallel architectures;
Centralized shared- memory architecture;
Distributed shared-memory architecture.
Cluster computers.

Module 4:

Issues with Multiprocessor Architectures: (4L)
Synchronization, memory consistency; Cache Coherence protocols (brief discussion only);
Non von Neumann architectures: (3L)
Data flow computers, RISC architectures, Systolic architectures.

References:

1. **Kai Hwang:** Advanced Computer Architecture – Parallelism, etc.
2. **Hennessey & Patterson :** Computer Architecture – A Quantitative Approach
3. **Hamacher et el:** Computer Organization (5^{th} Ed) & above
4. Kai Hwang & Briggs: Computer Architecture & Parallel Processing

Course Outcome:

CO1: Analyze the concept of pipelining, segment registers and pin diagram of CPU.
CO2: Understand and analyze various issues related to memory hierarchy.
CO3: Examine various inter connection structures of multi processor.
CO4. Design architecture with all the required properties to solve state-of-the-art problems

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Microprocessors & Microcontrollers					
Course Code: AEIE3105					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I - [8L]
Introduction to microcomputer system, History and evolution of microprocessor and microcontrollers
and their advantages and disadvantages;
Introduction to 8 bit microprocessor: 8085 microprocessor internal architecture, buses, 8085 pin description; Software instruction set, timing diagram of the instructions, addressing modes and assembly language programming; Interrupts of 8085 processor: classification of interrupts, Programming using interrupts.

Module II - [10L]
Introduction to 8086/8088 Architecture: Architecture, memory segmentation, signal descriptions, clock generator, resetting the microprocessor, wait state inserting, bus buffering, interrupts, instruction set, addressing modes and assembly language programming of 8086/8088.

Module III - [10L]
Introduction to microcontrollers: Intel MCS-51 family features, 8051 architecture, pin configuration, I/O ports and memory organization; Instruction set and basic assembly language programming, interrupts and returns; Interrupts, timer/counter and serial communication;MCS-51 applications: Square wave generation, LED, A/D converter and D/A converter interfacing with 8051;
Brief introduction to PIC microcontroller (16F877): Architecture, pin details, memory layout etc.

Module IV - [12L]
Memory and ADC / DAC interfacing with 8085/ 8086;
Support IC chips: 8255, 8237, 8259 and 8251- Block diagram, pin details, modes of operation, control word(s) format and interfacing with 8085/8086/8051.

References:

1. Ramesh S. Gaonkar, *Microprocessor architecture, programming and applications with 8085/8085A*; Wiley eastern Ltd.
2. B. Ram, *Fundamental of Microprocessor and Microcontrollers*; Dhanpat Rai Publications.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, *Microprocessors and Microcontrollers*; Oxford Publications.
4. A. Nagoor Kani, *8085 Microprocessor and its Applications*; Third Edition, TMH Education Pvt. Ltd.

5. Douglas V. Hall, *Microprocessors & Interfacing*, Tata McGraw-Hill.
6. Ray & Bhurchandi, *Advanced Microprocessors & Peripherals*, Tata McGraw-Hill.
7. Barry B. Brey, *The Intel Microprocessors*, PHI/Pearson Ed. Asia.
8. Muhammed Ali Mazidi and Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Education Inc.
9. Ajay V Deshmukh, *Microcontrollers Theory and Applications*, Tata McGraw-Hill.
10. Raj Kamal, *Embedded systems- Architecture, Programming and Design*, McGraw Hill Education (India) Pvt. Ltd.

Course outcome:

After the completion of the course the students will be able to:

1. Learn the architecture and function of each pin of 8 bit microprocessor 8085, 16 bit microprocessor 8086/8088, 8051 and PIC microcontroller.
2. Develop the skill in program writing for 8085 microprocessor, 8086 microprocessor, 8051 and PIC microcontroller.
3. Perform memory and I/O interfacing with 8085 microprocessor, 8086 microprocessor.
4. Describe the architecture of different types of programmable peripheral devices and their interfacing with microprocessor, 8086 microprocessor and 8051 microcontroller.

Course Name : Economics for Engineers					
Course Code: HMTS3101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module I:

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.

The basic concept of economics – needs, wants, utility.

National Income-GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity.

Inflation: meaning, reasons, etc. **(6L)**

Module II:

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.

Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India.

International Business or Trade Environment. **(4L)**

Module III:

Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.

Financial Statement Analysis (Ratio and Cash Flow analysis). **(8L)**

Module IV:

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.
Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.
Marginal Cost based decisions. **(6L)**

Module V:

Time Value of Money: Present and Future Value, Annuity, Perpetuity.
Equity and Debt, Cost of Capital. **(4L)**

Module VI:

Capital Budgeting: Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return.
Depreciation and its types, Replacement Analysis, Sensitivity Analysis. **(8L)**

References:

1. R**.** Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall of India Private Limited. New Delhi
2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of India Private Limited, New Delhi
3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *Engineering Economic Analysis.* New York: Oxford University Press. 2012.

Course Name : Database Management Systems Lab					
Course Code: CSEN3112					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

Creating Database

1. Creating a Database
2. Creating a Table
3. Specifying Relational Data Types
4. Specifying Constraints
5. Creating Indexes

Table and Record Handling

1. INSERT statement
2. Using SELECT and INSERT together

3. DELETE, UPDATE, TRUNCATE statements
4. DROP, ALTER statements

Retrieving Data from a Database

1. The SELECT statement
2. Using the WHERE clause
3. Using Logical Operators in the WHERE clause
4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
5. Using Aggregate Functions
6. Combining Tables Using JOINS
7. Subqueries

Database Management

1. Creating Views
2. Creating Column Aliases
3. Creating Database Users
4. Using GRANT and REVOKE
5. Cursors in Oracle PL / SQL
6. Writing Oracle PL / SQL Stored Procedures.

Course outcomes:

1. To provide a sound introduction to the discipline of database management as a subject in its own right, rather than as a compendium of techniques and product-specific tools.
2. To familiarize the participant with the nuances of database environments towards an information-oriented data-processing oriented framework.
3. To give a good formal foundation on the relational model of data.
4. To present SQL and procedural interfaces to SQL comprehensively
5. To give an introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design.
6. To motivate the participants to relate all these to one or more commercial product environments as they relate to the developer tasks.
7. To present the concepts and techniques relating to query processing by SQL engines.
8. To present the concepts and techniques relating to ODBC and its implementations.
9. To introduce the concepts of transactions and transaction processing.
10. To present the issues and techniques relating to concurrency and recovery in multi-user database environments.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Operating Systems Lab					
Course Code: CSEN3113					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

1. Shell programming [6P]: Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions and commands).
2. Process [6P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. Signal [9P]: signal handling, sending signals, signal interface, signal sets.
4. Semaphore [6P]: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v.
5. POSIX Threads [9P]: programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. Inter-process communication [9P]: pipes(use functions pipe, popen, pclose), named
7. pipes (FIFOs, accessing FIFO).

Learning Outcomes/Course Outcomes:

Upon the completion of Operating Systems practical course, the student will be able to:

1. Understand and implement basic services and functionalities of the operating system using system calls.
2. Will be able to describe and write shell scripts in order to perform basic shell programming.
3. Will be able to describe and create user defined processes.
4. Understand the benefits of thread over process and implement them.
5. Synchronization programs using multithreading concepts.
6. Use modern operating system calls and synchronization libraries in software to implement process synchronization.
7. Implementation of Inter-process communication using PIPE.

References:

1. Sumitabha Das. Your Unix The Ultimate Guide, MH.
2. Neil Matthew, Richard Stones, Beginning Linux Programming, Wrox.

Subject Name: Computer Architecture Lab					
Paper Code: CSEN 3114					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

VHDL introduction

1. Design digital logic gate (OR, AND, XOR,NOT, NAND, NOR) simulation
2. Implement basic gates using Universal gates.

3. Implement 2's Complement of a binary number.
4. Implement Binary to Excess-3 Code conversion using Array.
5. Implement Gray Code to Binary Code Conversion & vice versa .
6. Implement Half adder and Half subtractor.
7. Design a BCD adder and carry-look ahead Adder.
8. Design an Adder/Subtracter composite unit .
9. Implement Full adder and Full subtractor.
10. Implement MUX, Decoder, Encoder.
11. Implement Flip/Flop(RS, JK, D, T), b)Register,(4/8 bit Synchronized Data Transfer).
12. Design a ripple counter and comparator.
13. Use a multiplexer unit to design a composite ALU.
14. Design a Control Unit.
15. Design a simplified communication protocol.

Course Outcome:

1. After completion of this, students would be able to have adequate knowledge of basics of computer architecture.
2. Students would be able to understand detailed implementation of machine instructions, their classifications and their relevance to programming paradigms.
3. Students would have sufficient knowledge of design implementations of various arithmetic operations such as adder, multiplier etc.
4. Students would be able to design and simulate various combinatorial and sequential logic circuits using Vivado/Xilinx.
5. Students would be able to understand various memory functions.
6. Students would be able to design a formal testbench from informal system requirements.

Course Name : Microprocessors & Microcontrollers Lab					
Course Code: AEIE3115					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

1. Familiarization with 8085A trainer kit components with the process of storing and viewing the contents of memory as well as registers. Repeat the above all using 8085A Simulator.
2. Study of prewritten programs using basic instruction set (data transfer, load/store, arithmetic, logical) on the simulator. Assignments based on above.
3. Programming using kit/simulator for:
   a) Addition/Subtraction of two 8-bit Hex numbers
   b) Packing and unpacking of BCD numbers

c) Copying and Shifting block of memory
d) Addition of two 16-bit Hex numbers.
e) BCD Addition
f) Multiplication of two 8-bit unsigned numbers using sequential Shift - Add Method.
g) Binary to ASCII conversion

4. Familiarization of 8086 microprocessor kit/simulator and assembly language programming using 8086 microprocessor/simulator for :
   a) Addition of two 32-bit Hex numbers.
   b) String matching
   c) Shifting a block of data from one memory location to another
   d) Finding the largest/ smallest number from an array
5. Interfacing with switches and LEDs and glowing LEDs according to read switch status and scrolling-
   blinking using delay subroutines through
   a) PPI 8255A with 8085A trainer kit
   b) 8051 microcontroller
6. Interfacing with seven segment displays through 8-bit latch (e.g., 74LS373) using- a) 8085A
   trainer kit, b)8086A trainer kit and 8255A PPI employing absolute and partial decoding concept as a
   peripheral mapped output port with absolute address decoding.
7. ADC, DAC and Stepper motor interfacing with 8086 microprocessor/8051 microcontroller and their programming.

Course outcome:

After the completion of the course the students will be able to:

1. Understand and apply assembly language of 8085 microprocessor, 8086 microprocessor and 8051 microcontroller.
2. Write programs based on the arithmetical and logical algorithms.
3. Work with microprocessor 8085A,8086Aand microcontroller 8051 interfaced, with LEDs, seven segment displays ADC, DAC, and stepper motor etc.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Detailed Syllabus of Sixth Semester:

Course Name : COMPUTER NETWORKS					
Course Code: CSEN3201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I: Data Communication Fundamentals and Physical Layer [10L]

(A) **Introduction:** Direction of data flow (simplex, half duplex, full duplex), Network topology, categories of network (LAN, MAN,WAN); [1L]

(B) **Protocols and standards:** Reference models: OSI reference model, TCP/IP reference model, their comparative study [2L]

(C) **Physical Layer:** Digital signal coding, Modulation(Digital and Analog), Multiplexing [1L]

(D) Switching, Telephone Networks [4L]

(E) Transmission Media and its properties; [2L]

Module II: Data Link Layer and MAC Sublayer [13L]

(A) Data link layer Framing / Stuffing, Error detection and correction; [4L]

(B) Flow Control Protocols: Stop-and-Wait / Go-Back-N / Selective Repeat; [3L]

(C) HDLC, PPP [1L]

(D) MAC sub-layer: Ethernet (IEEE 802.3) : ALOHA / CSMA-CD / Collision Resolution, Controlled Access and Channelization methods; [3L]

(E) Devices: Transparent Bridges / Source-Route Bridges / Ethernet Switches ; Backward Learning Algo; Construction of Spanning Trees; Routers. [2L]

Module III: Network layer and Internetworking: [10L]

(A) IPv4: Packet format ; Classful addressing / subnetting / subnet mask; CIDR / supernetting / masks; [3L]

(B) IPv6: address format / packet format / differences with IP (v4); [1L]

(C) Protocols: IP, ICMP, ARP [2L]

(D) Routing algorithm: concept of static and dynamic routing, Distance vector / Link state algo; [2.5L]

(E) Protocols: OSPF, BGP [1.5L]

Module IV: Transport and Application layer [10L]

(A) Transport Layer: Process to process delivery / multiplexing and other services of transport layer [1L]

(B) Transport Layer protocols: TCP: Three way handshaking, Window management, Flow and congestion control with slow start, additive increase, multiplicative decrease; UDP; Difference between UDP and TCP [4L]

(C) General Congestion control algorithm: open and closed loop; Techniques to improve: QoS Leaky bucket / Token bucket. [2L]

(D) Modern Topics: Introduction to wireless LAN and Bluetooth, Mobile IP, Mobile TCP [3L]

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Text Books:

1. Andrew S. Tanenbaum: Computer Networks, Pearson Education , fourth edition.
2. William Stallings: Data and Computer Communication, Prentice hall, Seventh edition.
3. William Stallings: High speed Networks and Internets, Pearson education, second edition.

References:

1. William Stallings: Cryptography and Network security PHI, Third edition.
2. William Stallings: ISDN and Broadband ISDN with Frame Relay and ATM.
3. Kurose & Ross: Computer Networking: A Top Down Approach, 5th Ed.

Course Outcomes/Learning Outcomes:

Upon completion of their academic and internship requirements, graduates of Champlain College's undergraduate Computer Networking Program will:

- Describe and analyze the hardware, software, components of a network and the interrelations.
- Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.
- Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.
- Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols and security. Analyze performance of enterprise network systems.
- Use appropriate resources to stay abreast of the latest industry tools and techniques analyzing the impact on existing systems and applying to future situations.

