Heritage Institute of Technology

Anandapur, Kolkata - 700107

Department of Information Technology

B. Tech.

Batch

2020 – 2024

Revised on June, 2023

PART- I

Structures of Syllabus

1st Year

1st Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CHEM1001	Chemistry – I	3	1	0	4	4	Basic Science course
2	MATH1101	Mathematics – I	3	1	0	4	4	Basic Science course
3	ELEC1001	Basic Electrical Engineering	3	1	0	4	4	Engineering Science Course
Total Theory			**9**	**3**	**0**	**12**	**12**	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CHEM1051	Chemistry – I Lab	0	0	3	3	1.5	Basic Science course
2	ELEC1051	Basic Electrical Engineering Lab	0	0	2	2	1	Engineering Science Course
3	MECH1052	Engineering Graphics & Design Lab	1	0	4	5	3	Engineering Science Course
Total Laboratory			**1**	**0**	**9**	**10**	**5.5**	
Total of Semester without Honours			**10**	**3**	**9**	**22**	**17.5**	
1	HMTS1011	Communication for Professionals	3	0	0	3	3	Honours Course
2	HMTS1061	Professional Communication Lab	0	0	2	2	1	Honours Course
Total of Semester with Honours			**13**	**3**	**11**	**27**	**21.5**	

2nd Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	MATH1201	Mathematics – II	3	1	0	4	4	Basic Science course
2	PHYS1001	Physics – I	3	1	0	4	4	Basic Science course
3	CSEN1001	Programming for Problem Solving	3	0	0	3	3	Engineering Science Course
4	HMTS1202	Business English	2	0	0	2	2	Humanities & Social Sciences including Management
Total Theory			**11**	**2**	**0**	**13**	**13**	

Laboratory								Type of Paper
Sl .No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	PHYS1051	Physics – I Lab	0	0	3	3	1.5	Basic Science course
2	CSEN1051	Programming for Problem Solving Lab	0	0	4	4	2	Engineering Science Course
3	MECH1051	Workshop/ Manufacturing Practices Lab	1	0	4	5	3	Engineering Science Course
4	HMTS1252	Language Lab	0	0	2	2	1	Humanities & Social Sciences including Management
Total Laboratory			**1**	**0**	**13**	**14**	**7.5**	
Total of Semester without Honours			**12**	**2**	**13**	**27**	**20.5**	
1	ECEN1011	Basic Electronics	3	0	0	3	3	Honours Course
2	ECEN1061	Basic Electronics Lab	0	0	2	2	1	Honours Course
Total of Semester with Honours			**15**	**2**	**15**	**32**	**24.5**	

2nd Year

3rd Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CSEN2102	Discrete Mathematics	4	0	0	4	4	Engineering Science Course
2	ECEN2101	Analog Circuits	3	0	0	3	3	Engineering Science Course
3	ECEN2002	Digital Systems Design	3	0	0	3	3	Engineering Science Course
4	HMTS2001	Human Values And Professional Ethics	3	0	0	3	3	Humanities & Social Sciences including Management Courses
5	INFO2101	Fundamentals of Data Structure & Algorithms	3	1	0	4	4	Professional Core Courses
6	EVSC2016	Environmental Sciences	2	0	0	2	0	Mandatory Courses
Total Theory			**18**	**1**	**0**	**19**	**17**	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	ECEN2151	Analog Circuits Lab	0	0	2	2	1	Engineering Science Course
2	ECEN2052	Digital Systems Design Lab	0	0	2	2	1	Engineering Science Course
3	INFO2151	Fundamentals of Data Structure & Algorithms Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			**0**	**0**	**7**	**7**	**3.5**	
Total of Semester without Honours			**18**	**1**	**7**	**26**	**20.5**	
1	INFO2111	Information Theory & Coding	4	0	0	4	4	Honours Course
Total of Semester with Honours			**22**	**1**	**7**	**30**	**24.5**	

4th Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	MATH2201	Algebraic Structures	4	0	0	4	4	Basic Science course
2	INFO2201	Formal Language & Automata Theory	3	0	0	3	3	Professional Core Courses
3	INFO2202	Object Oriented Programming	3	0	0	3	3	Professional Core Courses
4	INFO2203	Computer Organization and Architecture	4	0	0	4	4	Professional Core Courses
5	INFO2204	Database Management Systems	4	0	0	4	4	Professional Core Courses
Total Theory			**18**	**0**	**0**	**18**	**18**	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO2252	Object Oriented Programming Lab	0	0	3	3	1.5	Professional Core Courses
2	INFO2253	Computer Organization & Architecture Lab	0	0	3	3	1.5	Professional Core Courses
3	INFO2254	Database Management Systems Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			**0**	**0**	**9**	**9**	**4.5**	
Total of Semester			**18**	**0**	**9**	**27**	**22.5**	

3rd Year

5th Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO3101	Advanced Java & Web Technology	3	0	0	3	3	Professional Core Courses
2	INFO3102	Operating Systems	3	0	0	3	3	Professional Core Courses
3	INFO3103	Design & Analysis of Algorithms	4	0	0	4	4	Professional Core Courses
4	INFO3104	Software Engineering	3	0	0	3	3	Professional Core Courses
5	INFO3131/ INFO3132/ INFO3133	Elective I	3	0	0	3	3	Professional Elective Courses
6	INCO3016	Indian Constitution And Civil Society	2	0	0	2	0	Mandatory Courses
Total Theory			**18**	**0**	**0**	**18**	**16**	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO3151	Advanced Java & Web Technology Lab	0	0	4	4	2	Professional Core Courses
2	INFO3152	Operating Systems Lab	0	0	3	3	1.5	Professional Core Courses
3	INFO3153	Design & Analysis of Algorithms Lab	0	0	4	4	2	Professional Core Courses
4	INFO3154	Software Engineering Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			**0**	**0**	**14**	**14**	**7**	
Total of Semester			**18**	**0**	**14**	**32**	**23**	

Elective I (5th Sem)

1. INFO3131 - Computer Graphics
2. INFO3132 - Distributed Database Management Systems
3. INFO3133 - Compiler Design

6th Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	HMTS3201	Economics For Engineers	3	0	0	3	3	Humanities & Social Sciences including Management Courses
2	INFO3201	Computer Networks	3	0	0	3	3	Professional Core Courses
3	INFO3202	Data Analytics	3	0	0	3	3	Professional Core Courses
4	INFO3231/ INFO3232/ INFO3233/ INFO3234	Elective II	3	0	0	3	3	Professional Elective courses
5	MATH3223/ ELEC3221/ ECEN3222	Open Elective I	3	0	0	3	3	Open Elective courses
Total Theory			**15**	**0**	**0**	**15**	**15**	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO3251	Computer Networks Lab	0	0	3	3	1.5	Professional Core Courses
2	INFO3252	Data Analytics Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			**0**	**0**	**6**	**6**	**3**	

Sessional								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO3293	Term Paper and Seminar	0	0	4	4	2	Seminar
Total Sessional			**0**	**0**	**4**	**4**	**2**	
Total of Semester			**15**	**0**	**10**	**25**	**20**	

Elective II (6th Sem)	**Open Elective I (6th Sem)**
1. INFO3231 – Multimedia Technology & Applications 2. INFO3232 – E-Commerce & ERP 3. INFO3233 – Cryptography & Network Security 4. INFO3234 – Digital Image Processing	1. MATH3222 - Advanced Probability and Information Theory 2. MATH3223 – Scientific Computing 3. ELEC3221 – Fundamentals of Circuit Theory 4.ECEN3222 – Designing with Processors and Controllers

** Open Elective I offered by IT Department is: **Introduction to E-Commerce(INFO3221)**

4th Year

7th Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	HMTS4101	Principles of Management	3	0	0	3	3	Humanities & Social Sciences including Management Courses
2	INFO4131/ INFO4132/ INFO4133/	Elective III	3	0	0	3	3	Professional Elective Courses
3	MATH4121/ AEIE4122/ ELEC4121/ ECEN4121/ ECEN4122/ ECEN4123/ INFO4122/ BIOT4124	Open Elective II	3	0	0	3	3	Open Elective Courses
4	ECEN4126/ ECEN4127/ AEIE4127/ BIOT4126/ MATH4126/ ELEC4126	Open Elective III	3	0	0	3	3	Open Elective Courses
Total Theory			**12**	**0**	**0**	**12**	**12**	

Sessional								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO4191	Industrial Training/ Internship	-	-	-	-	2	Internship in industry or Elsewhere
2	INFO4195	Project I	0	0	8	8	4	Project work, internship in industry or Elsewhere
Total Sessional			**0**	**0**	**8**	**8**	**6**	
Total of Semester			**12**	**0**	**8**	**20**	**18**	

Elective III (7th Sem)	**Open Elective II (7th Sem)**
1. INFO4131 – Introduction toInternet of Things 2. INFO4132 – Mobile Computing 3. INFO4133 – Real Time Systems	1. MATH4121 – Methods in Optimization 2. AEIE4122 - Linear Control Systems and Applications 3. ELEC4121 – Automatic Control System 4. ECEN4121- Software Defined Radio 5. ECEN4122 - Introduction to Machine Learning 6. ECEN4123 - Error Control Coding for Secure Data Transmission 7. INFO4122 - Machine Learning 8. BIOT4124 - Bio Sensor
	Open Elective III (7th Sem) 1. ECEN4126 – Principles of Radar 2. ECEN4127 - Ad Hoc Wireless Networks 3. AEIE4127 – Introduction to Embedded System 4. BIOT4126 - Bioploymer 5. MATH4126 - Advanced Linear Algebra 6. ELEC4126 - Principles of Electrical Machines

** Open Elective II offered by IT Department is: **Fundamentals of Cloud Computing (INFO4121)**

8th Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO4231/ INFO4232/ INFO4233/ INFO4234	Elective IV	3	0	0	3	3	Professional Elective courses
2	INFO4241/ INFO4242/ INFO4243	Elective V	3	0	0	3	3	Professional Elective courses
3	AEIE4222/ ELEC4221/ ECEN4221/ ECEN4222/ ECEN4223/ BIOT4221/ BIOT4222/ BIOT4223/ HMTS4222	Open Elective IV	3	0	0	3	3	Open Elective Courses
Total Theory			**9**	**0**	**0**	**9**	**9**	