Course Name : Software Engineering					
Course Code: CSEN3202					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**3**

<u>Module-1</u>[10L]:

1. Introduction to Software Engineering (3L)

- Software Engineering – objectives and definitions
- Software Life Cycle – different phases
- Lifecycle Models - Waterfall, Relaxed Waterfall, RAD, Prototyping, Incremental, Spiral, Agile

2. Requirements Phase (3L)

- Requirements Collection and Analysis
- Requirement Specifications – General Structure of Software Requirement Specifications (SRS)

- Functional and Non-functional Requirements
- Representing Requirements as Use Cases with examples

3. Structured Analysis Modeling Techniques (4L)

- Process Model using Context Diagrams (CD) and Data Flow Diagram (DFD) with examples
- Data Dictionary, Decision Tree, Decision Table with examples
- Data Model using Entity Relationship Diagram (ERD) with examples

Module-2: **[10L]**

4. Design Phase (4L)

- Overview – Comparison between Requirement Analysis and Design, Attributes of Good Design
- Define Approaches – Functional and Object Oriented
- Design Aspects – Top-Down and Bottom-Up
- Structured Design – Module Design (or High Level Design), Detail Design (or Low Level Design)
- Functional Decomposition – Abstraction, Cohesion, Coupling, Structure Chart, Structured English

5. Object Oriented Analysis and Design (6L)

- OOAD Basic Concepts
- Unified Modeling Language (UML) – different types of diagrams for different views of system
- User View – Use Case Diagram with examples
- Structural Views – Class Diagram with examples
- Behavioral View – Sequence, Collaboration, Activity and State Chart Diagrams with examples

Module-3: **[10L]**

6. Coding or Programming (2L)

- Programming Principles and Guidelines – Structured Programming, Code Re-use, Coding Standards / Guidelines
- Coding Process – Incremental Coding, Test Driven Development, Pair Programming / Extreme Programming
- Source Code Version Control, Build, Code Refactoring

7. Review and Testing (8L)

- Self Review / Peer Review
- Testing Overview -- Objective, Definition, Static and Dynamic Testing, Functional vs. Non-functional Testing
- Testing Artifacts – Test Cases and Test Suites, Traceability Matrix , Test Data , Stub and Driver
- Testing Process – Test Case Design, Test Case Execution, Test Result, Defect Logging and Tracking
- Testing Methods -- White Box Testing with Test Coverage using Control Flow Graph (CFG) and Cyclomatic Complexity, Black Box Testing with Equivalence Class Partitioning and Boundary Value Analysis,

- Testing Level – Unit Testing, Integration Testing, System Testing, (User) Acceptance Testing, Regression Testing, Performance Testing, Usability Testing, Non-functional Testing

Module-4:**[10L]**

8. Software Maintenance (2L)

- Types of Maintenance – Corrective, Preventive, Adaptive Change Management and Maintenance Process Software Estimation (3L)

9. Software Estimation (3L)

- Overview of Software Estimation – Size, Effort, Duration and Cost
- Size Estimation Methods – Lines of Code (LOC) and Function Points (FP)
- Estimation of Effort and Duration based on Size and Productivity
- Constructive Cost Model (COCOMO) – Basic COCOMO, Intermediate COCOMO (COCOMO 81), Detailed COCOMO (COCOMO II)

10. Project Management (3L)

- Project Management Overview -- Planning, Staffing, Execution, Monitoring and Control
- Responsibilities of Project Manager
- Project Scheduling – Work Breakdown Structure (WBS) and Gantt Charts

11. Configuration Management (2L)

- Overview of Configuration Management - Identification, Control, Status Accounting, Audits
- Concept of Baseline, Versioning of Configurable Items (CI)

Learning Objectives/Course Outcomes:

1) Knowledge and Understanding of:
   a) the system development lifecycle and associated models;
   b) the software-development process, including requirements analysis, design, coding, testing and maintenance;
   c) the basic principles of function-oriented and object-oriented software development with modular approach
   d) the essentials of software estimation and project planning
   e) the basics of software configuration management
   f) the fundamentals of software project risk management.
2) Ability to:
   a) prepare software requirement specifications as per IEEE guidelines
   b) model function-oriented and object-oriented software systems using industry-standard techniques (e.g., DFD, ERD, UML);
   c) approach testing of software systems in a methodical manner
   d) estimate software size using industry-standard methods (e.g., FPA)
   e) work out software project schedule and staffing plan
   f) identify software project risks and their mitigation approach.

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List of Electives

OPTIONS FOR ELECTIVE I (Even Semester)

CSEN 3280 Computer Graphics & Multimedia
CSEN 3281 Artificial Intelligence
CSEN 3282 Web technologies
CSEN 3283 Advanced Java Programming

OPTIONS FOR ELECTIVE I Lab* (Even Semester)

CSEN 3285 Computer Graphics & Multimedia Lab
CSEN 3286 Artificial Intelligence Lab
CSEN 3287 Web technologies Lab
CSEN 3288 Advanced Java Programming Lab

Course Name : Computer graphics and multimedia					
Course Code: CSEN3280					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module I:

Introduction to computer graphics & graphics systems [6L]: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion: [6L]: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II:

2D transformation & viewing [8L]: Basic transformations: translation , rotation, scaling ; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping , line clipping, clipping circles , polygons & ellipse.

3D transformation & viewing [7L]: 3D transformations: translation, rotation, scaling & other transformations. rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module III:

Curves [3L]: Curve representation, surfaces , designs , Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.
Hidden surfaces [3L]: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.
Color & shading models [2L]: Light & color model; interpolative shading model; Texture.

Module IV:

Multimedia [10L]: Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia.; Image, video and audio standards.
Audio: digital audio, MIDI, processing sound, sampling, compression.
Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression .
Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

Learning Outcomes/Course Outcomes:

1. Ability to write program functions to implement graphics primitives.
2. Ability to write programs that demonstrate geometrical transformations.
3. Ability to write programs that demonstrate an understanding of the use of object hierarchy in graphics applications.
4. Ability to write program functions to implement visibility detection.

Text Books:

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
4. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.)" – Pearson Education.
5. Ranjan Parekh-"Principles of Multimedia"-TMH

References:

1. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
2. Sanhker, Multimedia –A Practical Approach, Jaico
3. Buford J. K. – "Multimedia Systems" – Pearson Education
4. Andleigh & Thakrar, Multimedia, PHI
5. Mukherjee Arup, Introduction to Computer Graphics, Vikas
6. Hill,Computer Graphics using open GL, Pearson Education
7. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.
8. Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill

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Course Name : Artificial Intelligence					
Course Code: CSEN3281					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Module I:

Introduction [1L]: Definition of AI, Intelligent Behavior, Turing Test, Typical AI Problems, Various AI Approaches, Limits of AI.

Introduction to Intelligent Agents [1L]: Agents & environment, Agent Architecture, Agent Performance, Rational Agent, Nature of Environment, Simple Reflex Agent, Goal Based Agent, Utility Based Agent.

Knowledge Representation & Propositional Logic [2L]: Knowledge representation issues, Approaches to knowledge representation, Propositional Logic – its syntax & semantics, Inference rules, Application of those rules, Limitation of Propositional Logic.

Problem Solving using Single Agent Search [2L]: Introduction to State-space search, state-space search notation, search problem, Formulation of some classical AI problems as a state space search problem, Explicit Vs. Implicit State space.

Uninformed Search Techniques [4L]: Basic Principles, Evaluating parameters, BFS, DFS, Depth Limited Search, Iterative Deepening DFS, Uniform Cost Search & Bidirectional Search, Properties of various search methods & their comparative studies.

Module II:

Informed Search Methods [6L]: Basic Principles, Heuristics, Best First Search – Greedy Best First, A* Search, their Properties, Admissible & Consistent heuristic, Local Search Techniques – Hill climbing & Simulated Annealing, Comparison with other methods

Problem Solving using Two Agent Search [2L]: Adversarial Search – Game Tree, MINIMAX Algorithm, Alpha-Beta Pruning, Performance Analysis.

Constraint Satisfaction Problem [2L]: Definition of CSP, Representation of CSP, Formulation of Various popular problems as CSP, Solution methods of CSP – Backtracking & Forward Checking.

Module III:

Knowledge Representation & Predicate Logic [3L]

Syntax & Semantics of FOPL, Representation of facts using FOPL, Clauses, Resolution, Unification methods of inference, Default & Non-Monotonic reasoning.

Knowledge Representation using Rules [2L]

Rule based system, Horn clauses, Procedural vs. declarative knowledge, forward & backward reasoning, Introduction of logic programming using PROLOG/ LISP.

Other Representational Formalism [2L]

Inheritable knowledge, Semantic network, Inference in Semantic network, Extending Semantic Network, Frames, Slots as objects.

Probabilistic reasoning [3L]

Representing knowledge in an uncertain domain, probabilistic inference rules, Bayesian networks – representation & syntax, semantics of Bayesian net, Fuzzy sets & fuzzy logic.

Module IV:

Planning [2L]: Introduction, Simple planning agent, Problem solving vs. planning, Logic based planning, Goal Stack planning, Planning as a search, Total-order vs. partial order planning.

Learning [4L]: Overview, Taxonomy of learning system, various learning models, learning rules, inductive learning framework, Decision tree based learning, Learning using Neural Network & Genetic Algorithm.

Natural Language Processing [2L]: Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Expert Systems [2L]: Representing and using domain knowledge, expert system shells, knowledge acquisition.

Course Outcomes/Learning Objectives:

- At the end of this course the students are expected to be capable of understanding the basic features/ attributes that an intelligent system should have, how those attributes can be incorporated to the system.
- Beside this students should be able to know the importance of knowledge as far as intelligence is concerned and how this knowledge can be suitably represented so that it can be used to infer new knowledge.
- On completion of this course, the students also get an idea of the significance of efficient searching algorithms as far as intelligent decisions are concerned.
- Last but not the least, by the end of this course, students will be able to explore various problem solving paradigms, learning algorithms, game playing techniques, logic theorem proving etc.

References:

1. Artificial Intelligence A Modern Approach, Stuart Russell & Peter Norvig, Pearson Education
2. Artificial Intelligence, Ritch & Knight, TMH
3. Artificial Intelligence & Intelligent Systems, N.P.Padhy, Oxford University Press
4. Introduction to Artificial Intelligence & Expert Systems, Dan W. Patterson, PHI
5. PROLOG Programming for Artificial Intelligence, Ivan Bratko, Pearson India.

Course Name : Web Technologies					
Course Code: CSEN3282					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

MODULE 1 [Types of Web pages and Web page front end design]

Dynamic Web Pages [1L]

The need of dynamic web pages; comparative studies of different technologies of dynamic page creation

Active Web Pages [1L]

Need of active web pages; java applet life cycle.

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HTML (3L):
Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue.
Image Maps (1L): map, area, attributes of image area.

MODULE 2 [Web page scripting, server and client side**]**
HTTP[2L]: Message, Request, Response, Methods , Status Codes
Extensible Markup Language (XML) (4L): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.
Java Script [3L]
Data types, variables, operators, conditional statements, array object, date object, string ob ject.
Java Servlet [2L]
Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

MODULE 3 [Advanced Java Server Side Programming**]**
JSP [9L]: JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, using include and forward action, Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.
J2EE[4L]: An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans

MODULE 4 [Network Security**]**
Threats (1L):
Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.
Network security techniques (2L):
Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).
Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy.

References:

1. Web Technology: A Developer's Perspective, N.P.Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.(Chapters 5,6,12)
3. Murach's Java Servlets and JSP.
4. Java for the Web with Servlets, JSP, and EJB, Budi. Kurniawan
5. Cryptography and Network security by William Stallings

Course Outcome:
1. Students will be able to understand the basic tags of HTML, CSS, java script and DHTML.

2. Students will be able to connect a server side program using servlet and JSP to a DBMS and perform insert, update and delete operations on DBMS table.
3. Students will be able to write a server side programming using servlet and JSP to store the data sent from client, process it and store it on database.
4. 4. Students will be able to prepare a well formed / valid XML document , schema to store and transfer data.
5. 5. Students will be able to understand various types of attacks and their characteristics.
6. 6. Students will be able to get familiar with network security designs using available secure solutions (such as PGP, SSL, IPSec)

Course Name : Advanced Java Programming					
Course Code: CSEN3283					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module I:

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. [4L].

Module II:

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. [4L]

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. [5L]

EJB :Introduction, Comparison of EJB & Java Beans , Applications, Drawbacks, Different types of enterprise beans,Services provided by EJB container. [5L].

Module III:

RMI: Introduction and applications, Architecture ,Use of RMI Registry.

JNDI: Introduction and applications, Comparison between LDAP and JNDI

JDO (Java Data Objects): Introduction, Integration of EJB and JDO, JDO & RMI

JINI :Introduction, Applications [5L]

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. [5L].

Module IV:

XML: Java & XML, XML syntax, Document type definition., Parsers, SAX parsers, DOM parsers, SAX vs. Dom,

JAXP and JAXB. [8L].

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Text Books:

1. "Professional JAVA Server Programming", Allamaraju and Buest ,SPD Publication
2. "Beginning J2EE 1.4" Ivor Horton, SPD Publication.
3. "Advanced Programming for JAVA 2 Platform" Austin and Pawlan, Pearson

References:

1. Internet & Java Programming by Krishnamoorthy & S. Prabhu(New Age Publication)

Course Outcome:

Students will be able to:

CO 1: Understand evolution of Client/Server Computing to access desktop vs web application.

CO 2 : Understand various Architecture patterns used for web application.

CO 3 : Understand the common problems faced in architecting large scale applications and analyze the requirement for applying Java EE components at various level.

CO 4 : Learn various Java EE components and apply them for developing multilayered web application.

CO 5: Learn and use various components (JNDI, EJB) used for distributed processing in Java EE.

CO 6 : Understand and use XML for data transfer

CO 7: Understand database handling in web application using Java EE components (servlets, JSP)

CO 8: Apply various Java EE components for developing a database driven web application using MVC pattern.