Sessional								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	INFO4295	Project II	0	0	16	16	8	Project work, internship in industry or Elsewhere
2	INFO4297	Comprehensive Viva Voce	-	-	-	-	1	
Total Sessional			**0**	**0**	**16**	**16**	**9**	
Total of Semester			**9**	**0**	**16**	**25**	**18**	

Elective IV (8th Sem)	**Open Elective IV (8th Sem)**
1. INFO4231 – Fundamentals of BlockchainTechnology. 2. INFO4232 –Internet Technology 3. INFO4233 –Distributed Computing 4. INFO4234 – Artificial Intelligence	1. AEIE4222 – Medical Instrumentation 2. ELEC4221– Applied Illumination Engineering 3. ECEN4221– Low Power High Performance Digital VLSI Circuit Design 4. ECEN4222 – Cellular and Mobile Communication 5. ECEN4223 – Optical Fiber Communication 6. BIOT4221– Computational Biology 7. BIOT4222– Non-conventional Energy 8. BIOT4223 – Biology for Engineers 9. HMTS4222- Introduction to French Language
Elective V (8th Sem) 1. INFO4241 – Soft Computing 2. INFO4242 – Cloud Computing 3. INFO4243 – Pattern Recognition	

** Open Elective IV offered by IT Department is: **Fundamentals of Cryptography (INFO4221)**

Credit Points Distribution

Sl. No	Category	As per AICTE	**IT**
1	Humanities and Social Sciences including Management courses	12*	**12**
2	Basic Science courses	25*	**23**
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*	**28.5**
4	Professional core courses	48*	**52.5**
5	Professional Elective courses relevant to chosen specialization/branch	18*	**15**
6	Open subjects – Electives from other technical and /or emerging subjects	18*	**12**
7	Project work, seminar and internship in industry or Elsewhere	15*	**17**
8	Honours Course	-	**12**
9	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	**2 non credit subjects**
	Total	160	**172**

*Minor variation is allowed as per need of the respective disciplines.

Honours Credit Chart

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
1.	1st	HMTS1011	Communication for Professionals	3	0	0	3
2.		HMTS1061	Professional Communication Lab	0	0	2	1
3.	2nd	ECEN1011	Basic Electronics	3	0	0	3
4.		ECEN1061	Basic Electronics Lab	0	0	2	1
5.	3rd	INFO2111	Information Theory & Coding	4	0	0	4
	Total						12

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- ✓ A total of 160 credits will be necessary for a student to be eligible to get B Tech degree.
- ✓ A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits. These could be acquired through various Honours Courses offered by the respective departments.
- ✓ A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- ✓ For any additional information, the student may contact the concerned HODs.

Swayam/MOOCs courses recommended to the students of IT Department

Code	Name	Credit Points	Corresponding Online Course	Offered by	PLATFORM
ECEN1011	Basic Electronics	3	Fundamentals of Semiconductor Devices	IISc Bangalore	NPTEL
ECEN 1061	Basic Electronics Lab	1			
HMTS1011	Communication for Professionals	3	Effective Business Communication	IIM Bangalore	Swayam
HMTS1061	Professional Communication Lab	1	Developing Soft Skills and Personality	IIT Kanpur	Swayam
INFO2111	Information Theory & Coding	4	Information Theory	IISC Bangalore	Swayam

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PART- II

Detailed Syllabus

1st Year 1st Semester

Course Name: CHEMISTRY-1					
Course Code: CHEM1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

The subject code CHEM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules.

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

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 analyze microscopic chemistry in terms of atomic and molecular orbitals and inter molecular 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. 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.

Detailed Syllabus:

MODULE – I [10L]

Atomic structure and Wave Mechanics: [3L]

Brief outline of the atomic structure, Duel character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ, concept of atomic orbital.

Thermodynamics: [4L]

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation.

Spectroscopic Techniques & Application: [3L]

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation.
Principle and application of UV- visible and IR spectroscopy, Principles of NMR Spectroscopy and X-ray diffraction technique

MODULE – II [10L]

Chemical Bonding: [5L]

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi-molecular orbitals of ethylene and butadiene.

Periodicity: [3L]

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect.

Ionic Equilibria: [2L]

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation .

MODULE – III [10L]

Conductance: [3L]

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration.

Electrochemical Cell: [4L]

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion. Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells.

Reaction dynamics: [3L]

Rate Laws, Order & Molecularity; zero, first and second order kinetics. Pseudo-unimolecular reaction, Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collison theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

MODULE – IV [10L]

Stereochemistry: [4L]

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

Structure and reactivity of Organic molecule: [3L]

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity.

Organic reactions and synthesis of drug molecule: **[3L]**
Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation-reduction reactions. Synthesis of commonly used drug molecules.

Text Books

1. Atkins' Physical Chemistry, P.W. Atkins (10th Edition).
2. Organic Chemistry, I. L. Finar, Vol-1 (6th Edition).
3. Engineering Chemistry, Jain & Jain,(16th Edition).
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2nd Edition).
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3rd Edition).

Reference Books

1. General & Inorganic Chemistry, R. P. Sarkar.
2. Physical Chemistry, P. C. Rakshit, (7th Edition).
3. Organic Chemistry, Morrison & Boyd, (7th Edition).
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4th Edition).
5. Physical Chemistry, G. W. Castellan, (3rd Edition).
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1st Edition).

Course Name: MATHEMATICS – I					
Course Code: MATH1101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

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

1. Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations
2. Develop the concept of eigen values and eigen vectors
3. Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals
4. Analyze the nature of sequence and infinite series
5. Choose proper method for finding solution of a specific differential equation
6. Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus

Detailed Syllabus:

MODULE-I [10L]
Matrix: Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

MODULE-II [10L]
Vector Calculus: 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.

Infinite Series: Convergence of sequence and series; Tests for conver gence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

MODULE-III [10L]
First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

MODULE-IV [10L]
Calculus of functions of several variables: 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.
Multiple Integration: Concept of line integrals, Double and triple integrals. Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

Books

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2000.
2. Advanced Engineering Mathematics,E. Kreyszig, John Wiley & Sons, 2006.
3. Engineering Mathematics for first year, Veerarajan T., Tata McGraw-Hill, New Delhi, 2008.
4. Higher Engineering Mathematics, Ramana B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. Mathematical Methods for Physics and Engineering,K. F. Riley, M. P. Hobson, S. J. Bence., Cambridge University Press, 23-Mar-2006.
6. Differential Equations, S. L. Ross, Wiley India, 1984.
7. Differential Equations, G.F. Simmons and S.G. Krantz, McGraw Hill, 2007.
8. Vector Analysis (Schaum's outline series): M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education).
9. Engineering Mathematics: S. S. Sastry (PHI).
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education).

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

Course Outcome:

After successfully completing this 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.

Detailed Syllabus:

MODULE –I [11L]

DC Network Theorem: [6L]

Kirchhoff's law, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Star-Delta conversion.

Electromagnetism: [5L]

Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet.

MODULE–II [10L]

AC single phase system:

Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit.

MODULE–III [11L]

Three phase system: [4L]

Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method.

DC Machines: [7L]

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 – IV [10L]

Transformer: [6L]

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 and Introduction to three phase transformer .

3-phase induction motor: [4L]

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 Name: CHEMISTRY-I LAB					
Course Code: CHEM1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

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.

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

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 Fe^{2+}, Cu^{2+} 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 24hysic-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.

Syllabus:

1. Estimation of iron using KmnO4 self indicator.
2. Iodometric estimation of Cu^{2+}.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).

10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Books

1. Vogel's Textbook of Quantitative Chemical Analysis-G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry- S. C. Das.
3. Practicals in Physical Chemistry- P. S. Sindhu.

Course Name: BASIC ELECTRICAL ENGINEERING LAB					
Course Code: ELEC1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

1. Get an exposure to common electrical apparatus and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Apply various network theorems in Electrical Circuits
4. Understand the application of common electrical measuring instruments.
5. Understand the basic characteristics of different electrical machines.
6. Know the measurement technique various electrical parameters.

Syllabus:

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.

Books

A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company.

Course Name: ENGINEERING GRAPHICS & DESIGN					
Course Code: MECH1052					
Contact Hours per week	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcome:

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

1. To understand the meaning of engineering drawing.
2. To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
3. To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
4. To read and understand projection drawings.
5. To draw the section view and true shape of a surface when a regular object is cut by a section plane.
6. To use engineering drawing software (CAD).

Syllabus:

Lecture Plan (13L)

1. Importance and principles of engineering drawing **[1L]**
2. Concepts of Conic sections and Scale **[1L]**
3. Introduction to concept of projection (Projections of points, lines and surfaces) **[4L]**
4. Definitions of different solids and their projections **[1L]**
5. Section of solids and sectional view **[1L]**
6. Isometric projection **[2L]**
7. Introduction to CAD **[2L]**
8. Viva Voce **[1L]**

Detailed contents of Lab hours (52 hrs)

MODULE-I: Introduction to Engineering Drawing covering**,**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

[4hrs + 4hrs]

MODULE-II: Orthographic Projections covering**,**
Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

[4hrs + 4hrs + 4hrs]

MODULE-III: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views.

[4hrs + 4hrs]

MODULE-IV: Sections and Sectional Views of Right Angular Solids covering**,**
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

[4hrs]

MODULE-V: Isometric Projections covering**,**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

[4hrs + 4hrs]

MODULE-VI: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

[4hrs]

MODULE-VII: Customisation & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

[2hrs]

Annotations, layering & other functions covering
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

[2hrs]

MODULE-VIII: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

[4hrs]

Books

1. Elementary Engineering Drawing,Bhatt, N.D., Panchal V.M. & Ingle P.R.,(2014),Charotan Publishing House.
2. Engineering Graphics Narayana, K.L. and Kannaaiah,P ,TMH.
3. Engineering Graphics,Lakshminarayanan, V. and Vaish Wanar, R.S, Jain Brothers.
4. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. (2008), Pearson Education.
5. Engineering graphics, Agarwal B. & Agarwal C. M. (2012), TMH Publications.

Honours Course for 1st Year 1st Semester

Course Name: COMMUNICATION FOR PROFESSIONALS					
Course Code: HMTS1011					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.
5. Learn to articulate opinions and views with clarity.
6. Use various techniques of communication for multiple requirements of globalized workplaces.

Detailed Syllabus:

MODULE – I [9hrs]
Introduction to Linguistics

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Voice Modulation
- Accent Training
- Vocabulary Building
- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
- Synonyms, Antonyms and standard abbreviations

MODULE – II [10hrs]
Communication Skills

- 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 – III [10hrs]

Professional Writing Skills

- Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone
- Proposal Writing: Purpose, Types of Proposals, Structure of Formal Proposals.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

MODULE – IV [10hrs]

Communication skills at Work

- Communication and its role in the workplace
- Benefits of effective communication in the workplace
- Common obstacles to effective communication
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections,
- Identify common audiences and design techniques for communicating with each audience

Books

1. Communication Skills, Kumar,S. & Lata, P. OUP, New Delhi2011
2. Effective Technical Communication, Rizvi, Ashraf,M. Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018
3. Technical Communication: Principles and Practice, 2nd Ed., 2011,Raman, M. and Sharma, S.,

Course Name: PROFESSIONAL COMMUNICATION LAB					
Course Code: HMTS1061					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

1. Communicate in an official and formal environment.
2. Effectively communicate in a group and engage in relevant discussion.
3. Engage in research and prepare presentations on selected topics.
4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.
5. Organize content in an attempt to prepare official documents.
6. Appreciate the use of language to create beautiful expressions

Syllabus:

MODULE – I [4hrs]

- Techniques for Effective Speaking
- Voice Modulation: Developing correct tone
- Using correct stress patterns: word stress, primary stress, secondary stress
- Rhythm in connected speech

MODULE – II [6hrs]

- Effective Speaking and Social awareness
- The Art of Speaking
- Encoding Meaning Using Nonverbal Symbols
- How to Improve Body Language
- Eye Communication, Facial Expression, Dress and Appearance
- Posture and Movement, Gesture, Paralanguage
- Encoding meaning using Verbal symbols: How words work and how to use words
- Volume, Pace, Pitch and Pause
- Cross-Cultural Communication : Multiple aspects/dimensions of culture
- Challenges of cross-cultural communication
- Improving cross-cultural communication skills at workplace.

MODULE – III [6hrs]

- Group Discussion: Nature and purpose
- Characteristics of a successful Group Discussion
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure.

MODULE – IV [10hrs.]

- Professional Presentation Skills
- Nature and Importance of Presentation skills
- Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.
- Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides
- Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, provide closure.
- Improving Delivery: Choosing Delivery methods, handling stage fright
- Post-Presentation discussion: Handling Questions-opportunities and challenges.

Books

1. The Cambridge guide to Teaching English to Speakers of Other Languages Carter, R. And Nunan, D. (Eds), , CUP, 2001.
2. Writing and Speaking At Work: A Practical Guide for Business Communication, Edward P. Bailey, Prentice Hall, 3rd Ed., 2004.
3. Guide to Managerial Communication: Effective Business Writing and Speaking, Munter, M., Prentice Hall, 5th Ed., 1999.
4. Job Readiness For IT & ITES- A Placement and Career Companion, R. Anand, McGraw Hill Education.2015.
5. Campus Placements, Malhotra, A., McGraw Hill Education.2015.

1st Year 2nd SEMESTER

Course Name: Mathematics – II					
Course Code: MATH1201					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

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

1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.
2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.
3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.
5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.
6. Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

Detailed Syllabus:

MODULE-I [10L]

Basic Probability: Random experiment, Sample space and events, Classical and Axiomatic definition of probability, Addition and Multiplication law of probability, Conditional probability, Bayes' Theorem, Random variables, General discussion on discrete and continuous distributions, Expectation and Variance, Examples of special distribution: Binomial and Normal Distribution.

MODULE-II [10L]

Basic Numerical Methods: Solution of non-linear algebraic 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, Matrix Inversion Method. Solution of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta Method of 4th order.

MODULE- III [10L]

Basic Graph Theory: Graph, Digraph, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walk, Path, Circuit, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Dijkstra's Algorithm for shortest path problem. Definition and properties of a Tree, Binary tree and its properties, Spanning tree of a graph, Minimal spanning tree, Determination of spanning trees using BFS and DFS algorithms, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

MODULE-IV [10L]

Laplace Transformation: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. Introduction to integral transformation, Functions of exponential order, Definition and existence of Laplace Transform(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

Books

1. Advanced Engineering Mathematics, E.Kreyszig, Wiley Publications.
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier.
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning.
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India.
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Course Name: PHYSICS – I					
Course Code: PHYS1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

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

1. To develop basic understanding of the modern science to the technology related domain.
2. Analytical & logical skill development through solving problems.
3. To impart idea of concise notation for presenting equations arising from mathematical formulation of physical as well as geometrical problems percolating ability of forming mental pictures of them.
4. Imparting the essence and developing the knowledge of controlling distant object like satellite, data transfer through optical fiber, implication of laser technology, handling materials in terms of their electrical and magnetic properties etc.
5. To understand how the systems under force field work giving their trajectories which is the basic of classical field theory.
6. To impart basic knowledge of the electric and magnetic behavior of materials to increase the understanding of how and why electronic devices work .

Detailed Syllabus:

MODULE – I [(7+5) = 12L]

Mechanics

Elementary concepts of grad, divergence and curl. Potential energy function; F=-grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field; Central forces ; conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Satellite manoeuvres.

Non-inertial frames of reference; rotating coordinate system; five term acceleration formula- centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

MODULE – II [12L]

Oscillatory Motion: **[4L]**

Damped harmonic motion – Over damped, critically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics: **[3L]**

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, Polaroid and application of polarizations.: Polarimeter.

Laser & Fiber Optics: **[5L]**

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.

Fiber optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fiber.

MODULE – III [12L]

Electrostatics in free space: [8L]

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images, energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium: [4L]

Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge in front of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

MODULE – IV [12L]

Magnetostatics : [6L]

Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; equation for vector potential and it's solutions for given current densities .

Magnetostatics in a linear magnetic medium: [3L]

Magnetization and associated bound currents; Auxiliary magnetic field $\vec{H}$; boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility ; ferromagnetic , paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law: **[3L]**

Differential form of Faraday's law expressing curl of electric field in terms of time derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

Books

1. Optics – Eugene Hecht Pearson Education India Private Limited.
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited.
3. Waves and Oscillations by N.K. Bajaj.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley.
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press.
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education.
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education.
8. Optics, Ghatak, McGraw Hill Education India Private Limited.
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora.

Course Name: PROGRAMMING FOR PROBLEM SOLVING					
Course Code: CSEN1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

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

Detailed Syllabus:

MODULE – I [10L]
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. Basic Concepts of Assembly language, High level language, Compiler and Assembler. 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). Basic concepts of operating systems like MS WINDOWS, LINUX How to write algorithms & draw flow charts.

MODULE – II [10L]
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.

Flow of Control: Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

MODULE – III [10L]
Program Structures in C
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.

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.

MODULE – IV [10L]
Data Handling in C

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(), fseek(), ftell();

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 Name: BUSINESS ENGLISH					
Course Code: HMTS1202					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	2

Course Outcome:

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

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.
5. Write reports according to various specifications.
6. Acquire the skill to express with brevity and clarity

Detailed Syllabus:

MODULE–I [6L]
Grammar (Identifying Common Errors in Writing)

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced Modifiers
- Articles
- Prepositions
- Redundancies

MODULE –II [6L]
Basic Writing Strategies
Sentence Structures

- Use of phrases and clauses in sentences
- Creating coherence
- Organizing principles –accuracy, clarity, brevity
- Techniques for writing precisely
- Different styles of writing: descriptive, narrative, expository
- Importance of proper punctuation

MODULE – III [8L]
Business Communication- Scope & Importance

Writing Formal Business Letters: Form and Structure-Parts ofa Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular
Organizing e-mail messages, E-mail etiquette

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 of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

MODULE – IV [6L]

Writing skills

Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice

Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.

Précis: The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.

Essay Writing: Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

Books

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. &Agarwal,S. Business Communication,Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., , Oxford University Press.2nd Edition.2015
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

Course Name: PHYSICS – I LAB					
Course Code: PHYS1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
5. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Syllabus:

Minimum of six experiments taking at least one from each of the following four groups :

Group 1: Experiments in General Properties of matter

1. Determination of **Young's modulus** by **Flexure Method**
2. Determination of **bending moment** and **shear force** of a rectangular beam of uniform cross- section.
3. Determination of **modulus of rigidity** of the material of a rod by **static method**
4. Determination of **rigidity modulus** of the material of a **wire by dynamic method.**
5. Determination of **coefficient of viscosity** by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of **dispersive power** of the material of a prism
2. Determination of wavelength of light by **Newton's ring** method.
3. Determination of wavelength of light by **Fresnel's biprism method.**
4. Determination of the **wavelength of a given laser** source by diffraction method

Group 3: Electricity & Magnetism experiments

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 4: Quantum Physics Experiments

1. Determination of **Planck's constant**.
2. Determination of **Stefan's radiation** constant.
3. Verification of **Bohr's atomic orbital** theory through **Frank-Hertz experiment**.
4. Determination of **Rydberg constant** by studying **Hydrogen/ Helium** spectrum.

5. Determination of **Hall co-efficient of semiconductors.**
6. Determination of **band gap** of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Books

1. Optics – Eugene Hecht Pearson Education India Private Limited.
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited.
3. Waves and Oscillations by N.K. Bajaj.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley.
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press.
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education.
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education.
8. Optics, Ghatak, McGraw Hill Education India Private Limited.
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora.

Course Name: PROGRAMMING FOR PROBLEM SOLVING LAB					
Course Code: CSEN1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Outcome:

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

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX
NB: Cygwin (Windows based) may be used in place of LINUX

Syllabus:

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

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.

Course Name: WORKSHOP/ MANUFACTURING PRACTICES LAB					
Course Code: MECH1051					
Contact Hours per week	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcome:

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

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.