Course Name : Principles of Management					
Course Code: HMTS3201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	2	**0**	**0**	**2**	**2**

Module 1:

Management: Definition, nature, purpose and scope of management, Skills and roles of a Manager, functions, principles; Evolution of Management Thought: Taylor Scientific Management, Behavioral Management, Administrative Management, Fayol's Principles of Management, Hawthorne Studies. **(4L)**

Module 2:

a) **Planning:** Types of plans, planning process, Characteristics of planning, Traditional objective setting, Strategic Management, premising and forecasting.

b) **Organizing:** Organizational design and structure, Coordination, differentiation and integration.

c) **Staffing:** Human Resource Management and Selection, Performance appraisal and Career strategy, Managing Change.

d) **Decision-Making:** Process, Simon's model of decision making, creative problem solving, group decision-making.

e) **Coordinating:** Concepts, issues and techniques.

f) **Controlling:** Concept, planning-control relationship, process of control, Types of Control, Control Techniques (**8L)**

Module 3:

Span of management, centralization and de-centralization Delegation, Authority & power - concept & distinction, Line and staff organizations. **(4L)**

Module 4:

Organization Behaviour: Motivation, Leadership, Communication, Teams and Team Work**. (6L)**

Module 5:

Management by Objectives (MBO): Management by exception; Styles of management: (American, Japanese and Indian), McKinsey's 7-S Approach, Self Management. **(2L)**

References:

1. Harold Koontz & Heinz Weihrich, Essentials of Management, TMH.
2. Stoner, Freeman, Gilbert Jr., Management, PHI.
3. Bhatt & Kumar, Principles of Management, OUP.

Course Name : Circuit Theory					
Course Code: ELEC3001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Total: 40L

Module-I

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis. Network Theorems: Thevenin's, Norton's and Superposition theorem applied to circuits containing dependent sources. [10L]

Module-II

Laplace Transform: Review of Laplace transform. Properties of Laplace transform. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents. Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Concept of natural frequency and damping. Sketching transient response, determination of time domain specifications. [10L]

Module-III

SPICE: Structure of a SPICE program, active and passive device/element statements, different study like DC analysis, transient analysis and ac analysis statement in SPICE. Plotting and printing statement, input and output Impedance calculation using SPICE, voltage and current controlled components in SPICE. [5L]

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory. [5L]

Module-IV

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters and Hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [5L]

Filter Circuits: Concept of filters, Classification of filters. Analysis of Low pass, High pass, Band pass and Band reject filters using operational amplifier. [5L]

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.
3. Network Analysis, Van Valkenburg, Pearson Education .
4. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand.

References:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin,The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza & S.Seely, McGraw Hill.

COURSE OUTCOMES OF CIRCUIT THEORY

- Solve electric circuits containing AC and DC sources applying network theorems
- Apply Laplace transform for transient analysis of electrical circuits
- Solve electric circuits applying concepts of graph theory.
- Apply two port network analysis to calculate open circuit impedance parameter, short circuit admittance parameter, transmission parameter and hybrid parameter
- Circuit Simulation using SPICE
- Familiarization with different filter networks.

Course Name : Computer Networks Lab					
Course Code: CSEN3211					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

Network Programming Exercises: (To be implemented preferably in Java or C/C++):

1. Getting familiar with the Networking (Socket) API and associated data structures.
2. Implement Simple TCP Client Server Application.
3. Implement TCP Echo Server Client Application.
4. Implement TCP Chat Server Client Application.
5. Implement a File Server Client application.
6. Implement UDP Echo Server Client Application.
7. Implement UDP Time Server Client Application.
8. Implement multithreaded chat program.

9. Implement Web based protocol (looking up URLs, retrieving & examining content, posting a form etc.etc.).
10. Implement Multicasting / Broadcasting socket I/O.
11. Implement Sliding Window Protocol using Non-Blocking I/O (try the Selective Repeat).
12. Implement Secured TCP echo protocol.
13. Experimenting on cross-platform network based communication issues.

Network Hardware / Simulation Exercises:

14. Use of QualNet for Network Modeling. (Basic ideas / demonstration only)
15. Use of Wireshark for Network packet capturing.
16. Creating a small LAN by an Ethernet switch
17. Creating a Wireless LAN using an Access Point

Course Outcomes:

CO 1. Learn the terminology and concepts of network management in Linux platform by understanding shell commands and implementing the same.
CO 2. Understand the concepts of protocols, network interfaces, and design/performance issues through programs.
CO 3. Understanding the need of dividing stream of data into smaller units and implementing program to send such data units across a network.
CO 4. Demonstrate various types of protocols to transfer packets of data from a source to destination machine.
CO 5. Understand the need of different types of Transport Layer Protocols and implement them through socket programming.
CO 6. Learn how to synthesize the learning gathered from different network layers to build useful, relevant and user friendly applications with the objective to solve real life problems.

Course Name : Software Engineering Lab					
Course Code: CSEN3212					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

Exercises and Assignments on:

1. Preparation of SRS for sample application system(s).
2. Preparation of UML Diagrams for sample application problems – Class Diagrams and Sequence Diagrams using tools.
3. Preparation of Test Cases for sample application module(s).
4. Estimation of Project Size for sample application system(s) – Function Point Analysis (FPA).
5. Preparation of Project Schedule and Staffing Plan for sample software project(s) using tools.

Course Outcomes:

a) Students will be able to prepare SRS document for sample application system as per IEEE guidelines.

b) Students will be able to design sample software application problem using various UML diagrams (e.g. Class Diagram, Sequence Diagram etc.) using tools like Microsoft Visio.

c) Students will be able to prepare test cases for sample application module(s).

d) Students will be able to estimate the project size, duration and cost for sample application system using industry standard method like FPA.

e) Students will be able to prepare project schedule and plan the staffing for sample application system.

Course Name : System Administration Lab					
Course Code: CSEN3213					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**2**

- Introduction to the network environments and different configuration files
- System startup, runlevels and shutdown, file system
- User and group Creation and management with different option and permission
- Packet Monitoring software (tcpdump, ethereal)
- Trace route, Ping, Nmap , netstat
- NFS Configuration
- Firewall Configuration using iptables/ipchains
- Server configuration: FTP, telnet, SMTP, DHCP, HTTP/S, DNS

Course outcomes:

1. Students will demonstrate an understanding of basic knowledge about the installation and configuration of operating systems
2. Students will create different servers in Linux/ Unix System.
3. Students will configure firewall of the system

Course Name : Computer Graphics and Multimedia Lab					
Course Code: CSEN3285					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

- Point plotting, line & regular figure algorithms
- Raster scan line & circle drawing algorithms
- Clipping & Windowing algorithms for points, lines & polygons
- 2-D / 3-D transformations
- Filling algorithms.

- Photo Editing using Photoshop.
- Creating Animation using Flash.

Course Outcomes:

1. Students will demonstrate an understanding of contemporary graphics hardware.
2. Students will create interactive graphics applications in C using one or more graphics application programming interfaces.
3. Students will write programs that demonstrate computer graphics animation.
4. Students will write programs that demonstrate 2D image processing techniques
5. Students will do photo editing using photoshop.
6. Students will create animation in flash.

Course Name : Artificial Intelligence Lab					
Course Code: CSEN3286					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

In this laboratory students will be familiarized with PROLOG/ LISP language. A tentative outline for this laboratory is given below:

- Introduction to PROLOG facts & rules with the help of a simple family tree; how the goals are given in PROLOG; some simple queries on the family tree
- Formation of recursive definition; how PROLOG executes the goals; simple assignments
- How PROLOG deals with problems with numbers – integers, real; with some examples
- Introduction to LIST structure; how PROLOG implements LIST; some simple assignments on LIST.
- Some more complex assignments on LIST; Introduction of Accumulators – simple assignments
- Introduction to CUT with simple assignments; implementation of Sorting algorithms
- PROLOG clauses for file operation – with simple assignments
- Implementation of Graph Search algorithms like DFS, BFS; Some application of DFS & BFS
- Implementation of some well known puzzles, like 8-queens problem, Towers-of-Hanoi problem, Missionaries & Cannibals problem etc..
- Introduction to LISP
- Some simple assignments on LISP.

Course Outcomes/Learning Objectives:

At the end of this course, students are expected to get a good flavor of logical programming by using PROLOG/ LISP. Students should be able to apply those knowledge to solve some intelligent puzzles.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Web Technologies Lab					
Course Code: CSEN3287					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

HTML:

- **A)** A) Designing a web page with HTML.
- **B)** B) Designing HTML Form.
- **C)** C) Designing with CSS

Java Script :

- **A)** Data types, variables, operators, conditional statements, array object, date object, string object.
- **B)** Validate the fields of a form using JavaScript

XML :

A) How to write a XML document.
B) How to validate XML document.

Java Servlet :

- **A)** Servlet environment and role
- **B)** HTML support
- **C)** Cookies and Sessions.

JSP :

- **A)** JSP tags, layout in JSP, Declaring variables, methods in JSP
- **B)** Inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action
- **C)** Creating ODBC data source name.

Course Outcome:

1. Students will be able to **understand** the basic tags and properties to write client side and server side programming.
2. Students will be able to **develop** static and dynamic webpage by the use of HTML/CSS, java script and DHTML.
3. Students will be able to **connect** a server side programs using servlet and JSP to a DBMS and **perform** insert, update and delete operations on DBMS table.
4. Students will be able to **write** a server side programming using servlet and JSP to store the data sent from client, process it and store it on database.
5. Students will be able to **select** required HTML tags and CSS properties and java scripts to design a particular web page.
6. Students will be able to **prepare** a well formed / valid XML document , schema to store and transfer data.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Advanced Java Programming Lab					
Course Code: CSEN3288					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**0**	**3**	**3**

Java Data Base Connectivity: A Data Base can be accessed from program.
Servlets: Development of web based components.
Java Beans: Using EJB , programmer should visually assemble components and dynamically change properties.
Java Server Pages: Programs to implement to dynamically generate HTML, XML or other types of documents in response to a Web client request.
Remote Method Invocation: Programs to provide the mechanism by which the server and the client communicate and pass information back and forth.

Course Outcome:
CO 1: Students will be able to develop dynamic web pages using servlet, JSP, EJB
CO 2: Students will be able to access Data using JDBC from dynamic web page
CO 3: Students will be able to process data using XML

Syllabus of Sessional Course

Course Name : Seminar I					
Course Code: CSEN3297					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	1	**0**	**3**	**3**	**2**

Seminar on recent topics related to Computer Science & Engineering.
Course outcomes/Learning objectives:

- Students will demonstrate the ability to prepare appropriately to participate effectively in class discussion.
- Students will demonstrate the ability to follow discussions, oral arguments, and presentations, noting main points or evidence and tracking threads through different comments.
- Further, students will be able to challenge and offer substantive replies to others' arguments, comments, and questions, while remaining sensitive to the original speaker and the classroom audience.
- Students will learn to prepare materials on a topic relevant to the course and demonstrate critical faculties with the text discussed.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Name : Personality Development					
Course Code: HTMS3221					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	1	**0**	**0**	**1**	**1**

Module 1

Self-Growth

(i) Self Growth- Maslow's Hierarchy of Needs Theory
(ii) Anger, Stress & Time Management- Theories and application
(iii) SWOT Analysis

Module II

Stepping Up

(i) Growth & Environment
(ii) Competitive Spirit
(iii) Responsibility Factor

Module III

Professional Communication

(i) Impression Management- theory on social psychology
(ii) Employability Quotient
(iii) Cross-cultural communication

Module IV

Leadership & Team Playing

(i) Leadership & Team Playing: Theories, Styles, Stages
(ii) Motivation, Negotiation Skills, Conflict Management
(iii) Planning & Envisioning: Initiative and Innovation in the Work Environment- De Bono's Six Thinking Hats

References:

1. Personality Development and Soft Skills by Barun K. Mitra, Oxford University, 2011
2. Soft Skills: An Integrated Approach to Maxmise Personality by Gajendra Singh Chauhan and Sangeeta Sharma, Wiley, 2016.
3. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson, 2010

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Detailed syllabus of 7th semester

Course Name : Compiler Construction					
Course Code: CSEN4101					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	3

Module 1: **[10L]**

A) Introduction to Compiling: Analysis of the source program; The phases; Cousins of a compiler. (2L)

B) A simple One-pass Compiler (4L)

C) Lexical Analysis*:* The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens. A language for specifying lexical analyzer; Design of a lexical analyzer generator (Lex / Flex). (4L)

Module 2: **[13L]**

A) Syntax Analysis: The role of a parser, Context free grammars, Writing a grammar. Top down Parsing, Non-recursive Predictive parsing (LL(1)).
Bottom up parsing, Handles, Viable prefixes, Various forms of LR parsers :SLR(1), LR(0), LR(1), Construction of LALR(1) parsing table using / avoiding LR(1) parsing tables.
Parser generators (yacc / Bison). (7L)

B) Type Checking: Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.
(2L)

C) Run-Time Environment:
Source Language Issues: Procedures, Activation Trees, Control stacks, Scope of variable declarations, Binding of names.
Storage Organization: Sub-division of Run time memory, Activation Records.
Storage Allocation strategies: Static allocation / stack allocation / heap allocation.
Scope: Blocks, With or Without Nested Procedures, Access Links, Displays.
Parameter passing.
Symbol tables: organization; data structures used. (4L)

Module 3: **[8L]**

B) Syntax Directed Translation:
Syntax directed definitions: Synthesized attributes, Inherited attributes.
Construction of Syntax trees: Expressions, DAG for Expressions.
Bottom-up Evaluation of S-Attributed Definitions: Synthesized attributes on the Parser stack.
L-Attributed definitions: Translation schemes.
Top-down Translation: Elimination left recursion.