Syllabus:

(i) Lectures & videos: (13 hours)

Detailed contents

1. Introduction on Workshop and Safety Precautions. [**1L]**
2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods [**3L]**
3. CNC machining, Additive manufacturing **[1L]**
4. Fitting operations & power tools **[1L]**
5. Electrical & Electronics **[1L]**
6. Carpentry **[1L]**
7. Plastic moulding, glass cutting **[1L]**
8. Metal casting **[1L]**
9. Welding (arc welding & gas welding), brazing **[2L]**
10. Viva-voce **[1L]**

(ii) Workshop Practice :(52 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop **[12 hours]**
2. Fitting shop **[8 hours]**
3. Carpentry **[4 hours]**
4. Electrical & Electronics **[4 hours]**
5. Welding shop **(Arc welding 4 hrs + gas welding 4 hrs) [8 hours]**
6. Casting **[4 hours]**
7. Smithy **[4 hours]**
8. Plastic moulding& Glass Cutting **[4 hours]**
9. Sheet metal Shop **[4 hours]**

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Books

1. Elements of Workshop Technology,Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

2. Manufacturing Engineering and Technology Kalpakjian S. And Steven S. Schmid, 4th edition, Pearson Education India Edition, 2002.

3. Manufacturing Technology – I,Gowri P. Hariharan and A. Suresh Babu,Pearson Education, 2008.

4. Processes and Materials of Manufacture,Roy A. Lindberg, 4th edition, Prentice Hall India, 1998.

5. Manufacturing Technology Rao P.N., Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Name: LANGUAGE LAB					
Course Code: HMTS1252					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

Syllabus:

MODULE – I [4hrs]

Listening Skills

- Principles of Listening: Characteristics, Stages.
- Types of Listening: Passive listening, Marginal or superficiallistening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
- Guidelines for Effective Listening
- Barriers to Effective Listening
- Listening Comprehension

MODULE – II [8hrs]

- Interviewing
  Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

MODULE – III [6hrs]

- Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
- Characteristics of a good speech : content and delivery, structure of a speech
- Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.
- Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
- Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.

- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

MODULE – IV [8hrs]

Presentation Skills

- Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
- Project Team/Group Presentations

Books

1. The Cambridge guide to Teaching English to Speakers of Other Languages, Carter, R. And Nunan, D. (Eds), CUP, 2001.
2. Writing and Speaking At Work: A Practical Guide for Business Communication, Edward P. Bailey, Prentice Hall, 3rd Ed., 2004.
3. Guide to Managerial Communication: Effective Business Writing and Speaking, Munter, M., Prentice Hall, 5th Ed., 1999.
4. Communication and Language Skills, Sen, S.,Mahendra,A. &Patnaik,P., Cambridge University Press, 2015.
5. Business and Administrative Communication Locker,Kitty O McGraw-Hill/ Irwin.
6. Intercultural Business Communication. Chaney,L.andMartin,J., Prentice Hall.

Honours Course for 1st Year 2nd Semester

Course Name: BASIC ELECTRONICS					
Course Code: ECEN1011					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

After successfully completing 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.

Detailed Syllabus:

MODULE – I [10L]
Basic Semiconductor Physics:
Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor

Diodes and Diode Circuits:
Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application. Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

MODULE – II [8L]
Bipolar Junction Transistors (BJT):
PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

MODULE – III [9L]
Field Effect Transistors (FET):
n-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI),
Classification of Integrated circuits (IC) and their applications.

MODULE – IV [9L]
Feedback in amplifiers:
Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:
Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:
Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

Books

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

Course Name: BASIC ELECTRONICS LAB					
Course Code: ECEN1061					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

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.

Syllabus:

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization 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 Differentiators.

Books:

1. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
2. B Sasikala : Electronics Laboratory Primer

2nd Year 1st SEMESTER

Course Name: DISCRETE MATHEMATICS					
Course Code: CSEN2102					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

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

1. Interpret the problems that can be formulated in terms of graphs and trees.
2. Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.
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.
4. Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
5. Analyze the logical fundamentals of basic computational concepts.
6. Compare the notions of converse, contrapositive, inverse etc in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

Detailed Syllabus:

MODULE-I [10L]
Graph Theory:

- Tree, Binary Tree, Spanning Tree.
- Walk, Path, Cycle
- Hamiltonian Graph ,The Travelling Salesman Problem, Euler Graph, The Chinese Postman Problem.
- Planar Graph, Euler's Formula for Planar Graph and Related Problems, Examples of
- Non-Planar Graphs, Kuratowski's Theorem.
- Matching and Augmenting Paths, Hall's Marriage Theorem and Related Problems.
- Vertex Colouring, Chromatic Polynomials.

MODULE-II [10L]
Number Theory:

- Well Ordering Principle
- Principle of Mathematical Induction
- 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 ($\mathbb{Z}n$) and its examples

MODULE-III [10L]
Combinatorics:

- 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
- Divide-and-Conquer Methods, Formulation and Solution of Recurrence Relations in Computer Sorting, Searching and other Application Areas

MODULE-IV [10L]
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

Books

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Tata McGraw- Hill.
2.Elements of Discrete Mathematics : A Computer Oriented Approach, C L Liu and D P Mohapatra, Tata McGraw Hill.
3. Discrete Mathematical Structure and It's Application to Computer Science, J.P. Tremblay and R. Manohar, Tata McGraw Hill.
4. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott, A. Kandel and T.P.Baker, Prentice Hall.
5. Discrete Mathematics, Norman L. Biggs, Oxford University Press,
6.Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson.
7. Higher Algebra(Classical), S.K. Mapa, Sarat Book Distributors.
8. Introduction to Graph Theory (2nd Ed), D G West, Prentice-Hall of India, 2006.

Course Name: ANALOG CIRCUITS					
Course Code: ECEN2101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Apply the previous knowledge gathered from Basic Electrical and Basic Electronics papers.
2. Understand the concepts of BJT, MOSFET and biasing techniques of BJT and MOSFET based amplifier circuits.
3. Analyze frequency response of amplifier circuits.
4. Design different types sinusoidal oscillators and multivibrator circuits.
5. Construct algebraic equations based amplifier and analog computers using OP-AMP
6. Design stable high-gain amplifier circuits.

Detailed Syllabus:

MODULE-I: Analog Signals and Devices [9L]

Basic concepts and device biasing: [5L]
Analog, discrete and digital signals. Diode: piecewise-linear model, clipping and clamping operation. BJT biasing circuits, Q-point and stability.

Small Signal analysis of Amplifiers: [4L]
Small signal (h-parameter and r_e model) analysis of BJT CE mode amplifier circuit (derive input impedance, output impedance, voltage gain, current gain for the amplifiers).

MODULE-II: Oscillators and Frequency Responses of Amplifiers [9L]

Frequency Responses of Amplifiers: [2L]
Frequency response of CE mode RC-coupled amplifier; effect of external and parasitic capacitors on cut-off frequencies.

Feedback & Oscillator Circuits: [7L]
Concept of feedback, Effects of negative feedback in amplifiers, Oscillators circuits: Phase-shift, Wien-Bridge, Hartley, Colpitt and crystal Oscillators.

MODULE 3: Operational Amplifiers (OPAMPs) [7L]

Fundamentals of OPAMP: [4L]
Basic building blocks of OPAMP: Differential Amplifiers, Current source and current mirror circuits. Types of differential amplifiers, AC and DC analysis of differential amplifiers; Characteristics of an ideal OPAMP.

Applications of OPAMP: [3L]
Inverting and non-inverting OPAMP amplifiers, Log-antilog amplifiers, Instrumentation amplifier, Precision rectifiers, basic comparator, Schmitt Trigger.

MODULE-IV: Analog Circuit Applications [7L]

Power Amplifiers: [4L]
Concepts and operations of Class A, B and AB amplifiers; Calculation of DC power, AC power and efficiency of these amplifiers.

Applications Analog IC: [3L]
Description of 555 Timer IC, a stable and mono-stable operations using 555. Study of 78XX and 79XX voltage regulator ICs.

Books

1. Microelectronic Circuits by Adel S. Sedra, Kenneth C. Smith.
2. Electronics Devices and Circuits by Robert L. Boylestad, Louis Nashelskey.
3. Fundamentals of Microelectronics by Behzad Razavi.
4. Integrated electronics by Jacob Millman, Christos C. Halkias.

Course Name: DIGITAL SYSTEMS DESIGN					
Course Code: ECEN2002					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Make use of the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method, and Tabular method.
2. Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
3. Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
4. Outline the concept of different types of A/D and D/A conversion techniques.
5. Realize basic gates using RTL, DTL, TTL, ECL, and CMOS logic families.
6. Relate the concept of Flip flops to analyze different memory systems including RAM, ROM, EPROM, EEROM, etc.

Detailed Syllabus:

MODULE-1 [8L]
Data and number systems; Binary, Octal, and Hexadecimal representation and their conversions;
BCD, Gray 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; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method, Tabular method.

MODULE-II [12L]
a) Combinational circuits- Adder and Subtractor, BCD adder, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator. **[7L]**
b) Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logic devices and gate arrays. (PLAs and PLDs) **[5L]**

MODULE-III [8L]
Sequential Circuits- Basic memory element S-R, J-K, D, and T Flip Flops, Interconversions of Flip- Flop, State table and state transition diagram, sequential circuits design methodology, various types of Registers and Counters (Synchronous, asynchronous, Irregular, ring, johnson) and their design, Lockout and its remedy.

MODULE-IV [8L]
a) Different types of A/D (Flash, SAR, Counter type, Dual slope) and D/A(R-2R, weighted resistor) conversion techniques. **[4L]**
b) Logic families- RTL, DTL, TTL, ECL, and CMOS, their operation and specifications. **[4L]**
Total: 36 hours

Text Books

1. Digital Logic Design, Morries Mano- PHI.
2. Modern Digital Electronics, 2/e, R.P.Jain- Mc Graw Hill.
3. Digital technology, Virendra Kumar- New Age Publication.
4. Digital Circuit & Design, S.Salivahanan, S.Arivazhagan- Bikas Publishing.
5. Fundamental of Digital Circuits, A. Anand kumar- PHI.

Reference Books

1. Digital Integrated Electronics, H.Taub & D.Shilling- Mc Graw Hill.
2. Moss-Digital Systems, 9/e, Tocci, Widmer, Pearson.
3. Digital Principles &Application, 5/e, Leach & Malvino- Mc Graw Hill.
4. Digital Fundamentals, Floyed & Jain- Pearson.

Course Name: HUMAN VALUES AND PROFESSIONAL ETHICS					
Course Code: HMTS2001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

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

Detailed Syllabus:

MODULE-I [10L]
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 [10L]
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 [10L]
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 [6L]
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.