Bottom-up Evaluation of Inherited Attributes: Removing Embedding actions, Inheriting attributes, Simulating the Evaluation of Inherited attributes, Replacing Inherited by Synthesized attributes. (3L)

C) Intermediate Code Generation:

Intermediate Languages: Graphical representation,
Three-address code: different types, Translation into Three-address code, Quadruples / Triples / Indirect Triples, their comparisons.
Translation of Declarations statements: Procedures, Records.
Assignment statements.
Addressing array elements.
Boolean expressions, Flow of control statements, Case statements.
Backpatching: Boolean expression, Flow-of-control statements.
Procedure calls. (5L)

Module 4: [9L]

A) Code generation:

Issues in the design of a code generator: Memory management; Instruction selection; The target machine.
Run-time storage management.
Basic blocks and flow graphs: Transformations on basic blocks; Flow graphs; Loops;
A simple code generator: Algorithm; Conditional statements;
Register allocation and assignment.
The DAG representation of basic blocks. (5L)

B) Code optimization*:*

Principal source of optimization: common subexpression, Copy propagation, Dead – code elimination, Loop optimization, Code motion, Induction variables.
Loops in flow graphs: Dominators, Natural loops, Inner loops.
Peephole optimization. (4L)

References :

[1] Aho, Sethi, Ullman: Compilers: Principles, Techniques and Tools: 1st Edition, Pearson Education.
[2] Holub - "Compiler Design in C" – PHI
[3] Tremblay and Sorenson Compiler Writing-McgrawHill International .
[4] Chattopadhyay , S- Compiler Design (PHI)

Course Outcome:

- On completion this course, students are expected to have an overview of how a real life compiler works across various phases.
- Besides this students should be able to understand various necessary tasks related to compilers like token identification, grammar writing, type conversion and storage management.
- Also students will learn to generate intermediate codes, generate actual machine codes targeting a particular architecture and optimize generated code across various phases of the compilation process.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

OPTIONS FOR ELECTIVE II

CSEN 4141 Information Retrieval
CSEN 4142 Advanced Operating System
CSEN 4143 Computational Geometry
CSEN 4144 Data Mining and Knowledge Discovery
CSEN 4145 Cloud Computing

Course Name : Information Retrieval					
Course Code: CSEN 4141					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module-1: [9L]

Introduction [2L]: Introduction to Information Retrieval, Goals and history of IR (Information Retrieval), The impact of the web on IR.
Basic IR Models [4L]: Boolean model, Vector Space Model, Probabilistic information retrieval models ; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.
Basic Tokenizing, Indexing and Implementation of Vector-Space Retrieval [3L]: Simple tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors.

Module-2: [9L]

Experimental Evaluation of IR [**2L**]: Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.
Query Operations [3L]: Relevance feedback; Query expansion; Query languages.
Text Representation [4L]: Word statistics; Heaps' law; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and markup languages (SGML, HTML, XML).

Module-3:[9L]

Web Search [4L]: Search engines; Spidering; Metacrawlers; directed spidering; Link analysis (e.g. hubs and authorities, Google PageRank); shopping agents.
Text Categorization [5L]: Categorization algorithms: Rocchio classification, Nearest neighbor classification, and Naive Bayes classification. Applications to information filtering and organization.

Module-4:[9L]

Language-Model Based Retrieval [1L]: Language models, the query likelihood model, Language modeling versus other approaches in IR. Extended language modeling approaches.

Text Clustering [**4L**]: Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to web search and information organization.

Recommender Systems[2L]: Collaborative filtering and content-based recommendation of documents and products.

Information Extraction and Integration[2L]: Extracting data from text; semantic web; collecting and integrating specialized information on the web.

Course Outcomes

1. Students should be able to demonstrate basic knowledge of information retrieval and relates models.
2. Students should be able to write programs to implement the related IR algorithms when necessary.
3. Students will get an exposure to the present state-of-the-art algorithms and methods in the area of information retrieval. Therefore, it will act as a primer for students, who want to pursue research in IR in future.

TEXT BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press.
2. Baeza-Yates and Ribeiro-Neto, "Modern Information Retrieval", Pearson Education.
3. Bruce Croft, Donald Metzler, Trevor Strohman, "Search Engines: Information Retrieval in Practice", Pearson Education.
4. Soumen Chakrabarti,"Mining the Web: Discovering Knowledge from Hypertext Data", Morgan Kaufmann.
5. David A Grossman and Ophir Frieder, "Information Retrieval: Algorithms and Heuristics", 2nd Edition, Springer International Edition, 2004.

Course Name: ADVANCED OPERATING SYSTEMS					
Paper Code: CSEN 4142 [39L]					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module I [Total: 9]

Introduction: [4]

Architecture of distributed OS, Global Knowledge, Naming, Scalability, Compatibility, Process Synchronization, Resource Management, Security, Communication Networks, Communication Primitives, The Message Passing model, Remote Procedure Call.

System Operating Structures: [3]

Review of structures: monolithic kernel, layered systems, virtual machines. Process based models and client server architecture; The micro-kernel based client-server approach.

Communication [2]

Inter-process communication, Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Module II [Total: 8]

Theoretical Foundation of Distributed Operating Systems: [3]

Inherent Limitations of a distributed system, Lamport's Logical Clock, Casual Ordering of Messages, Chandy-Lamport's Global State Recoding System.

Distributed Mutual Exclusion: [5]

Classification of distributed mutual exclusion algorithm. NonToken based Algorithm: Lamport's, Ricart-Agrawala, and Mackawa algorithms. Token based Algorithm: Suzuki-Kasami's broadcast algorithm.

Module III [Total: 10]

Distributed Deadlock Detection: [6]

The system model, Resource vs Communication Deadlocks, Wait-for Graphs, Deadlock Handling Strategies in Distributed systems, Issues in Deadlock detection & Resolution, Control organizations for distributed deadlocks, Ho-Ramamoorthy's Centralized deadlock detection algorithm, Distributed deadlock detection algorithms, Obermark's, Chandy-Sinha-Natarajan, Chandy-Misra-Haas algorithms.

Protection and Security: [4]

Requirements for protection and security regimes. The access matrix model of protection. System and user modes, rings of protection, access lists, capabilities. User authentication, passwords and signatures. Use of single key and public key encryption.

Module IV [Total: 12]

Distributed File System: [4]

Architecture, Mounting, Caching, Naming and Name Resolution, Name Server, Cache Consistency, SUN Network File System, Stateful and Stateless Server, the SPRITE File System, the X-Kernel Logical File System.

Multiprocessor Operating Systems: [5]

Difference between Multiprocessing and Distributed environments, Tightly coupled vs Loosely Coupled systems, UMA, NUMA, NORMA architectures, Interconnection networks for multiprocessor systems, BUS, Crossbar Switch, Multistage, Hypercube architectures, the separate supervisor, master slave, symmetric configuration, Threads, User-level and Kernel Level threads, Case Studies (MACH OS, MACH Kernel).

Real Time Operating System: [3]

Definition, types of RTOS, A reference model of Real Time System, Commonly used approaches to Real Time Scheduling.

References:

1. Tanenbaum, A. S. Distributed Operating Systems, (ISBN 0-131-439-340), Prentice Hall 1995.
2. Tanenbaum, A. S. Modern Operating Systems, 2nd Edition (ISBN 0-13-031358-0), Prentice Hall 2001.

3. Bacon, J., Concurrent Systems, 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
4. Silberschatz, A., Galvin, P. and Gagne, G., Applied Operating Systems Concepts, 1st Edition, (ISBN 0-471-36508-4), Wiley 2000.
5. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, (ISBN 0-201-61918-0), Addison Wesley 2001.
6. Galli, D.L., Distributed Operating Systems: Concepts and Practice (ISBN 0-13-079843-6), Prentice-Hall 2000.
7. Operating Systems Concepts & design - Milan Milenkovic, TMH
8. Operating System - H.M. Deitel, Pearsons .
9. Advanced Concepts in operating Systems - Mukesh Singhal and Niranjan G. Shivaratri, TMH
10. Real-Time Systems-Jane W. S. Liu, Pearson Education

Course Outcome:

By the end of the course students should be able to:
1. Describe operating system structures and communication protocols.
2. Illustrate the concept of distributed operating system (DOS), contrast and compare different distributed mutual exclusion algorithms.
3. Understand and analyze theory and implementation of distributed deadlocks with algorithms.
4. Become familiar with DOS protection and security.
5. Understand the high-level structure distributed file systems.
6. Acquire a detailed understanding of multiprocessor operating systems. Gather a detail overview of real time operating system.

Course Name: Computational Geometry					
Course Code : CSEN4143					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcome:
At the end of this course, students should be able to:
1. Know the common algorithms for solving well-known geometric algorithms
2. Identify a geometric problem or rather identify where an algorithm for an existing geometric problem can be useful to solve the problem at hand.
3. develop new algorithms for simple geometric problems.
4. implement geometric algorithms.

Module-I:
Preliminaries[5L]
Basic Euclidean geometry, Basic Visibility Problems , Polygons and Art Gallery Theorem, The Maximal Points Problem ,

The Plane Sweep Technique and applications - Segment Intersection Problem and Rectangular Union, Intersections amongst orthogonal segments, Bentley-Ottman algorithm, red-blue segment intersections

Convex Hull: Different Paradigms [4L]

Gift wrapping, Quickhull, Graham scan, Jarvis' March, Chan's Algorithm, Incremental algorithm, Preparata-Hong algorithm

Module-II:

Point Location and Triangulation [5L]

Planar Point Location, Triangulation of Arbitrary Polygon, Kirkpatrick's method, trapezoidal decompositions and analysis, history DAGs

Voronoi Diagram and Delaunay Triangulation [4L]

Closest Pairs. Bichromatic Closest Pairs**,** Fortune's sweep Algorithm, Delaunay triangulations

Module-III:

Range Searching [7L]

Introduction, Orthogonal Range searching, Priority Search Trees (kd-trees, range trees, segment trees), Non - Orthogonal Range Searching, Half - Plane Range Query, Adding range restrictions. Colored
Range Searching.

Module-IV:

Arrangements and Duality [4L]

Point/line duality, incremental construction of arrangements and the zone-theorem, applications.

Geometric Approximation [3L]

Dudley's theorem and applications, well-separated pair decompositions and geometric spanners, VC dimension, epsilon-nets and epsilon-approximations

Textbooks:

1. **Computational Geometry: Algorithms and Applications** (2nd Edition), M. de Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, Springer-Verlag, 2000.
2. **Computational Geometry**, F. Preparata and M. Shamos, Springer-Verlag, 1985

References:

1. **Computational Geometry: An Introduction Trough Randomized Algorithms,** K. Mulmuley, , Prentice-Hall, 1994
2. **Discrete and Computational Geometry,** S. L. Devadoss and J. O'Rourke, 2011
3. **Computational Geometry Lecture Notes,** David M. Mount, Department of Computer Science, University of Maryland, Fall 2002

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: DATA MINING & KNOWLEDGE DISCOVERY					
Paper Code: CSEN4144					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module I. Introduction and Rule-based Classification [9L]

What is Data Mining? Why do we need data mining? Differences between Data Mining and Machine Learning. Motivating challenges in Data Mining. **(2L)**

Decision Tree (5L): General approach for solving a classification problem. Decision Tree Induction – How a decision tree works, how to build a decision tree, expressing attribute test conditions, measures for selecting best split, algorithm for decision tree induction. Model overfitting – Pre-pruning, post-pruning.

Rule-based Classification (2L):

How a rule-based classifier works, rule-ordering schemes, how to build a rule-based classifier, direct and indirect methods for rule extraction.

Module II. Advanced Classification Techniques [9L]

Bayesian Classifier (3L): Bayes theorem – using it for classification, Naïve Bayes classifier, Bayes error rate.

Support Vector Machines (SVM) (6L):

Maximum margin hyperplanes, Linear SVM: separable case, non-separable case, Non-linear SVM.

Module III. Ensemble Methods, Association Rule Mining [9L]

Ensemble Methods (3L): Bagging, Boosting, Random Forests

Association Rule Mining (6L):

Problem definition, Frequent itemset generation (Apriori principle, candidate generation and pruning), Rule generation, Compact representation of frequent itemsets, FP-growth algorithm, Sub-graph mining.

Module IV. Cluster Analysis [9L]

What is clustering analysis? Motivations, objectives and applications of clustering. Different types of clustering. (1L)

Partitional Clustering (2L): K-means, Bisecting K-means, PAM.

Hierarchical Clustering (3L): Agglomerative, Divisive, MIN, MAX, dendrogram representation.

Density-based Clustering (2L): DBSCAN.

Cluster evaluation, further reading – OPTICS, DENCLUE, CHAMELEON, BIRCH, CURE, ROCK **(1L).**

Text Books :

1. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach and Vipin Kumar. Pearson Publishers.
2. Machine Learning by Tom Mitchell.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Reference

1. Data Mining: Concepts and Techniques by Jiawei Han and Micheline Kamber. Publisher: Elsevier.

Course Outcomes:

1. Students should be able to demonstrate basic knowledge of data mining and related models.
2. Students should be able to write programs to implement the related data mining algorithms when necessary.
3. Students will get an exposure to the present state-of-the-art algorithms and methods in the area of data mining. This expertise will help them in pursuing research in areas related to data mining.

Subject Name: CLOUD COMPUTING					
Paper Code: CSEN 4145					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Educational Objectives:

The main objective of the course is to focus on learning emerging issues related to cloud computing.

1. To gain familiarity with basic concepts related to cloud computing models – NIST, Cloud Cube
2. To understand the architecture and concepts of cloud service models – IaaS, PaaS, SaaS
3. To become familiar with application development and deployment cloud platforms – from Amazon [e.g., Elastic Compute Cloud (EC2), Amazon Web Services (AWS)], from Google [e.g., Google App Engine (GAE), Google Web Toolkit (GWT)]
4. To learn basic features of distributed file systems such as Hadoop Distributed File System (HDFS) and Google File System (GFS)
5. To gain exposure to the underlying principles of cloud virtualization, cloud storage, cloud security

Course Outcomes:

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

1. Appreciate the benefits and limitations of cloud based computing environments
2. Understand the underlying principles of cloud virtualization, cloud storage, cloud security
3. Analyze the suitability and/or applicability of various cloud computing models, platforms, services, solution offerings and tools from some industry leaders
4. Gain insight into various distributed computing issues (like performance, scalability, availability, reliability) in light of distributed file systems (such as HDFS, GFS)
5. Identify security and privacy issues in cloud computing

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Detailed Syllabus:

1) Module-1: Basics of Cloud Computing: [06L]
   i) Defining a Cloud
   ii) Cloud Types – NIST Cloud Reference Model, Cloud Cube Model
   iii) Deployment Models – Public, Private, Hybrid, and Community Clouds
   iv) Service Models – Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
   v) Characteristics of Cloud Computing
   vi) Benefits and Limitations of Cloud Computing

2) Module-2: Cloud Services and/or Applications: [10L]
   i) IaaS – Basic Concept and Characteristics, Virtual Machine Instances / Images, examples of IaaS solutions
   ii) PaaS – Basic Concept and Characteristics, Tools and Development Environment with examples
   iii) SaaS – Basic Concept and Characteristics, Open SaaS and SOA, examples of SaaS solutions
   iv) Identity as a Service (IDaaS)

3) Module-3: Cloud Solution Offerings: [11L]
   a) Concepts of Abstraction and Virtualization: [03L]
      i) Virtualization: Taxonomy of Virtualization Techniques
      ii) Hypervisors: Machine Reference Model for Virtualization
   b) Solution Offerings from Industry Leaders: [08L]
      i) Amazon: some AWS Components and Services – Compute (EC2), Storage [Simple Storage Service (S3), Elastic Block Store (EBS), Simple Queue Service (SQS)], Database (Relational, NoSQL, SimpleDB), Content Distribution (CloudFront), Deployment (Elastic Beanstalk)
      ii) Google: quick look at Google Applications Portfolio – AdWords, Analytics, overview of GWT, a few Google APIs, some key services of GAE

4) Module-4: Cloud Storage and Security: [09L]
   a) Cloud-based Storage: [06L]
      i) Block Devices and File Devices
      ii) Managed Storage and Unmanaged Storage
      iii) File Systems – GFS and HDFS
   b) Cloud Security: [03L]
      i) Security Concerns, Security Boundary, Security Service Boundary
      ii) Security Mapping Overview
      iii) Data Security – Storage Access, Storage Location, Tenancy, Encryption, Auditing, Compliance
      iv) Identity Management (awareness of Identity Protocol Standards)

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2012
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud Computing: Theory and Practice by Dan Marinescu, Morgan Kaufmann, 2014
4. Cloud Computing: A Hands-on Approach by A Bahga and V Madisetti, 2014
5. Cloud Computing: A Practical Approach for Learning and Implementation by A Srinivasan and J Suresh, Pearson, 2014
6. Cloud Computing by U S Pande and Kavita Choudhary, S Chand, 2014
7. Cloud Computing for Dummies by J Hurwitz, M Kaufman, F Halper, R Bloor, John Wiley & Sons, 2014
8. Cloud Computing by Kris Jamsa, Jones & Bartlett Learning, 2015

Papers:

1. The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology by Peter Mell and Timothy Grance, National Institute of Standards and Technology Special Publication 800-145, ©2011
2. Introduction to Cloud Computing Architecture: White Paper (1st Edition) by Sun Microsystems Inc., ©2009
3. A Survey on Open-source Cloud Computing Solutions by Patrícia Takako Endo, Glauco Estácio Gonçalves, Judith Kelner, Djamel Sadok, VIII Workshop on Clouds, Grids and Applications at UFPE, Brazil
4. GFS: Evolution on Fast-Forward – Kirk McKusick (BSD/BFFs) interviews Sean Quinlan (former GFS Tech Leader), CACM, ©2009-2010
5. The Google File System (GFS) by Sanjay Ghemawat, Howard Gobioff, Shun-Tak Leung, ©2011
6. The Hadoop Distributed File System: Architecture and Design by Dhruba Borthakur, Apache Software Foundation, ©2007.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

OPTIONS FOR ELECTIVE III

CSEN 4161 Natural Language Processing
CSEN 4162 Cryptography and Network Security
CSEN 4163 Graph Algorithms
CSEN 4164 Parallel Algorithms
CSEN 4182 Web Intelligence and Big Data

Subject Name: Natural Language Processing					
Paper Code: CSEN 4161					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcome:

1. Understanding the models, methods, and algorithms of statistical Natural Language Processing (NLP) for common NLP tasks and in future do speech recognition, machine translation, spam filtering, text classification, and spell checking.
2. Students can understand the probabilistic models, estimate parameters for such models.
3. The student may apply core computer science concepts and algorithms, such as dynamic programming.
4. The student can gain understanding of linguistic phenomena and will explore the linguistic features relevant to each NLP task.
5. The student can see opportunities for research await and prepare to conduct research in NLP or related fields.

Module I:

Introduction to NLP [2L]:

Natural language processing: issues and strategies. Tools for NLP, Linguistic organization of NLP. NLP as an Application domain. 2L

Word Classes [7L]:

Regular Expressions: Chomsky hierarchy, CFG and different parsing techniques 2L

Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules 2L

Introduction to probability theory: The backbone of modern NLP, Joint and conditional probability, marginal, independence. Probabilistic Language modeling and it's Applications. 3L

Module II:

Language Modeling and Naïve Bayes [4L]:

Markov models, N- grams. Estimating the probability of a word and smoothing. Counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing),4L

Part Of Speech Tagging and Hidden Markov Models [7L]: Part of Speech tagging, The Penn Treebank and Brown Corpus. Noun –phrase segmentation and information extraction models that combine maximum entropy and finite –state machines. HMM tagger, rule based and stochastic POST, Viterbi algorithm for finding most likely HMM Path. HMM tagging, transformation based tagging. 4L

Probabilistic Context Free Grammars: Weighted context free grammars .Weighted CYK. Pruning and beam search. 3L

Module III:

Semantics [9 L]:

Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, 2L

Semantic Analysis: Syntax driven, attachment & integration, robustness 2L

Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words, metaphor and metonymy and their computational Approaches 3L

Word Sense Disambiguation: Selectional restriction based, machine learning based and dictionary based approaches. 2L

Module IV:

Pragmatics [10L]:

Information Theory: Entropy, Cross-entropy, information gain. 2L

Discourse: Reference resolution and phenomena, syntactic and semantic constraints. Pronoun resolution algorithm, text coherence, and discourse structure 4L

Dialogues: Turns and utterances, grounding, dialogue acts and structures 1L

Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations). 3L

Text Book:

1. D. Jurafsky & J. H. Martin – "Speech and Language Processing – An introduction to Language processing,
2. Computational Linguistics, and Speech Recognition", Pearson Education

Reference Books:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.
3. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
4. Manning, Christopher and Heinrich Schutze. 1999. "Foundations of Statistical Natural Language Processing". MIT Press.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Cryptography and Network Security					
Paper Code: CSEN 4162					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Expected Course Outcome:-

CO1: To discuss on various types of attacks and their characteristics.

CO2: To illustrate the basic concept of encryption and decryption for secure data transmission.

CO3: To Analyze and compare various cryptography techniques.

CO4: To explain the concept of digital signature and its applications.

CO5: To be familiar with network security designs using available secure solutions (such as PGP, SSL, IPSec, etc)

Module 1. Introduction and Number Theory

Introduction- Need for Security, Security approaches, Principles of Security, Types of attack, Plain text & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size. [4L]

Brief introduction to number theory, Euclidean algorithm, Euler's totient function, Fermat's theorem and Euler's generalization, Chinese Remainder Theorem, primitive roots and discrete logarithms, Quadratic residues, Legendre and Jacobi symbols. [8L]

Module 2. Symmetric Key and Asymmetric Key Cryptography

Symmetric Key Cryptography- Overview, Block Cipher, DES algorithm, AES algorithm, IDEA algorithm, Blowfish, RC5 algorithm. [8L]

Asymmetric Key Cryptography – Overview, RSA, Key Management – Key Distribution, Diffie-Hellman Key Exchange Algorithm, Elliptic Curve Arithmetic, Elliptic Curve Cryptography [4L]

Module 3. Authentication

Authentication Methods – Message Digest, Kerberos [6L]

Digital Signatures – Algorithms (DSA, ElGamal signature, ECDSA), Digital Signature Standard, Authentication Protocols [6L]

Module 4. Internet Security

Email Security – PGP, MIME, S/MIME. [3L]

IP Sec-Architecture, AH protocol, Encapsulating Security Payload (ESP) Protocol, ISAKMP Protocol, Oakley Key Determination Protocol, VPN [6L]

Web Security-SSL, Firewalls [3L]

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

References

1. Cryptography and Network Security: Principles and Practice, 7/E, William Stallings, Pearson.
2. Cryptography and Network Security, 3rd Edition, Atul Kahate, McGraw Hill Education (India) Private Limited.
3. Cryptography and Information Security, 2nd Edition, V. K. Pachghare, PHI Learning Private Limited.

Course Name : Graph Algorithms					
Course Code: CSEN 4163					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Learning Objective: The main objective of the course is for students to learn some classical theorems and algorithms in this domain. It is expected that students will be able to demonstrate their knowledge of algorithms by solving concrete problems. In addition, students will learn some proofs of the discussed theorems and prove simple facts about graphs and graph algorithms.

Course Outcomes:

Students who complete the course will demonstrate the ability to do the following:

1. Learn the advanced concepts and key features of Graph algorithms.
2. Understand the algorithmic approach to Graph related problems.
3. Explain and analyze the major graph algorithms.
4. Employ graphs to model engineering problems, when appropriate.
5. Defend and argue the application of the specific algorithm to solve a given problem.
6. Synthesize new algorithms that employ graph computations as key components, and analyze them.
7. Hypothesize for a critical problem, where graph is involved as an absolutely necessary component.

Module I: [7L]

Connected components and transportation related graph problems

i) Representation of graphs

ii) Strongly connected components, Tarjan's algorithm for strongly connected components

iii) Eulerian tours, Hamiltonian cycles and Travelling salesman problem.

iv) Exponential-time dynamic programming for the TSP, approximation algorithms and the approximation ratio, MST-doubling heuristic, Christofides' heuristic.

Module II: [9L]

Matching and covering related graph problems

i) Matchings, stable marriage problem, Gale-Shapley algorithm for stable marriage problem.

ii) Bipartite graphs, formulating bipartite maximum matching as a flow problem,
iii) Hopcroft–Karp algorithm. Using matchings to find vertex covers and independent sets.

Module III: [9L]
Graph Coloring, Max cut, Min cut, Clique problems, longest path

i) Graph coloring, greedy coloring, Maximal clique, interval graphs, perfect graphs, chordal graphs.
ii) Maximum Clique-Minimum coloring problem. (in interval graph)
iii) Introduction to planarity of the graph, duality of the planar graph and max cut of the planar graph.
iv) Algorithms for independent set, clique and vertex coloring in chordal graphs
v) Longest path Problem, hardness and heuristic for solution

Module IV: [7L]
Flow networks and random graphs

i) Max flow min cut theorem, max flow algorithms and their applications
ii) Min cost max flow algorithm, their applications
iii) Random graphs and probabilistic methods

Text Books

1. Introduction to Graph Theory, Douglas B. west, Prentice Hall, 2001.
2. Graph Theory and Its Applications Jonathan L. Gross and Jay Yellen
3. Algorithm Design - Jon Kleinberg and Eva Tardos
4. Advanced graph algorithms, T.kloks

Reference Books

1. R. Diestel, "Graph Theory", Springer-Verlag, 2nd edition, 2000
2. Bela Bollobas, Modern Graph Theory, Springer, 1998

Code	Subject	Contact periods / week			Total	Credits
		L	T	P		
CSEN4164	Parallel Algorithms	3	0	0	3	3

Module 1:
Introduction: [10L]

A) Architecture: Parallelism in uniprocessor system, memory-interleaving, pipelining and vector processing, parallel computer structures, architectural classifications; Shared-Memory (SM) SIMD Computers – EREW / CREW / ERCW/ CRCW; Programming MIMD Computers; (4L)

B) System interconnect architectures: Static interconnection networks: array, tree, mesh, hypercube, cube-connected-cycles, butterfly, Cayley graphs; Dynamic

interconnection networks: crossbar, Clos network, multistage interconnection networks, blocking, non-blocking and rearrangeable operations, properties and routing. (3L)

C) Parallel computer models*:* PRAM models, program properties: conditions of parallelism, program partitioning and scheduling, granularity and scalability. (2L)

D) Analyzing Algorithms: Running Time, Speedup, Number of Processors. (1L)

Module 2: Basic Algorithms: [10L]

A) Selection: A sequential algorithm; Desirable Properties for Parallel Algorithms: Number of Processors, Running Time, Cost. An Algorithm for Parallel Selection. (2L)

B) Basic Techniques: Balanced Trees; Divide & Conquer; Partitioning; Pipelining; Cascading; (2L)

C) Merging: A Network for Merging; Merging on the CREW & EREW Model ; Finding the Median of Two Sorted Sequences; (2L)

C) Sorting: Sorting on a Linear Array, Sorting on the CRCW /CREW / EREW model; Sorting by Conflict-Free Merging, Sorting by Selection. (2L)

D) Searching: Searching on a sorted sequence / random sequence / Trees / Mesh. (2L)

Module 3: General Data Structures: [8L]

A) Lists & Trees*:* List ranking; Euler-Tour technique; Tree contraction; (3L)

B) Graphs: Connected components; Minimum Spanning Trees; All pairs shortest paths; (3L)

C) Strings: String Matching; Text Analysis; (2L)

Module 4: [12L]

A) Arithmetic Computation*:* Adding n integers; Multiplying two numbers; Prefix sum; Polynomial Multiplication & Division; (3L)

B) Matrix Operations*:* Transposition; Matrix multiplication; (2L)

C) Decision and Optimization problem: Computing Prefix Sums; Knapsack problem; (2L)

D) Fourier Transforms: Fast Fourier Transform; The DFT computation in parallel; (2L)

E) Networked computers as a multi-computer platform: Basics of message passing, computing using workstation clusters, software tools, Message Passing Interface MPI, CUDA and General Purpose GPU (GPGPU) programming. (3L)

References :

1. S.G.Akl: Design and Analysis of Parallel Algorithms, Prentice Hall.
2. J. Ja Ja: Introduction to Parallel Algorithms, Addison Wesley, 1990.
3. M.G. Quinn: Design of Efficient Algorithms for Parallel Computers, McGraw Hill, 1988.
4. K. Hwang: Computer Arithmetic: Principles, Architecture and Design, John Wiley.
5. Hwang & Briggs: Advanced Computer Architecture and Parallel processing, McGraw Hill.
6. Peter Pacheco: Parallel Programming with MPI
7. Jason Sanders, Edward Kandrot: CUDA by Example: An Introduction to General-Purpose GPU Programming.

8. T. Leighton: Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, Morgan Kauffmann Pub., San Mateo, 1992.

Course Outcomes/Learning Objectives:

1. On completion this course, students are expected to be able to understand the special techniques required for designing and analyzing parallel algorithms
2. Besides this students should be able to understand the process of how a sequential version of an algorithm can be converted to a parallel version and how the performance improvements can be compared with respect to the predicted analysis.
3. Also students will pick up rudimentary skills of some parallel programming techniques and use the same for implementing and testing some of the parallel algorithms learnt in this course.

Subject Name: WEB INTELLIGENCE AND BIG DATA					
Paper Code: CSEN4182					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module 1: Intelligent Information Retrieval

Learning from user interactions. Rating and voting, emailing and link forwarding, bookmarking, purchasing items, reviews.