Books

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

Course Name: FUNDAMENTALS OF DATA STRUCTURE & ALGORITHMS					
Course Code: INFO2101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

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

1. Develop the knowledge of basic data structures for storage and retrieval of ordered or unordered data.
2. Design linear and non-linear data structures to be used for storing, accessing and manipulating data, and be able to choose the appropriate data structure to be used for different real life applications.
3. Evaluate and compare the runtime and memory usage of algorithms with the help of mathematical background (Asymptotic Notation) of algorithm analysis.
4. Apply graph based algorithms on shortest path problems.
5. Apply efficient algorithm for solving problems like sorting, searching, insertion and deletion of data.
6. Analyze hash functions and collision resolution techniques for storing and retrieving data efficiently into a hash table.

Detailed Syllabus:

MODULE-I [8L] Linear Data Structure I

Introduction **[2L]**
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Introduction to time and space complexity analysis of algorithm.

Array: **[1L]**
Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials.

Linked List: **[5L]**
Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

MODULE II [10L] Linear Data Structure II

Stack : **[5L]**
Stack and its implementations (using array, using linked list), Principles of Recursion – Applications of stack, differences between recursion and iteration, tail recursion.

Queue: **[5L]**
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.

MODULE III [13L] Nonlinear Data structures

Trees: **[9L]**

Basic terminologies, tree representation (using array, using linked list).
Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left,right,full).
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.

Graphs: **[4L]**

Graph definitions and Basic concepts .Graph representations/storage implementations – adjacency matrix, adjacency list, Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)

MODULE IV [12L] Searching, Sorting, Hashing:

Sorting Algorithms: **[8L]**

Bubble sort and its optimization, insertion sort, shell sort, selection sort, merge sort, quicksort, heap sort, radix sort. Complexity analysis.

Searching: **[2L]**

Sequential search, binary search, Interpolation Search

Hashing: **[2L]**

Hashing functions, collision resolution techniques (Open and closed hashing).

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, Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. Data Structures in C,Aaron M. Tenenbaum.
4. Data Structures, S. Lipschutz.
5. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
6. Data Structures using C,Reema Thareja

Course Name: ENVIRONMENTAL SCIENCES					
Course Code: EVSC2016					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	0	0

Course Outcome:

The subject code EVSC2016 corresponds to basic environmental chemistry for the 2nd year B.Tech students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it.

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

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
5. Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
6. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Detailed Syllabus:

MODULE-I [6L]
Socio Environmental Impact
Basic ideas of environment and its component
Population growth: exponential and logistic; resources; sustainable development. **[3L]**
Concept of green chemistry, green catalyst, green solvents
Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. **[3L]**

MODULE-II [6L]
Air Pollution
Structures of the atmosphere, global temperature models
Green house effect, global warming; acid rain: causes, effects and control. **[3L]**
Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. **[3L]**

MODULE-III [6L]
Water Pollution
Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.
Biochemical effects of heavy metals; eutrophication: source, effect and control. **[2L]**
Water quality parameters: DO, BOD, COD.
Water treatment: surface water and waste water. **[4L]**

MODULE-IV [6L]

Land Pollution

Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. **[3L]**

Noise Pollution

Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. **[3L]**

Text Books:

1. Basic Environmental Engineering and Elementary Biology,GourKrishna Das Mahapatra, Vikas Publishing House P. Ltd.
2. Environmental Chemistry, A. K. De, New Age International.
3. Environmental Chemistry with Green Chemistry,A. K. Das, Books and Allied P. Ltd.

Reference Books

1. Environmental Science,S. C. Santra, New Central Book Agency P. Ltd.
2. Fundamentals of Environment & Ecology, D. De, D. De, S. Chand & Company Ltd.

Course Name: ANALOG CIRCUITS LAB					
Course Code: ECEN2151					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

1. Study and compare frequency responses of amplifiers.
2. Design different timer circuits with 555 IC.
3. Design rectifiers and measure rectifier parameters.
4. Generate various waveforms using OP AMPs.

Syllabus:

Experiments using discrete components

1. Study of frequency response of RC coupled amplifier circuit.
2. Study of a stable multi-vibrator using 555 timer IC.
3. Study of mono stable multi-vibrator using 555 timer IC.
4. Study of full wave and half wave precision rectifier circuits.
5. Study of Wien-Bridge oscillator circuit.
6. Study of Phase Shift oscillator circuit.
7. Study of a stable multi-vibrator using OPAMP.
8. Study of Triangular wave generator circuit using OPAMP.
9. Study of Schmitt trigger circuit.
10. Study of fixed voltage regulator circuits using 78XX and 79XX ICs.

Experiments using ASLKv2010StarterKit

11. Negative feedback amplifiers and instrumentation amplifiers to measure parameters like time response, frequency response, DC transfer characteristics,
12. Study of analog filters like LPF, HPF, BPF and BSF
13. Study of VCO and PLL
14. Automatic gain / volume control (AGC/AVC)
15. PC based Oscilloscope

Course Name: DIGITAL SYSTEMS DESIGN LAB					
Course Code: ECEN2052					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

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

1. Design code converters.
2. Design adder and subtractor circuits.
3. Design decoders and multipexer circuits.
4. Realize counters.

Syllabus:

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3. Design of Four-bit parity generator and comparator circuits.
4. Construction of simple arithmetic circuits-Adder, Subtractor.
5. Construction of simple Decoder & Multiplexer circuits using logic gates.
6. Realization of different combinational circuits using Multiplexers.
7. Realization of RS, JK, and D flip-flops using Universal logic gates.
8. Realization of Asynchronous Up/Down counters.
9. Realization of Synchronous Up/Down counters.
10. Design of Sequential Counter with irregular sequences.
11. Realization of Ring and Johnson's counters.

Books

1. Linear Integrated Circuits, Salivahanan, McGraw Hill Education, Third Edition.
2. Digital design, Morris Mano, Prentice Hall of India, Third Edition.
3. An Engineering approach to Digital Design‖, William I. Fletcher, Prentice Hall of India, 2009.
4. Switching and Finite Automata Theory‖, Zvi Kohavi, Tata Mc Graw Hill, second edition.
5. Switching Theory and Logic Design‖, A. Ananda Kumar, Prentice Hall of India, 2009.

Course Name: FUNDAMENTALS OF DATA STRUCTURE & ALGORITHMS LAB					
Course Code: INFO2151					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Outcome:

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

1. Design and analyze the time and space efficiency of the data structure.
2. Capable to identity the appropriate data structure for a given problem.
3. Implement the Stack ADT using both array based and linked-list based data structures.
4. Implement the Queue ADT using both array based circular queue and linked-list based implementations.
5. Implement Nonlinear Data structure operations and its applications
6. Apply Sorting and Searching algorithms on various problems and analyze run-time execution of these methods.

Syllabus:

1. Design and Implement List data structure using i) array ii) singly linked list.
2. Design and Implementation of basic operations on doubly linked list.
3. Design and Implementation of Linear Data Structure :
   a) Stack using i)array ii) singly linked list
   b) Queue using i)array ii) singly linked list
   c) Basic operations on Circular Queue
4. Design and Implementation of Conversion and Evaluation of expressions(Infix, Postfix) operations.
5. Implementation of Sorting Techniques.
6. Implementation of Searching Techniques.
7. Design and Implement Binary Search Tree (BST)- create, insert, delete, search elements. Traversal in a BST- inorder, preorder, postorder.
8. Design and Implement Graph Algorithms: Breadth First Search Techniques, Depth First Search Techniques.

Books

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.
2. Programming in ANSI C, E. Balaguruswamy, Tata McGraw-Hill.
3. Schaum's Outline of Programming with C, Byron Gottfried, McGraw-Hill.
4. Data Structures, Schaum's Outlines Series, Seymour Lipschutz, TataMcGraw-Hill.
5. Fundamentals of Data Structures in C, Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, W. H. Freeman andCompany.
6. How to Solve it by Computer, R. G. Dromey, Prentice-Hall of India.
7. Data Structures using C, Reema Thareja, Oxford University Press.

Honours Course for 2nd Year 1st Semester

Course Name: INFORMATION THEORY & CODING					
Course Code: INFO2111					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

Course Outcome:

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

1. Derive equations for entropy, mutual information and channel capacity for all types of channels.
2. Compare among different types of error correcting codes.
3. Evaluate the channel performance using Information theory.
4. Formulate the basic equations of linear block codes.
5. Apply convolution codes for performance analysis.
6. Design BCH code for Channel performance improvement.

Detailed Syllabus:

MODULE-I [14L]

Source Coding: Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes, Shanon Codes.

Channel Capacity and Coding: Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

MODULE-II [15L]

Linear And Block Codes For Error Correction: Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes: Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

MODULE-III [8L]

BCH Codes:Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, Error Syndrome,Error location polynomial,examples of BCH codes.

MODULE-IV [8L]

Convolutional Codes :Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Books

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
6. Introduction to Error Control Codes-Salvatore Gravano.

2nd Year 2nd SEMESTER

Course Name: ALGEBRAIC STRUCTURES					
Course Code: MATH2201					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

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.

Detailed Syllabus:

MODULE-I [10L]

Sets, Relations and Functions:

Basic operations on sets, Venn diagrams. Binary relations defined on sets, equivalence relations and equivalence classes, order, relation and lattices, partially ordered sets, Hasse diagrams, maximal, minimal, greatest and least elements in a partially ordered set, lattices and their properties, principle of duality, distributive and complemented lattices.

MODULE-II [10L]

Group Theory I:

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.

MODULE-III [10L]

Group Theory II:

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.

MODULE-IV [10L]

Morphisms, Rings and Fields:

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.)

Books

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.

Course Name: FORMAL LANGUAGE & AUTOMATA THEORY					
Course Code: INFO2201					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

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

1. Describe and Design the Finite State Machine and the concept of Automata using sequential circuits.
2. Describe, Evaluate and express the different concepts of Finite Automata (NFA, DFA).
3. Describe and Design the Regular Language for Finite Automata (NFA, DFA).
4. Classify, describe and discuss different types of Grammar (Regular Grammar and Context Free Grammar).
5. Construct Context Free Language using Context Free Grammar.
6. Describe and Design Turing Machine and Push Down Automata for Context Free Language.