Extracting intelligence from tags. Tag related metadata. Tag generation. Leveraging tags: dynamic navigation, using tag clouds, targeted search, recommendations based on tags.

Extracting intelligence from content: Blogs, Wikis, Message boards.

Module 2: Clustering, Classification and Recommendations

Clustering and web intelligence. Overview of clustering algorithms.

Classification and Web Intelligence. Need for classification. Overview. Automatic categorization of emails and spam filtering. Classification and fraud detection. Combining classifiers.

Creating Suggestions and Recommendations. Concepts of distance and similarity. Recommendations based on similar users. Recommendations based on similar items. Recommendations based on content.

Module 3: Introduction to Hadoop

Starting Hadoop. Components of Hadoop. HDFS. Working with files in HDFS. Introduction to MapReduce. Streaming in Hadoop. Advanced MapReduce: Chaining MapReduce jobs, Joining data from different sources. Developing MapReduce programs in local mode and pseudo-distributed mode. Moving data into and out of Hadoop. Data input and output in MapReduce. Applying MapReduce patterns to Big Data. Streamlining HDFS for big data.

Module 4: Algorithms Using MapReduce

Matrix-Vector Multiplication by MapReduce. Relational-Algebra Operations. Computing Selections by MapReduce. Computing Projections by MapReduce. Union, Intersection, and Difference by MapReduce. Computing Natural Join by MapReduce. Grouping and Aggregation by MapReduce. Matrix Multiplication.

Graph Algorithms using MapReduce: Shortest Paths, Friends-of-Friends. PageRank computation in MapReduce.

Course Outcome

1. Web Intelligence is a fast-growing area of research that combines multiple disciplines including artificial intelligence, machine learning, data mining, natural language processing.
2. Making the web intelligent is the art of customizing items in response to the needs of the users. Predicting users'behaviors will expedite and enhance browsing experience, which could be achieved through personalization.
3. The first half of this subject will provide the students a platform which will give them an introduction to the subject and will empower them to find the most appropriate and best information for their interest.
4. Hadoop and MapReduce are useful tools to work with Big Data. Hadoop is a free, Java-based programming framework that supports the processing of large data sets in a distributed computing environment. MapReduce is a core component of the Apache Hadoop software framework.
5. The second half of the course gives students an introduction to the use of Hadoop and MapReduce.

Text Books:

1. Algorithms of the Intelligent Web. H. Marmanis and D. Babenko. Manning Publishers, 2009.
2. Collective Intelligence in Action. S. Alag. Manning Publishers, 2009.
3. Hadoop in Action by Chuck Lam. Manning Publishers. 2011.
4. Hadoop in Practice by Alex Holmes. Manning Publishers. 2012.
5. Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeff Ullman. Cambridge University Press. 2011.

Reference Books:

1. Mining the Web: Discovering Knowledge from Hypertext Data.
2. S. Chakrabarti, Morgan-Kaufmann Publishers, 2002.
3. Recommender Systems Handbook: Francesco Ricci, Lior Rokach, Bracha Shapira, Paul B. Kantor, Springer, 2011.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

OPTION FOR FREE ELECTIVE I (Odd Semester)

MATH4181 Operation Research and Optimization techniques
MATH4182 Linear Algebra
ECEN4181 VLSI Design Automation
ECEN 4182 Control Systems
ECEN4183 Principles of Communication systems
BIOT4181 Biosensors
MECH4181 Computational Fluid Dynamics
AEIE 4182 Introduction to Embedded System

Code	Subject	Contact periods / week			Total	Credits
		L	T	P		
MATH4181	**Operations Research and Optimization Techniques**	**3**	**0**	**0**	**3**	**3**

Module- I **9 L**

Linear Programming Problem (LPP)-I

Formulation of an LPP; Graphical Method of solution of an LPP; Convex Combination and Convex Set; Convex Hull and Convex Polyhedron; Canonical and Standard form of an LPP; Basic Solution of a system of linear equations; Simplex Method; Big-M Method; Concept of Duality; Mathematical formulation of duals; Dual Simplex Method.

Module- II **9 L**

Linear Programming Problem (LPP)-II and Game Theory

Transportation Problems (TP) ; Representation of Transportation Problems as LPP; Methods of finding initial basic feasible solution of TP: North -West Corner Rule, Matrix Minima Method, Vogel's Approximation Method; Optimality test of the basic feasible solution; Assignment Problems; Hungarian Method; Travelling Salesman Problem.
Strategies; The Minimax and Maximin Criterion; Existence of Saddle Point; Games without a Saddle Point; Mixed Strategies; Symmetric Games; Dominance Principle; Two-Person Zero-Sum Game; Graphical Method of Solution; Algebraic Method of Solution.

Module- III **9 L**

Non-Linear Programming Problem (NLPP)-I

Single- variable Optimization; Multivariate Optimization with no constraints: Semidefinite Case, Saddle Point; Multivariate Optimization with Equality Constraints: Method of Lagrange Multipliers; Multivariable Optimization with inequality constraints: Kuhn-Tucker Conditions.

Module- IV **9 L**

Non-Linear Programming Problem (NLPP)-II

Unimodal Function; Elimination Methods: Interval Halving Method, Fibonacci Method,

Golden Section
Method; Interpolation Methods: Quadratic Interpolation Methods; Cubic Interpolation Method, Newton
Method, Quasi- Newton Method, Secant Method.

Suggested Readings:

1. *Linear Programming and Game Theory* by J. G. Chakraborty and P. R. Ghosh, Moulik Library.
2. *Operations Research* byKanti Swarup, P. K. Gupta and Man Mohan, S. Chand and Sons.
3. *Engineering Optimization* by S. S. Rao, New Age Techno Press.
4. *Algorithms for Minimization without Derivative* byR. P. Brent,Prentice Hall.

Code	Subject	Contact periods / week			Total	Credits
		L	T	P		
MATH4182	**Linear Algebra**	**3**	**0**	**0**	**3**	**3**

Course Objective:

Here are some of the objectives for studying the course:

1. Eigenvalues and eigenvectors , Diagonalizing A, computing powers Ak and Matrix Exponentials
2. Symmetric matrices and positive definite matrices
3. Generalized Inverses
4. Basis and dimension, Linear independence and Spanning Sets
5. Least squares solutions : closest line by understanding projections
6. Orthogonalization by Gram-Schmidt (factorization into A = QR)
7. Singular Value Decomposition
8. Vector spaces and subspaces
9. Linear transformations and change of basis

Prerequisites

Good understanding of Matrix Algebra as described in MATH1101

Syllabus

Module I: Characteristic Equations, Eigen Values and Eigen Vectors, Diagonalization, Applications to Differential equations, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition, Generalized Inverses. 9L

Module II: Definition of Field, Vector Spaces, Elementary Properties in Vector Spaces, Subspaces, Linear Sum of Subspaces, Spanning Sets, Linear Dependence and Independence, Basis and Dimension. Application to matrices and system of linear equations. 9L

Module III: Inner Product Spaces, Concept of Norms, Orthogonality, Projections and subspaces, Orthogonal Complementary Subspaces, Orthogonal Projections, Gram-Schmidt Orthogonalization Process, Least square approximations, QR decomposition. 9L

Module IV: Linear Transformations, kernels and images, The Rank-Nullity-Dimension Theorem. Matrix representation of a Linear Transformation, Change of Basis, Linear space of linear mappings. 9L

Suggested Books:

1. Linear Algebra and its Applications: Gilbert Strang (Thomson Brooks/Cole Cengage Learning)
2. Matrix Computations : Gene H. Golub, Charles F. Van Loan (JHU Press)
3. Linear Algebra : Kenneth M. Hoffman, Ray Kunze (Prentice-Hall)
4. Linear Algebra A Geometric Approach: S. Kumaresan (PHI)

Course Name: VLSI Design Automation					
Course Code : ECEN 4181					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	**0**	**0**	**4**	**4**

Module I: VLSI Circuits & Physical Layout: [12L]
Unit1: MOS Transistor Characteristics, MOS as Digital Switch, NMOS Logic Family, CMOS Logic Family, CMOS Inverter Characteristics (VTC), Inverter Delay & Noise, NAND and NOR gates, Complex Logic Circuits, Pass Transistor Logic & Transmission Gate, CMOS Sequential Circuits, CMOS D-Latch and D-Flip-Flop

Unit2: CMOS Cross Section, Layout and Mask layers, Inverter Layout, Lambda Rule vs Micron Rule, Std Cell Layout Topology, Stick Diagram, Euler Path Algorithm, Layout Legging.

Module II: VLSI Design Methodology: [8L]
Unit1: Moore's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), Technology growth and process Node,

Unit2: Full Custom Design, Std Cell based Semi Custom Design, Gate Array Design, PLD, FPGA: CLB, LUT, MUX, VLSI Design Cycle, Y-Chart.

Module III: EDA Tools: High level Synthesis and HDL: [8L]
Unit1: High level Synthesis EDA Flow, Control and Data Flow Graph, Scheduling, Allocation, Binding, RTL

Unit2: Why HDL ? Frontend Design Flow using HDL (Behavioral, RTL and Gate Level), Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed, Test Bench, FSM Example: Mealy Machine and Moore Machine. Pipeline Example.

Module IV: EDA Tools: Logical Synthesis and Physical Design Automation: [12L]
Unit1: Combinational Logic Optimization: BDD: Binary Decision Diagram, OBDD, ROBDD, Technology Mapping: Pattern DAG, Subject DAG, Sequential Logic Optimization

Unit2: Physical Layout Automation EDA Flow, Partitioning: KL Algorithm, Floor-planning cost function, Placement, Detailed Routing: Channel Routing, Horizontal Constraint Graph, Vertical Constraint Graph, Cyclic Constraint, Left-edge Algorithm, Global Routing: Steiner Tree, Maze Routing.

Text Book:

1. Principles of CMOS VLSI Design, A Systems Perspective, Author: Neil Weste, Kamran Eshraghian, Addison Wesley, 2nd Edition, 2000
2. Algorithms for VLSI Physical Design Automation, Author: N. Sherwani, KLUWER ACADEMIC PUBLISHERS (3rd edition)

Reference Book:

1. CMOS Digital Integrated Circuits, Analysis and Design, Author: Sung-Mo Kang, Yusuf Leblebici, Tata McGraw Hill (3rd Edition), 2006
2. CMOS VLSI Design, A Circuits and Systems Perspective (3rd Edition) Author: Neil Weste, David Harris, Ayan Banerjee. Pearson, 2011
3. Digital Integrated Circuit, Design Perspective, Author: .M. Rabaey, Prentice-Hall
4. VLSI Design and EDA TOOLS, Author: Angsuman Sarkar, Swapnadip De, Chandan Kumar Sarkar, SCITECH PUBLICATIONS (India) Pvt. Ltd., 2011
5. Algorithms for VLSI Design Automation, Author: Gerez, Wiley, 2011

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT
Detailed syllabus of 8th semester

Course Name : Organizational Behaviour					
Course Code: HMTS-4201					
Contact hrs per week:	L	T	P	Total	Credit points
	2	0	0	2	2

Module I

Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities (1L)

Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization.(2L)

Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys. (2L)

Module II

Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. (2 L)

Motivation-Definition, Theories of Motivation-Maslow's Hierarchy of Needs Theory,McGregor's TheoryX&Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.(4L)

Module III

Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. (4L)

Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of Group Development, Group Decision making, Group Decision MakingVs Individual Decision Making. (4L)

Module IV

Organizational Design-Various organizational structures and their pros and cons.

Concepts of organizational climate and culture, Organizational Politics-Concept, Factors influencing degree of Politics (2L)

Conflict management- Concept,Sources of conflict, Stages of conflictprocess, Conflict resolution techniques,Tools-Johari Window to analyse and reduce interpersonal conflict, Impact on organization. (3L)

Suggested Readings:

1. Organization Behaviour by Stephen Robbins
2. Organization Behaviour by Luthans
3. Organization Behaviour by L.M. Prasad
4. Organization Behaviour: Text, Cases &Games by AswathappaK.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

OPTIONS FOR ELECTIVE IV

CSEN 4241 Distributed Algorithms
CSEN 4242 Approximation Algorithms
CSEN 4243 Computational Complexity
CSEN4244 Pattern Recognition
CSEN4245 Social Network Analysis
CSEN 4246 Mobile Computing

Course Name : Distributed Algorithms					
Course Code: CSEN 4241					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Course Outcome:

1. The student will **learn the basics** of distributed algorithms, which are designed to run on multiple processors, without tight centralized control
2. The student will understand various kinds of distributed computing environments, including shared-memory and network-based environments
3. The student will be able to **identify** problems solvable in distributed computing environments and will also be able to identify certain tasks which cannot be carried out in certain kinds of distributed settings
4. They will be able to **design** distributed algorithms and **analyze** the correctness, performance, and fault-tolerance of their algorithms. They will also learn to prove lower bounds and other impossibility results in distributed settings.
5. The students learn the **applications** in many practical systems, ranging from large computer networks to multiprocessor shared-memory systems, including problems of communication, data management, resource management, synchronization, and distributed agreement.

Course Details:

Module I: [8L]
Synchronous networks: – Model – Leader election (symmetry-breaking) – Network searching, Broadcast and converge-cast. Shortest paths, spanning trees – Processor failures: Stopping and Byzantine – Fault-tolerant consensus: Algorithms and lower bounds – Other problems: Commit, k-agreement, Approximate agreement. Distributed commit

Module II: [8L]
Asynchronous model – Interaction State Machines (I/O automata), Proving Correctness of Distributed algorithms•. Asynchronous networks, no failures: – Model – Leader election, network searching, spanning trees, revisited. – Synchronizers (used to run

synchronous algorithms in asynchronous networks) – Logical time, replicated state machines. – Stable property detection (termination, deadlock, snapshots).

Module III: [12L]

Asynchronous shared-memory systems, no failures: – Model – Mutual exclusion algorithms and lower bounds – Practical mutual exclusion algorithms – Resource allocation, Dining Philosophers • Asynchronous shared-memory, with failures – Impossibility of consensus – Atomic (linearizable) objects, atomic read/write objects, atomic snapshots – Wait-free computability; wait-free consensus; wait-free vs. f-fault-tolerant objects

Module IV: [12L]

Shared-memory multiprocessor programming – Contention, caching, locality – Reader/writer locks – List algorithms: locking algorithms, optimistic algorithms, lock-free algorithms – Transactional memory Asynchronous networks, with failures – Asynchronous networks vs. asynchronous shared-memory – Impossibility of consensus, revisited – Failure detectors and consensus – Paxos consensus algorithm • Self-stabilizing algorithms • Partially-synchronous systems – Models – Timing-based Mutual exclusion, consensus – Clock synchronization

Text Book:

1. Title: **Distributed Algorithms, (The Morgan Kaufmann Series in Data Management Systems).**
Author: **Nancy A. Lynch**

References:

1. Title: **Introduction to Reliable and Secure Distributed Programming**
Author: Christian Cachin, Rachid Guerraoui, Luís Rodrigues
2. Title: **Distributed Algorithms - An Intuitive Approach**
Author: Wan Fokkink
3. Title: **Introduction to Distributed Algorithms**
Author: Gerard Tel

Course Name : Approximation Algorithms					
Course Code: CSEN 4242					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Learning Objective: The field of approximation algorithms has developed in response to the difficulty in giving exact solutions for many optimization problems. For computationally hard problems, approximation algorithms provide nearly-optimal (approximate) solutions with provable guarantees on the performance of these algorithms. A student doing this course will have an idea about the common existing techniques by which approximation algorithms are designed. Also given such situations

where they have to implement a solution for such or similar problems as a part of a research project or an implementation project in the industry, they should be able to code them up. They should also develop a limited capability of designing an approximation algorithm for a new problem, which is shown to be NP-hard.

Module I: [7L]
Introduction, P vs NP, NP Optimization problems, Approximation Ratio, Additive vs. Multiplicative.
Techniques: Greedy and combinatorial methods, Local search
Module II: [7L]
Techniques: Dynamic programming and approximation schemes,
Module III: [10L]
Linear programming rounding methods (randomized, primal-dual, dual-fitting, iterated rounding), Semi-definite program based rounding
Module IV: [8L]
Metric methods, inapproximability, Hardness of approximation: simple proofs, approximation preserving reductions, some known results
Problems that can be discussed -

- Tour Problem: TSP
- Scheduling
- Connectivity & Network Design: Steiner tree, Steiner forests, Survival network
- Covering Problems: Vertex cover, Set cover.
- Constraint Satisfaction: MaxSAT problem
- Cut Problems: Sparsest cut, Multi cut, Multiway cut

Text Books

1. The Design of Approximation Algorithms, David P. Williamson and David B. Shmoys, Cambridge University Press, 2011

Reference Books

2. Approximation Algorithms by Vijay Vazirani, Springer-Verlag, 2004.

Subject Name: Computational Complexity					
Paper Code: CSEN4243					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcome:

- By the end of the course, a student should have a broad understanding of the various notions in computational complexity theory to classify computational problems.

- One should become familiar with the important complexity classes, how they are related to each other, typical problems in those classes, and some of the fundamental open problems in the field.
- The ability to follow the proofs and to develop a concept of the techniques used in analysis about computational complexity should be improved.
- The course will also briefly introduce applications of complexity theory to different domains.

Module-I (9 Lectures)
Computational Models; Problems, Computability, Algorithms, and Complexity; Introduction to P and NP; Turing machines (time and space bounds, non-determinism); Turing machines Logic (Boolean logic, circuits).

Module-II (9 Lectures)
P, NP, coNP, and NP-Completeness; P vs. NP, NP vs. coNP; NP-completeness of SAT and other problems; Complexity classes (hierarchy theorem, P, NP, Co-NP); Reduction and completeness; Interactive proof systems; Polynomial hierarchy.

Module-III (7 Lectures)
Randomized computation: Basic concept, Definitions and relation among the randomized classes RP, coRP, PP, BPP; Relation of BPP to the polynomial hierarchy and non-uniform computation; Approximability.

Module-IV (7 Lectures)
Nondeterministic Space Classes: Logarithmic space; Polynomial space, Savitch's Theorem; Exponential time and space. A PSPACE complete problem- quantified Boolean formula problem (QBF). Derandomization; Pseudorandom constructions: expanders and extractors. Proofs of PCP theorems and the Fourier transform technique.

Text Books:

1. Michael Garey and David S. Johnson: *Computers and Intractability: A Guide to the Theory of NP-Completeness.* New York: W. H. Freeman & Co., 1979.
2. Christos H. Papadimitriou: *Computational Complexity*, Addison-Wesley Longman.

Reference Books:

1. Sanjeev Arora and Boaz Barak: *Computational Complexity: A Modern Approach*. Cambridge University Press, 2009.
2. Michael Sipser: *Introduction to the Theory of Computation*, PWS Publishing.
3. John E. Hopcroft and Jeffrey D. Ullman, *Introduction to Automata, Languages and Computation*, Addison-Wesley, 1979.
4. J. Balcazar, J. Diaz, and J. Gabarro, Structural Complexity, Volumes I and II, Springer.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Pattern Recognition					
Paper Code: CSEN4244					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

Students will be able to:

1. Understand the feature, pattern and the problem of pattern recognition.
2. Describe and explain the difference between supervised and unsupervised learning.
3. Describe and explain pattern recognition algorithm that utilizes supervised learning.
4. Describe and explain pattern recognition algorithm that utilizes unsupervised learning.
5. Design simple pattern recognition systems.

Module – I: Introduction – Definitions, Representations of Patterns and Classes, overview of different approaches, Metric and non-metric measures. Feature selection criteria and algorithms; Minimum distance classifiers, k-NN rule, Discriminant functions (linear and non-linear), parametric and nonparametric learning. (9L)

Module – II: Decision Trees, Bayesian classification, Decision Boundaries, training and test sets, Neural network models for pattern recognition - Perceptron, Multi-layer Perceptron, some applications. (9L)

Module – III: Clustering techniques – Unsupervised learning, basic hierarchical and non-hierarchical clustering algorithms, c-means, fuzzy c-means, DBSCAN, Concepts of hierarchical clustering, Clustering Large datasets. (10L)

Module – IV: dimensionality reduction, principal components analysis, some applications, Some advanced topics with applications, (e.g., neuro-fuzzy approach, genetic algorithms, data mining). (10L)

REFERENCES

1. Devi V.S.; Murty, M.N., Pattern Recognition: An Introduction, Universities Press, Hyderabad, 2011.
2. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
3. 2. J. T. Tou and R. C. Gonzalez: Pattern Recognition Principles, Addison-Wesley, London, 1974.
4. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

5. K. Fukunaga: Introduction to Statistical Pattern Recognition, 2nd eel, Academic Press, New York, 1990.
6. A. K. Jain and R. C. Dubes: Algorithms for Clustering Data, Prentice Hall, Englewood Cliffs, 1988.
7. Neural Networks and Learning Machines, Simon Haykin, Third Edition, PHI Learning, 2009.

Subject Name: SOCIAL NETWORK ANALYSIS					
Paper Code: CSEN4245					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes

1. Students should be able to demonstrate basic knowledge of social networks and related application-oriented models.
2. Students should be able to write programs to implement the related social network analysis algorithms when necessary.
3. Students will get an exposure to the present state-of-the-art algorithms and methods in the area of social networks. This expertise will help them in pursuing research in areas related to social networks.

Module I. Introduction [9L]

Motivating challenges in analysing social networks. **(1L)**

Measures and Metrics (4L):

Degree centrality, Eigenvector centrality, Katz centrality, PageRank, hubs and authorities (HITS), closeness centrality, betweenness centrality, groups of vertices, transitivity, reciprocity, signed edges and structural balance, similarity, homophily and assortative mixing

Large Scale Structure of Networks (4L):

Components, shortest paths and the small world effect, degree distributions, power laws and scale-free networks, distributions of centrality measures, clustering coefficients

Module II. Random Networks [9L]

Understanding mean number of edges, mean degree, degree distribution, clustering coefficient, giant component, small components, and average path lengths for the following models-

Erdos-Renyi Network (3L)

Small-world networks and Watts-Strogatz model (3L)

Preferential attachment and Barabasi-Albert model (3L)

Module III. Propagation of Information in Netowrks [6L]

Contagion Models (3L):

Models of disease spread – SI, SIS, SIR, SIRS and related literature. Outbreak detection.

Influence Maximization (3L):
Influence spread models - independent cascade model, linear threshold model. Maximizing propagation of influence under different setups – greedy approximation algorithm by Kempe et. al. and related literature.

Module IV. Community Detection [12L]
What is a community? Notion of disjoint and overlapping communities. Goodness measures – modularity. Benchmarks and comparing with the benchmarks (F-measure, NMI, Omega index) **(2L)**
Strength of weak ties and related models. **(1L)**
Clique Percolation model **(1L)**
Modularity maximization, Clauset-Newman-Moore (CNM) method, Louvain Method **(3L)**
Label propagation algorithm and its variants **(2L)**
Random walks, Entropy-based method: Infomap **(2L)**
Community preserving sparsification of social networks **(1L)**

Text Books :
1. Networks: An Introduction by Mark Newman. Oxford University Press.

Reference Books :
1. Networks, Crowds and Markets: Reasoning About a Highly Connected World by David Easley and Jon Kleinberg.

Subject Name: Mobile Computing					
Paper Code: CSEN4246					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Expected Course Outcome:-

CO1: To be able to understand the difference between Mobile computing and Wireless Networking
CO2: To be able to learn about the wireless networks fundamentals
CO3: To be able to know about the evolution of Wireless Networks
CO4: To be accustomed with the modifications necessary in normal IP and TCP protocols to be made suitable for wireless networks
CO5: To have an overview of MANET, LAN, WAN and PAN
CO6: To learn the basic concepts of WAP and WLL
CO7: To learn the basics of Android Operating System
CO8: To be able to develop Android based Applications

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Module 1: Introduction to Mobile Communication

Introduction to mobile wireless communication and systems, Description of cellular system. [2L]
Channel interferences. Channel assignment schemes. [2L]

Concept of 1G. Multiple Access Technologies in cellular communication: Time division multiple access (TDMA), Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA). Second generation (2G) Network: Global system for mobile communication (GSM). [2L]

2.5G Wireless Networks-GPRS, CDMA (IS 95), Third Generation 3G Wireless Networks-UMTS, Fourth Generation 4G Wireless Networks-LTE Advanced, Fifth Generation 5G Wireless Networks: Cognitive Radio and Internet of Things. [6L]

Module 2: Mobile Network and Transport Layer

Wireless LAN – IEEE 802.11 [2L]
PAN-Bluetooth- Piconet, Scatternet, Connection Establishment, Protocol Stack [2L]
Recap of Mobile IP, MIPv6 [2L]
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, ATCP, Transmission / Timeout Freezing Selective Retransmission, Transaction oriented TCP. [4L]

Module 3: Advanced Issues in Mobile Network

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, routing and various routing algorithms- DSR, WRP,DSDV, AODV,ZRP. Multicast Routing Algorithms: MAODV,ODMRP. [6L]

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). [2L]
Cognitive Radio Network, Wireless Sensor Network. [4L]

Module 4: Basics of Android Programming

Android Overview-Environment Setup, Architecture, Application Components, Activities and Services, Content Providers, Fragments, Intents and Filters. [6L]
UI Design and Event Handling-Drag and Drop, Notifications, Location Based Services, Sending Email, Sending SMS, Phone Calls. [6L]

Text Books:

1. Wireless Networks: Applications and Protocols, T.S. Rappaport, Pearson Education
2. Wireless Communications, A. Goldsmith, Cambridge University Press.
3. Wireless Communication: Stallings, Pearson.
4. https://www.tutorialspoint.com/android/
4a. https://developer.android.com/training/basics/firstapp/starting-activity.html
5. Cryptography and Network Security: Atul Kahate.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

OPTIONS FOR ELECTIVE V

CSEN 4261 Distributed Databases
CSEN 4262 Image Processing
CSEN 4263 Soft Computing
CSEN 4264 Machine Learning
CSEN4265 Real Time & Embedded System

Subject Name: Distributed Databases					
Paper Code: CSEN 4261					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	

Course Educational Objectives:

The main objective of the course is to expose the students to database creation and maintenance in distributed environment.

1. To understand how data is collected and distributed in a database across multiple physical locations
2. To gain knowledge on creating and maintaining databases in distributed environment
3. To learn to manage distributed data with different levels of transparency
4. To acquire knowledge of handling all types of queries, together with query optimization techniques
5. To become familiar with use of database administration tools in a distributed environment

Course Outcomes:

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

1. Demonstrate knowledge on creating and maintaining databases in distributed environment
2. Gain knowledge on handling all types of distributed queries using query optimization techniques
3. Understand how to use query processing layers in distributed multi-DBMS situations
4. Gain familiarity with managing distributed transactions

Text Books:

1. Stefano Ceri and Giuseppe Pelagatti, "Distributed Databases – Principles and Systems", 1st Edition, Tata McGraw-Hill, Edition, 2008
2. M Tamer Ozsu and Patrick Valduriez, "Principles of Distributed Database Systems", 2nd Edition, Pearson Education

Reference Books:

1. Silberschatz, Korth and Sudarshan: Database System Concepts, TMH
2. Ramakrishnan and Gehrke: Database Management Systems, TMH
3. Elmasri and Navathe: Fundamentals of Database Systems, Pearson.