Detailed Syllabus:

MODULE-I [11L]

Fundamentals:

Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept), Design of sequence detector, Introduction to finite state mode

Finite state machine:

Definitions, capability & state equivalent, kth- equivalent concept, Minimization of FSM, Equivalence between two FSM's , Limitations of FSM, Merger graph, Merger table, Compatibility graph, Finite memory definiteness, testing table & testing graph, Information lossless.

MODULE-II [13L]

Deterministic finite automaton and non deterministic finite automaton. Transition diagrams and Language recognizers.

Finite Automata:

NFA with Î transitions - Significance, acceptance of languages.

Conversions and Equivalence:

Equivalence between NFA with and without λ-transitions. NFA to DFA conversion. Application of finite automata, Finite Automata with output- Moore & Mealy machine.

Regular Language :

Regular sets Regular expressions, identity rules. Arden's theorem state and prove Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA, Pumping lemma of regular sets, Closure properties of regular sets (proofs not required).

MODULE-III [11L]

Grammar Formalism:

Regular grammars-right linear and left linear grammars. Equivalence between regular linear grammar and FA. Inter conversion, Context free grammar. Derivation trees, sentential forms. Right most and leftmost derivation of strings (Concept only). Context Free Grammars, Ambiguity in context free grammars. Normal forms for Context Free Grammars. Chomsky normal form and Greibatch normal form. Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications.

MODULE-IV[8L]

Push Down Automata:

Push down automata, definition. Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion (Proofs not required). Introduction to DCFL and DPDA.

Turing Machine :

Turing Machine definition, model, Design, Computable functions, Universal Turing Machine, Halting problem (proofs not required)

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. Switching & Finite Automata, ZVI Kohavi, 2nd Edn., Tata McGraw Hill.
5. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
6. Introduction to languages and the Theory of Computation, John C Martin, TMH.
7. Elements of Theory of Computation, Lewis H.P. & Papadimitrou C.H. Pearson, PHI.
8. An Introduction to Formal Languages and Automata, Peter Linz, Jones & Bartlett Learning.

Course Name: OBJECT ORIENTED PROGRAMMING					
Course Code: INFO2202					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Recall the knowledge of procedural language and map it to paradigm of Object oriented concept.
2. Relate the real world problem with object oriented approach.
3. Describe and illustrate the features of object oriented programming.
4. Analyze any real world problem with object oriented approach and formulate a solution for the same.
5. Manage the complexity of procedural language by using the concept polymorphism, inheritance, abstraction, encapsulation.
6. Create and explain some GUI and thread based application.

Detailed Syllabus:

MODULE-I [10L]

Basics of OOP and Introduction to JAVA:

Properties of object oriented programming language, Comparison between object oriented programming language and Procedural Programming Language, Major and minor elements, Object, Class, relationships among objects. Aggregation, Association, Generalization, meta-class. Class, object, message passing, inheritance, encapsulation, polymorphism.

Basic concept of JAVA programming– advantages of java, byte-code & JVM, data types, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection.

MODULE-II [10L]

Class & Object proprieties:

Different types of access specifiers, method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables, methods and block nested & inner classes, basic string handling concepts, concept of mutable and immutable string.

Reusability properties:

Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages. Implementation of different relationships in OOPs.

MODULE-III [8L]

Exception handling and I/O:

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Input Output stream structure, Wrapper class, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes. File copy programming using command line arguments.

MODULE-IV [10L]

Multithreading and Applet & Swing Programming:

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets. Basic of swing programming, Difference between applet and swing, AWT Event handling, message box input box, introduction to JFrame, JButton , JLabel.

Books

1. Object Oriented Modelling and Design,Rambaugh, James Michael, Blaha ,Prentice Hall, India.
2. Object Oriented System Development Ali Bahrami,Mc Graw Hill.
3. The complete reference-Java2,Patrick Naughton, Herbert Schildt,TMH.
4. Core Java For Beginners,R.K Das,VIKAS PUBLISHING.
5. Java How to Program,Deitel and Deitel,6th Ed. – Pearson.
6. Beginning Java 2 SDK,Ivor Horton's,Wrox.
7. Programming With Java: A Primer,E. Balagurusamy,3rd Ed.,TMH.

Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE					
Course Code: INFO2203					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

Course Outcome:

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

1. Describe and explain the difference between computer organization and computer architecture .
2. Design the ALU for different arithmetical and logical problems and apply the knowledge of different multiplication and division algorithm.
3. Formulate design methodology for using various types of instructions.
4. Differentiate between different Memory hierarchy(Primary, Secondary, Cache). Able to solve different kind of numericals based on memory technologies and page replacement techniques.
5. Differentiate between types of pipeline, hazards and selecting remedial techniques to handle the hazards. able to distinguish between parallel architectures. Compare performance parameters of pipelines and deduce derivations to demonstrate change in performance parameters when branching is introduced. Able to solve numericals based on pipeline concepts.
6. Comparing techniques of ILP, types of CU, types of shared memory architectures. Distinguish between different multiprocessor architectures, Data Flow architecture, RISC and CISC architecture.

Detailed Syllabus:

MODULE-I [11L]
Introduction to Computer and Computer Arithmetic:
Von Neumann and Harvard Architecture, Computer organization vs Computer Architecture, Instruction format, Addressing modes, Addition and subtraction with signed magnitude, Half adder, Full adder, Ripple carry adder, Carry Look-ahead adder, Multiplication algorithm, Division algorithm, Floating point number representation, IEEE 754 standard and ALU design.

MODULE-II [10L]
Memory Organization and I/O techniques:
Inclusion, coherence and locality properties, Memory Hierarchy, Cache memory organization, Memory replacement policies, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Modes of transfer, Handshaking and DMA.

MODULE-III [10L]
Pipeline and ILP:
Quantitative techniques in computer design, Introduction to pipeline, Instruction pipeline, Arithmetic pipeline, processor pipeline, Types of Pipeline hazards and its countermeasures, Super-pipeline, Superscalar and VLIW architecture. Introduction to ILP and techniques to improve ILP, Array and Vector processor.

MODULE-IV [11L]

Multiprocessor Architecture and Control Unit:

Taxonomy of parallel architectures, Types of Multiprocessor architectures, Multi Cache inconsistency, Centralized and Distributed shared memory architecture, Memory Consistency models, Cluster computer, Data flow architecture, RISC and CISC architecture. Introduction to Control unit, Hardwired CU and Micro programmed CU.

Books

1. Advanced Computer Architecture by Kai Hwang.
2. Computer Architecture: A Quantitative approach- Patterson and Hennessy.
3. Computer Architecture and Parallel processing- Hwang and Briggs.
4. Computer Architecture by T.K.Ghosh.
5. Computer System Architecture, PHI Mano, M.M.
6. Computer Organisation, McGraw Hill Hamacher

Course Name: DATABASE MANAGEMENT SYSTEMS					
Course Code: INFO2204					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

Course Outcome:

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

1. Understand the need of DBMS over traditional file system and acquire the knowledge on overall database description, at three levels, namely, internal, conceptual, and external levels
2. Deduce the constraints , i.e., the candidate keys, super-keys, that exists in a given real world problem and design the entity relationship diagram to graphically represent entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems
3. Formulate a mathematical tool using relational algebra that operates on one or more relational tables and outputs a relational table as result, and design a normalized Database based on real-world situations, maintaining all constraints and manipulate database relations using SQL and PL/SQL.
4. Prove whether the ordering of concurrent transactions result in inconsistency of the database system or not.
5. Compare the number of block access required for searching a particular record, in an un indexed data file, with respect to a data file having (primary , secondary , clustering or multilevel) index structure.
6. Create a complete Normalized Database system, maintaining all the requirement specifications for a real life problem, and creating indexed relations for efficient accessing.

Detailed Syllabus:

MODULE-I [7L]
Introduction and Conceptual Modeling
Database Model, Schema and architecture: [2L]
Concept & Overview of database and DBMS, Advantages of using DBMS approach, Database Users , Database Administrator, Database applications. Data Models and its categories, Schema, Instances, Database Languages, Three Schema architecture of DBMS, Data independence, Centralized and client server architecture for DBMS. Classification of DBMS. Introduction to big data.

Entity-Relationship Model: [5L]
Basic concepts, Design Issues, Cardinality, SuperKeys, Candidate keys, Entity types, Entity sets, attributes and keys. Relationship types, Relationship sets, Attributes of relationship types, Weak Entity Sets , ER diagram design issues, Extended E-R modeling: generalization, specialization, aggregation.

MODULE-II [10L]
Relational Model: Languages and query processing

Introduction to relational model: [1L]
Concepts of domains, attributes, tuples, relations. Transformation of ERD model to relational model.
Relational Algebra and Calculus: [5L]
Operators in relational algebra: select, project, rename, cartesian product, different types of join, Division,Intersect, Union, Minus. Tuple relational calculus, Domain relational calculus.
Introduction to Database languages [4L]
SQL: Concept of DDL, DML, DCL,TCL,DQL. Query structure, concept of subquery, group functions. View. PL/SQL basic structure, Control structure, Cursor,Triggers.

MODULE-III [12L]

Relational Database Design

Database integrity: [1L]

Domain constraints, entity integrity, referential integrity constraints. Concept of null and not null constraint

Functional Dependencies: [3L]

Basic concept of functional dependency, Axioms, Closure, Attribute closure, Equivalent set of FD, Cover, Canonical cover.

Normalization: [8L]

Concept of Super keys, Candidate keys. Determining candidate keys from FD. Different anomalies in designing a Database. First, second and third normal form, Boyce-Codd Normal Form, Nomalization using multi-valued depedencies and join dependency. Dependency preservation, Lossless decomposition. Query Opyimization.

MODULE-IV [13L]

Transaction Processing, Data Storage

Transaction processing concepts [8L]

Transaction properties, states, serial vs. concurrent execution, Serializability, Concurrency control techniques, and Recovery Management

File Organization & Index Structures [5L]

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 .

Books

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

Course Name: OBJECT ORIENTED PROGRAMMING LAB					
Course Code: INFO2252					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.
2. Implement Object Oriented Programming Features to improve the solution designs.
3. Apply Multithreading solutions of real life problems.
4. Reconstruct the solution to a problem in GUI mode.
5. Design programs in platform independent environment.

Syllabus:

Implement all problems abiding by features of object oriented programming (Abstraction, Encapsulation, Reusability, Data Hiding, Generalization, Specialization.)

Lab1:
Familiarization on object oriented approach of programming: use of class, object, reference.

Lab 2:
Use of constructor, static, final, array, date, access specifiers.

Lab 3:
Familiarization with String, StringBuffer, ArrayList and LinkedList classes

Lab 4:
Inheritance and Dynamic Method Dispatch

Lab 5 & 6:
Abstract Class, Interface and Package
Java Exception Handling.

Lab 7:
Familiarization on Java IO using Scanner, BufferedReader, PrintWriter. File handling in Java.

Lab 8:
Exploring Java multithreading concept.

Lab 9:
Java Applet, AWT Event Handling

Lab 10:
Exploring JOptionPane
Basics of Java Swing: Different Layouts, Event Handling

Lab 11:
Basic JDBC connection and data handling.

Books

1. Object Oriented Modelling and Design,Rambaugh, James Michael, Blaha – Prentice Hall, India.
2. Object Oriented System Development ,Ali Bahrami – Mc Graw Hill.
3. The complete reference-Java2, Patrick Naughton, Herbert Schildt –TMH.
4. Core Java For Beginners R.K Das,VIKAS PUBLISHING.
5. Java How to Program, 6th Ed. Deitel and Deitel –Pearson.
6. Beginning Java 2 SDK,Ivor Horton's– Wrox.
7. Programming With Java: A Primer,E. Balagurusamy,3rd Ed. – TMH.

Course Name: COMPUTER ORGANIZATION & ARCHITECTURE LAB					
Course Code: INFO2253					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. Analyze different types of logic gates and verify K-Maps and truth tables of logic gates.
2. Construct adder and subtractor circuits and defend the obtained truth tables and K-maps via TBW.
3. Design and construct Multiplexer circuits and defend the obtained truth tables and K-maps.
4. Design and construct different converters and ALU circuits and defend the obtained truth tables and K-maps via TBW.
5. Design horizontal and vertical expansion of RAM and compare their results from obtained truth tables.
6. Design seven segment display and defend the obtained truth tables.

Syllabus:

1. Logic gates
2. Adders: Half-Adder, Full Adder
3. Subtractors: Half Substractor, Full Substractor
4. Horizontal and vertical expansion of RAM
5. Combinational circuit designs
    a. Multiplexers: 4:1 and 8:1, 8:1 using 4:1 and 2:1
    b. Code Converters: 4-bit binary to gray, 4-bit gray to binary
    c. 7-segment display
    d. ALU

Books

1. The Practical Xilinx Designer Lab Book: Version 1.5, David E. Van, Den Bout, Prentice Hall.
2. Programmable Logic Fundamentals Using Xilinx ISE, Denton Dailey, Prentice Hall.
3. Programmable Logic Design Quick Start Hand Book, Karen Parnell, Nick Mehta, Xilinx Corporation.

Course Name: DATABASE MANAGEMENT SYSTEMS LAB					
Course Code: INFO2254					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1.Define and understand the Oracle Server architecture and also indentifying the different DDL,DML,DCL,DQL,TCL sql statement.
2.Construct and map an Entity Relationship model to relational tabular structure and maintaining all relationships and domain integrity, referential integrity, entity integrity constraints.
3. Make use of SQL commands to populate and query a database.
4. Apply and implement security and administrative aspect to a database.
5. Experiment with implementing event oriented programming using PL/SQL TRIGGER and CURSOR, and also implement user defined functions to solve real world problem.
6. Develop a normalized database system maintaining all the requirement specifications with respect to real life problem.

Syllabus:

Structured Query Language

1.Introduction to server architecture
2.Creating database objects
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Column Aliases
- DROP, ALTER statements
- Creating an object structure from another existing structure

3. Table and Record Handling
- INSERT statement
- DELETE, UPDATE, TRUNCATE statements
- Populating data from other tables using insert and select together

4. Retrieving Data from a Database

The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING
- Clause
- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

5. Database Management

Creating Views Creating
Database Users
Granting and revoking
Privileges (GRANT,
REVOKE) Granting
object privileges

Basics of Programming Language/Structured Query Language (PL/SQL)

- Conditional /Iterative Statements
- Introduction to Functions and Stored procedures
- Exception Handling
- Cursor and its application
- Triggers

Books

1. SQL, PL/SQL the Programming Language of Oracle by Ivan Bayross.
2. SQL The Complete Reference by Groff James.
3. Oracle PL/SQL Programming by Feuerstein, Steven**.**

3rd Year 1st SEMESTER

Course Name: ADVANCED JAVA & WEB TECHNOLOGY					
Course Code: INFO3101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Design web pages using HTML, Java Script and CSS.
2. Distinguish between Servlet and CGI technology.
3. Explain the relationship between JSP and Servlet.
4. Implement server side program using servlet and JSP to a DBMS and perform insert, update and delete operations on DBMS table.
5. Analyze J2EE architecture.
6. Describe EJB, RMI and XML and relate them with J2EE.

Detailed Syllabus:

MODULE – I [8L]
*Static Web Pages:*Web Pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWW Basic concepts, web client and web server, http protocol (frame format), universal resource locator (URL), HTML different tags, sections, image & pictures, listings, tables, frame, frameset, form. *Dynamic Web Pages:*The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation. *Active Web Pages:* Need of active web pages; java applet life cycle, Java Swing.

MODULE – II [7L]
Java Script: Data types, variables, operators, conditional statements, array object, date object, string object.
Java Servlet: Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

MODULE – III [10L]
*JSP:*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, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

MODULE – IV [10L]
*J2EE:*An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans, basics of RMI, JNI.
XML: Extensible Markup Language (XML), basics of XML, elements and attributes, document type definition, XML parsers, sequential and tree approach.

Text Books

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design - Xavier C., New Age Publication.
3. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers

Reference Books

1. Advanced Java Programming-Uttam Kumar Roy, Oxford university press.

Course Name: OPERATING SYSTEMS					
Course Code: INFO3102					
Contact Hours	L	T	P	Total	Credit Points
per week	3	0	0	3	3

Course Outcome

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

1. Analyze and differentiate between different types of operating systems (namely, batch, multi programmed, time-sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.
2. Demonstrate and describe system operations, internal structure of computer system and operating system.
3. Design multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.
4. Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.
5. Demonstrate the operations of IO devices and how they are governed by the operating system
6. Discuss the activity and impact of threat, virus, worm and how the system could be protected from them.

Detailed Syllabus:

MODULE – I [9L]

Introduction **[3L]**

Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, timesharing, 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, and system calls.

Process and Threads **[3L]**

Processes **[1L]**

Concept of processes, operations on processes.

Threads **[2L]**

Overview, benefits of threads, user and kernel threads.

MODULE – II [14L]

Process Scheduling **[2L]**

Process scheduling, co-operating processes, inter process communication.

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 [10L]

Memory Management **[4L]**

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.

Disk Management **[3L]**

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

MODULE-IV [12L]

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.

Protection & Security **[4L]**

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

Text books

1. Operating System : Concept & Design, Milenkovie M., McGraw Hill.
2. Operating System Design & Implementation, Tanenbaum A.S., Practice Hall NJ.
3. Operating System Concepts, Silbersehatz A. and Peterson J. L., Wiley.

Reference books

1. Operating System, Dhamdhere,TMH
2. Operating Systems, Maxwell McMillan International Editions, 1992.
3. An Introduction to Operating Systems, Dietel H. N., Addison Wesley.

Course Name: DESIGN & ANALYSIS OF ALGORITHMS					
Course Code: INFO3103					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

Course Outcome:

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

1. Demonstrate how the time complexity of an algorithm is defined and analyze the asymptotic performance of algorithms.
2. Understand basic algorithm designing techniques such as divide and conquer, greedy, dynamic programming, branch and bound, backtracking and analyze them.
3. Explain the graph algorithms such as BFS, DFS, Ford Fulkerson Method, etc and analyze them.
4. Synthesize efficient algorithms in common engineering design situations.
5. Exploration of various research problems in algorithm like NP-hard and NP-complete problems.
6. Explain what an approximation algorithm is, and the benefit of using approximation algorithms.

Detailed Syllabus:

MODULE – I [9L]

Introduction: **[3L]**

Properties of an algorithm, Patterns in algorithm, Time and Space Complexity, Different Asymptotic notations – their mathematical significance, The Master theorem, Generating Functions.

Divide and Conquer: **[2L]**

Basic method, Binary Search, Merge Sort, Quick Sort and their complexity.

Matrix Manipulation Algorithm: **[1L]**

Strassen's matrix manipulation algorithm.

Heapsort: **[2L]**

Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues.

Lower Bound Theory: **[1L]**

O(nlgn) bound for comparison sort. Set manipulation algorithm like UNION-FIND.

MODULE – II [12L]

Graph traversal algorithm: **[5L]**

Introduction of Graph, Breadth First Search (BFS), Depth First Search (DFS), Best First Search, Bidirectional Search.

Network Flow: **[3L]**

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration).

Backtracking: **[4L]**

Basic method, 8 queens problem, Graph coloring problem.

MODULE – III [12L]

Greedy Method: **[4L]**

Basic method, Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm, Dijkstra algorithm for single source shortest path

Dynamic Programming: **[8L]**

Basic method, All pair shortest paths, Single source shortest path, Matrix Chain Manipulation, Travelling salesperson problem.

MODULE – IV [8L]

Branch and Bound: **[2L]**

Basic method, 15 puzzles problem.

Notion of NP-completeness: **[3L]**

P class, NP class, NP hard class, NP complete class – their interrelationship, Cook's theorem (Statement only), Satisfiability problem, Clique decision problem, Non-deterministic Algorithm.

Approximation Algorithms: **[3L]**

Necessity of approximation scheme, Polynomial time approximation schemes, Travelling salesman problem.