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Detailed Syllabus:

5) Module-1: Introduction to Distributed Databases: [06L]
   a) Overview of Distributed Databases: [04L]
      i) Features of Distributed versus Centralized Databases
      ii) Why Distributed Databases?
      iii) Distributed Database Management Systems (DDBMSs)
   b) Recapitulation of Databases and Computer Networks: [02L]
      i) Review of Databases
      ii) Review of Computer Networks
6) Module-2: Principles of Distributed Databases: [12L]
   a) Levels of Distribution Transparency: [06L]
      i) Reference Architecture for Distributed Databases
      ii) Types of Data Fragmentation
      iii) Distribution Transparency for Read-only Applications
      iv) Distribution Transparency for Read-write Applications
      v) Integrity Constraints in Distributed Databases
   b) Design of Distributed Database: [06L]
      i) A Framework for Distributed Database Design
      ii) Design of Database Fragmentation
      iii) Allocation of Fragments
7) Module-3: Processing of Distributed Queries: [10L]
   a) Translation of Global Queries to Fragment Queries: [06L]
      i) Equivalence Transformations for Queries
      ii) Transforming Global Queries into Fragment Queries
      iii) Distributed Grouping and Aggregate Function Evaluation
      iv) Parametric Queries
   b) Optimization of Access Strategies: [04L]
      i) A Framework for Query Optimization
      ii) Join Queries
      iii) General Queries
8) Module-4: Management / Administration of Distributed Transactions: [08L]
   a) Management of Distributed Transactions: [05L]
      i) A Framework for Transaction Management
      ii) Supporting Atomicity of Distributed Transactions
      iii) Concurrency Control for Distributed Transactions
      iv) Architectural Aspects of Distributed Transactions
   b) Administration of Distributed Database: [03L]
      i) Catalog Management in Distributed Databases
      ii) Authorization and Protection

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Subject Name: Image Processing					
Paper Code: CSEN 4262					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

COURSE OBJECTIVES:

Major Learning Objectives are:

1. describe and explain basic principles of digital image processing;
2. design and implement algorithms that perform basic image processing (e.g., noise removal and image enhancement);
3. design and implement algorithms for advanced image analysis (e.g., image compression, image segmentation);
4. Assess the performance of image processing algorithms and systems.

COURSE OUTCOMES:

Students who complete this course will be able to:

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation, restoration etc.
5. Implement image process and analysis algorithms.
6. Apply image processing algorithms in practical applications.

Module I: Introduction [2L] :

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [2L]:

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries [6L]:

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.

Module II: Image Enhancement [6L]:

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.

Digital Image Transforms [4L]:
Basis for transformation, Introduction to Fourier Transform, DFT, FFT, Properties of Fourier Transform, DCT, Walsh Transform, Hadamard Transform, Haar Transform.

Module III: Image Restoration [6L]:
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.
Image Compression [4L]:
Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Huffman Coding, Arithmetic Coding,LZW coding, Transform Coding, Sub-image size selection, Run length coding, Bit-plane encoding, Bit-allocation, JPEG,Lossless predictive coding, Lossy predictive coding,

Module IV: Morphological Image Processing[4L]:
Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Reconstruction by dilation and erosion.
Image Segmentation [7L] :
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding – Iterative thresholding, Otsu's method, multivariable thresholding, Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging, Watershed algorithm.

References:
1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis,Chanda & Majumder,PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS- Clarke Keith. C; PE.
7. Concepts & Techniques of GIS - Lo C.P, Albert, Yeung K.W- PHI.

Subject Name: Soft Computing					
Paper Code: CSEN 4263					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome: After going through this course, a student shall be able to -

- Familiarize with soft computing concepts.
- Adopt bio inspired techniques in modeling the real life problems and providing pragmatic solutions.

- Find global optimal solution for complex optimization problems.
- Integrate various soft computing techniques together as and when required.

Module I:

1. Introduction [2 Lectures]

Introduction to Soft Computing, Different tools and Techniques, Usefulness and applications.

2. Fuzzy sets and Fuzzy logic [7 Lectures]

Introduction - Definition, Fuzzy sets versus crisp sets, Fuzzy Membership Functions, Fuzzification & De-Fuzzification, Fuzzy set theoretic operations, Fuzzy Arithmetic, Extension Principle, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Fuzzy rules and fuzzy reasoning, Fuzzy inference systems.

Module II:

Artificial Neural Network [9 Lectures]

Introduction, Supervised & Unsupervised Learning, basic models, Hebb's learning, Perceptron, Multilayer feed forward network, Back propagation algorithm, Competitive learning, Self-Organizing Feature Maps, Introduction to Recurrent and Convolution Neural Networks.

Module III:

1. Evolutionary Algorithms [6 Lectures]

Introduction to Genetic Algorithm (GA), GA operators, Schema theorem and convergence of Genetic Algorithm, Applications, Introduction to real coded GA. Introduction to Genetic Programming, Brief overview of Multi-Objective Genetic Algorithm (MOGA).

2. Stochastic Techniques [3 Lectures]

Simulated annealing and stochastic models, Boltzmann Machine, Probabilistic Neural Network

Module IV:

1. Rough Set [3 Lectures]

Introduction to Rough Sets, Indiscernibility Relations, Reducts & Core, Rough Approximation, Decision Matrices, Applications.

2. Swarm Intelligence Techniques [4 Lectures]

Introduction, Key Principles of Swarm, Overview of - Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Artificial Bee Colony Optimization (ABC) techniques with Applications

3. Hybrid Systems [2 Lectures]

ANN Based Fuzzy Systems, Fuzzy Logic Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Reference Books:

1. Davis E. Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley
2. B. Yegnanarayana, Artificial Neural Networks, PHI
3. S. Rajasekaran and G.A.Vijaylakshmi Pai. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill
5. K. H. Lee. First Course on Fuzzy Theory and Applications, Springer-Verlag.

Subject Name: Machine Learning					
Paper Code: CSEN4264					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module – I: The learning Problem: Example of learning, Components of learning, A simple model, Types of learning; The Linear Model I: Input Representation, Linear Classification, Linear and Logistic Regression, Nonlinear Transformation; (9L)

Module – II: Error and Noise; Training vs Testing: From Training to Testing, Dichotomies, Growth Function, key notion: Break Points; The VC Dimension: The definition, VC Dimension of Perceptrons, Interpreting the VC Dimension, Utility of VC Dimension. Bias-Variance Tradeoff: Bias and Variance, Learning Curves;

Module – III: The linear Model II: Logistic Regression, Nonlinear Transformation, Likelihood measure, Gradient Descent; Neural Networks: Neural Network Model, Backpropagation algorithm; Introduction to Radial Basis Function, Recurrent Neural Network, Convolution Neural Network and Deep Neural Network. (9L)

Module – IV: Support Vector Machines (SVM): The Margin, Maximizing the Margin, The solution, Support Vectors, Nonlinear Transform; Kernel Methods: The Kernel methods, Soft-margin SVM; Overfitting: What is overfitting? Dealing with overfitting ; Regularization: Regularization - informal, Regularization – formal, Weight decay, Choosing a regularizer. (9L)

References:

1. Pattern Recognition and Machine Learning. Christopher Bishop. First Edition, Springer, 2006.
2. Pattern Classification. Richard Duda, Peter Hart and David Stock. Second Edition, Wiley-Interscience, 2000.
3. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill, 1997.
4. Computational Intelligence Principles, Techniques and Applications, Amit Konar, Springer, 2012.
5. Neural Networks and Learning Machines, Simon Haykin, Third Edition, PHI Learning, 2009.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Course Outcome:

On completion of the course the student should be able to:

1. Extract features that can be used for a particular machine learning approach in various IOT applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyze various machine learning approaches and paradigms.

Subject Name: Real Time and Embedded System					
Paper Code: CSEN 4265					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	

COURSE OBJECTIVES

1. To provide a clear understanding on the basic concepts, Building Blocks for Embedded System
2. To introduce on Embedded Process development Environment
3. To be exposed to the basic concepts of real time operating system
4. To familiar with system design techniques and networks for Embedded System

Module I

Introduction to embedded systems: [2L]

Embedded system VS General computing systems, Purpose of Embedded systems Embedded systems overview with various type of examples in different domains such as in communication systems, robotics application and in control application

Complex systems and micro processors [8L]

Design challenge – optimizing design metrics, embedded processor technology, Microprocessor and Microcontroller.

Embedded system design process –Design example: Model train controller- Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption

Module II

Devices and Communication Buses: [8L]

I/O types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols UART RS232/RS85, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth. Different types of I/O devices and interfacing: Keypad, LCD, VGA. Design of Control Unit – hardwired and micro programmed control. Horizontal and Vertical instruction. Introduction to I/O interfaces: Interrupts, Interrupt hardware, Enabling and disabling interrupts, Concepts of handshaking, Polled I/O, Memory mapped I/O, Priorities, Stack and Queues. Vectored interrupts, Direct memory access, DMA controller. Sensors and actuators.

Interfacing with Memory & I/O Devices: [6L]

Different types of embedded memory devices and interfacing: SRAM, DRAM, EEPROM, FLASH, CACHE memory. Different types of I/O devices and interfacing: Keypad, LCD, VGA. Square wave and pulse wave generation, LED, A/D converter and D/A Converter interfacing to 8051.

Module III

Real Time operating Systems [10L]

Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, Definition and types of RTOS,

A reference model of Real Time System- Processors, Resources, Temporal parameters, Periodic Task, Aperiodic Task, Sporadic Task

Commonly used approaches to Real Time Scheduling - Clock driven, event driven , Priority based scheduling- Inter-process communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

Module IV

System Design Techniques and Networks [4L]

Design methodologies- Design flows – Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

Case Study [4L]

Data compressor – Alarm Clock – Audio player – Software modem-Digital still camera – Telephone answering machine-Engine control unit – Video accelerator.

Course Outcome:

Upon completion of the course, students will be able to:

1. Describe the architecture and programming of ARM processor.
2. Outline the concepts of embedded systems
3. Explain the basic concepts of real time Operating system design.
4. Use the system design techniques to develop software for embedded systems Differentiate between the general purpose operating system and the real time operating system
5. Model real-time applications using embedded-system concepts

Text Book/ References:

1. Embedded System Design: A Unified Hardware/Software Approach – 2nd Ed Frank Vahid and Tony Givargis
2. Computers as Components: Principles of Embedded Computing System Design – 2nd Ed Wayne Wolf.
3. Embedded Real Time Systems Programming, Sriram V Iyer, Pankaj Gupta , Tata Mc-Graw Hill, 2004.
4. Embedded Systems Architecture, .Tammy Noergaard,,Elsevier,2006.
5. Real-Time Systems-Jane W. S. Liu, Pearson Education.

COURSE STRUCTURE OF B. TECH IN COMPUTER SCIENCE & ENGINEERING, HIT

Subject Name: Distributed Database Lab					
Paper Code: CSEN 4271					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	2

Course Educational Objectives:

The main objective of the course is to expose the students to database management in distributed environment using Oracle RDBMS environment

1) To use a range of relevant tools and techniques
2) To design and implement some database application modules
3) To tune and/or optimize some database application modules
4) To become familiar with use of database administration tools in a distributed environment

Course Outcomes:

At the end of the course the students will be able to demonstrate knowledge or skills on using a range of tools and techniques for database management in distributed environment using Oracle RDBMS based tools through:

6. Handling various types of distributed queries using query optimization techniques
7. Matching / Mapping of schema
8. Detecting data inconsistencies based on integrity constraints

Books / References:

1. Oracle 9i Database Concepts from Oracle Corporation
2. Oracle 9i Database Administrator's Guide from Oracle Corporation
3. Oracle 9i Database Utilities from Oracle Corporation
4. Oracle 9i Performance Tuning Guide from Oracle Corporation

List of Experiments / Assignments (to be chosen from):

Sl.	**Description**
1.	SQL Refresher: Basic DDL and DML (including use of Run-time Variables, Aggregate / Group Functions, Nested Queries / Sub-queries, Joins as well as use of Constraints, Indexes, Sequences, Synonyms, Triggers, Views) – *to be done mostly as Assignments*
2.	PL/SQL Programming: Blocks, Programs, Cursors, Packages, Procedures – *to be done mostly as Experiments*
3.	Some Enhanced DML Features: Inserting into multiple tables using INSERT ALL | FIRST, MERGE statements, Correlated sub-queries (with CASE, GROUP BY … HAVING, DECODE, NVL) – *to be done mostly as Experiments*
4.	Native and Bulk Dynamic SQL: including EXECUTE IMMEDIATE, BULK FETCH, COLLECT INTO, etc. – *to be done mostly as Experiments*
5.	Vertical Fragmentation and Partitioning (both Horizontal and Vertical): – *to be done mostly as Experiments*

6.	Database Links, Location and Statement Transparency, Remote and Distributed SQL Statements: – *to be done as Case Studies*
7.	Data Corruption Detection / Correction: ANALYZE .., VALIDATE STRUCTURE, DBMS_REPAIR, RMAN, etc. – *to be done mostly as Experiments*
8.	Some DBMS Packages: DBMS_DDL, DBMS_JOB, DBMS_OUTPUT, DBMS_SQL, UTL_FILE, UTL_HTTP, UTL_TCP, etc. – *to be done mostly as Experiments*
9.	Bulk Data Loading: SQL*Loader, Bad and Discard Files, Log Files – *to be done mostly as Experiments*

Subject Name: Image Processing Lab					
Paper Code: CSEN 4272					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	2

1. Display of Grayscale Images.
2. Histogram Equalization.
3. Non-linear Filtering.
4. Edge detection using Operators.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. Display of color images.
8. DWT of images.
9. Segmentation using watershed transform.

Subject Name: Soft Computing Lab					
Paper Code: CSEN 4273					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	2

Course Outcome: After going through this course, a student shall be able to -

1. Solve real life problems using Fuzzy Logics.
2. To design different Artificial Neural Network models for solving real life problems.
3. Represent and solve various real life problems using Genetic Algorithm.

A sample assignment list is given below:

Fuzzy Logic:

1. Write a program to implement different Fuzzy Membership functions.
2. Write a program to implement various Fuzzy set operations
3. Write a program to implement composition of Fuzzy and Crisp Relations.

4. Write Matalab code to implement Fuzzy Information System (develop the system using command line and GUI based Fuzzy toolbox)

Neural network:

5. Write a program to implement McCulloch-Pitts neural network for generate AND, OR functions.
6. Write a program to implement Perceptron (including MLP) learning for particular set of problems.

Genetic Algorithm

7. Write a program for maximizing single and multiple variables functions in a given domain, e.g., $F(x) = (x-2)^2 + \sin(x+3)$, $-31 < x < 31$ using Genetic Algorithm.
8. Use of Genetic Algorithm toolbox in MATLAB for optimization problem solving.
9. Implementation of Simple Genetic Algorithms in C for solving real life problems.

Subject Name: Machine Learning Lab					
Paper Code: CSEN4274					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**2**

1. Linear Regression with single and Multiple Variables
2. Non-linear Regression
3. Classifiers
    1. K-NN
    2. Naïve Bayes Classifier
    3. Perceptron
    4. Multi Layer Perceptron

4. Clustering Algorithms
    1. K-Means
    2. DB-Scan

5. Applications of ANN and SVM using tools
6. Familiarization with a few ML Tools
    1. Excel
    2. WEKA
    3. R
    4. Python
    5. TensorFlow