Books

1. Introduction to Algorithms,T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein,
2. The Design and Analysis of Algorithms ,A. Aho, J.Hopcroft and J.Ullman
3. The Art of Computer Programming ,D.E.Knuth
4. Algorithm Design Jon Kleiberg and Eva Tardos
5. Data Structures and Algorithms" - Vol. I & Vol. 2. K.Mehlhorn
6. Computer Algorithms,S.Baase
7. Fundamentals of Computer Algorithms,E.Horowitz and Shani
8. Combinatorial Algorithms- Theory and Practice ,E.M.Reingold, J.Nievergelt and N.Deo, Prentice Hall, 1997

Course Name: SOFTWARE ENGINEERING					
Course Code: INFO3104					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Prepare software requirement specifications as per IEEE guidelines.
2. Model function-oriented software systems using DFD.
3. Develop object-oriented software systems using ERD, UML.
4. Analyze different approaches of testing methodology in software system.
5. Estimate software size using Function Point Analysis.
6. Work out software project schedule and staffing plan.

Detailed Syllabus:

MODULE-1[11L]

Introduction to Software Engineering [3L]

Software Engineering – objectives and definitions, SDLC – different phases; Lifecycle Models - Waterfall, RAD, Prototyping, Incremental, Iterative, Spiral, Agile, Introduction to DevOps.

Requirements Phase [3L]

Requirements Gathering and Analysis, Requirement Specifications – General Structure of Software Requirement Specifications (SRS).

Structured Analysis Modelling Techniques [4L]

Process Model using Data Flow Diagram (DFD) with examples, Data Dictionary, Decision Tree, Decision Table with examples, Data Model using Entity Relationship Diagram (ERD) with examples.

MODULE-II [10L]

Design Phase [4L]

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

Object Oriented Analysis and Design [6L]

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

MODULE-III [10L]

Coding or Programming [2L]

Programming Principles and Guidelines – Structured Programming, Code Re-use, Coding Standards / Guidelines

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, Stub and Driver, 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-IV [11L]

Software Maintenance **[2L]**

Types of Maintenance – Corrective, Preventive, Adaptive Change Management and Maintenance Process, Introduction to Continuous Integration (CI) and Continuous Deployment (CD).

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 , Detailed COCOMO .

Project Management **[4L]**

Project Management Overview -Planning, Staffing, Execution, Monitoring and Control, Project Scheduling – Work Breakdown Structure (WBS) ,Gantt Charts and PERT diagram.

Configuration Management **[2L]**

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

Books

1. Software engineering - a practitioner's approach - Roger pressman, McGraw hill, New York.
2. Fundamentals of Software Engineering-Rajib Mal,PHI Learning Pvt. Ltd.
3. Software engineering-Ian sommerville, addison-wesley publishing company, England.
4. An integrated approach to software engineering-Pankaj Jalote, Narosa publishing House, New Delhi.
5. The unified modeling language User guide-Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson education, New York.

Course Name: COMPUTER GRAPHICS					
Course Code: INFO3131					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Demonstrate activities and applications of device dependant and independent color models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.
2. Apply DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; to create composite geometric figures.
3. Compare effectiveness of scan line polygon-fill algorithm, boundary fill algorithm, flood fill algorithm, Cohen and Sutherland line clipping, Liang-Barsky line clipping method, Sutherland-Hodgeman Polygon clipping, Weiler Atherton Polygon Clipping.
4. Employ 2D and 3D transformation techniques (translation, rotation, scaling, shearing, reflection)
5. Demonstrate 3D object representation and projection, curve and surface representation techniques using Bezier curves, B-spline curves, and end conditions for periodic B-spline curves, rational B-spline curves algorithms.
6. Describe hidden surface representation using Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal – geometry

Detailed Syllabus:

MODULE – I [10L]
Introduction to computer graphics & graphics systems, Overview & use of computer graphics & Multimedia, Image, Image Processing, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing; Color Models, lookup table, Histogram; Image representing hardwares: Cathod Ray Tube, LCD & LED Display devices, Scanner, Digital Camera. Gamma, Interlacing, properties of display devices, different image formats.
Scan Conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm;

MODULE – II [10L]
Area Filling Algorithms: Scan line polygon-fill algorithm, Boundary fill algorithm, Flood fill algorithm.
2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.
Overview of 3D Transformation

MODULE – III [10L]

Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse, Text clipping. Cohen and Sutherland line clipping, Liang-Barsky line clipping method, Sutherland-Hodgeman Polygon clipping, Weiler Atherton Polygon Clipping.
Overview of 3D Viewing
3D Display: Perspective Projection and Parallel Projection, Vanishing Points, Horizon.
3D Object Representation: Depth Cuing, Polygon Table, Plane Equation, Polygon Mesh.

MODULE – IV [10L]

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

Text Books

1. Computer Graphics (C version 2nd Ed.)- Hearn, Baker – Pearson education
2. Mathematical Elements for Computer Graphics (2nd Ed.)-D. F. Rogers, J. A. Adams — TMH

Reference Books

1. Schaum's outlines Computer Graphics (2nd Ed.) – Z. Xiang, R. Plastock – TMH
2. Fundamental of Computer Graphics, Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, CRC Press
3. Computer Graphics: Theory into Practice Jeffrey McConnell, Jones and Bartlett Publishers

Course Name: DISTRIBUTED DATABASE MANAGEMENT SYSTEMS					
Course Code: INFO3132					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the need of distributed database and various architectures of DDBMS
2. Apply various distribution fragmentation techniques given a problem
3. Apply the different transaction recovery techniques.
4. Analyze and apply query optimization algorithms
5. Compare various approaches to concurrency control in Centralized and Distributed database
6. Design a normalized centralized database, and can convert into distributed database with respect to a given problem

Detailed Syllabus:

MODULE-I [9L]
Introduction to Oracle RDBMS architecture, Relational Algebra, Functional Dependency, Different anomalies in designing a Database.

Normalization using functional dependencies, Lossless Decomposition ,Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

MODULE-II [10L]
Distributed DBMS features and needs. Centralized vs. Distributed DBMS

Distributed DBMS Architecture : Models- Autonomy, Distribution, Heterogeneity
DDBMS Architecture – Client/Server, Peer to peer, MDBS

Design Alternatives – localized data, distributed data
Fragmentation – Vertical, Horizontal (primary & derived), hybrid, general guidelines, correctness rules
Distribution transparency – location, fragmentation, replication
Impact of distribution on user queries – No Global Data Dictionary(GDD), GDD containing location information, Example on fragmentation

MODULE-III [10L]
Distributed Transaction Management & Concurrency Control:
Transaction concept, ACID property, Objectives of transaction management, Types of transactions, Objectives of Distributed Concurrency Control, Concurrency Control anomalies, Methods of concurrency control, Serializability and recoverability, Distributed Serializability, Enhanced lock based and timestamp based protocols, Multiple granularity, Multi version schemes, Optimistic Concurrency Control techniques

Distributed Deadlock & Recovery: Deadlock concept, Deadlock in Centralized systems**,**
Deadlock in Distributed Systems – Detection, Prevention, Avoidance, Wait-Die Algorithm, Wound-Wait algorithm
Recovery in DBMS - Types of Failure, Methods to control failure, Different techniques of recoverability, Write-Ahead logging Protocol,
Advanced recovery techniques- Shadow Paging, Fuzzy checkpoint, ARIES, RAID levels, Two Phase and Three Phase commit protocols

MODULE-IV [10L]
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Evaluation of Expressions. Query Processing in Distributed Systems – Mapping global query to local, Optimization,

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression, Choice of Evaluation Plans. Distributed Query Optimization Algorithms

Text Books

1. Principles of Distributed Database Systems, Ozsu, Pearson Publication
2. Distributed Databases, Sachin Deshpande, Dreamtech

Reference Books

1. Distributed Database Mangement Systems, Rahimi & Haug, Wiley
2. Distributed Database Systems, Chanda Ray, Pearson Publication

Course Name: COMPILER DESIGN					
Course Code: INFO3133					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Explain the concepts and different phases of compilation and design lexical analyzer for a language.
2. Describe and DesignTop Down andBottom Up parsers.
3. Design syntax directed translation schemes for a given context free grammar.
4. Understand and Discuss the concept of Type Checking and Run Time Environments.
5. Generate intermediate code for statements in high level language.
6. Apply optimization techniques to intermediate code and generate machine code for high level language program.

Detailed Syllabus:

MODULE – I [8L]

Introduction to Compiling **[3L]**

Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.

Lexical Analysis **[5L]**

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

MODULE – II [12L]

Syntax Analysis **[8L]**

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation **[4L]**

Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

MODULE – III [11L]

Type checking **[3L]**

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments **[5L]**

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Intermediate code generation **[3L]**

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

MODULE – IV [9L]

Code optimization **[5L]**

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations **[4L]**

Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books

1. Compiler Principles, Techniques and Tools– Aho, Sethi, Ullman - Pearson Education.
2. Compiler Design in C - Holub - PHI.

Reference Books

1. Modern Compiler Implementation in C- Andrew W. Appel- Cambridge University Press

Course Name: INDIAN CONSTITUTION AND CIVIL SOCIETY					
Course Code: INCO3016					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	0

Course Outcome:

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

1. Analyze the historical, political and philosophical context behind the Indian Constitution-making process
2. Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions.
3. Understand the contemporaneity and application of the Indian Constitution in present times
4. Critique the contexts for constitutional amendments in consonance with changing times and society.
5. Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels.
6. Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work.

Detailed Syllabus:

MODULE – I [6L]
Introduction to the Constitution of India-Historical Background,
Making of Indian Constitution -the process of framing the constitution, the constituent assembly.

MODULE – II [6L]
Salient Features of the Indian constitution
Comparison with the constitutions of other countries

MODULE – III [6L]
Relevance of the Constitution of India
Constitution and Governance
Constitution and Judiciary
Constitution and Parliament-Constitutional amendments

MODULE – IV [6L]
Constitution and Society- democracy, secularism, justice
Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental duties

Books

1. Civil Society and Democracy,C.M.Elliot, (ed.), OUP, Oxford, 20012..
2. The Idea of the Modern State, David Held et.al (ed), Open Univ. Press, Bristol, 1993
3. Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

Course Name: ADVANCED JAVA & WEB TECHNOLOGY LAB					
Course Code: INFO3151					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Outcome:

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

1. Design web pages using HTML.
2. Implement CSS and Java Script in HTML pages.
3. Develop Servlet and JSP program.
4. Create database connectivity with the help of JDBC.
5. Develop Cookie based application.
6. Design XML document and DTD.

Syllabus:

1. HTML
2. CSS [Inline, External]
3. JavaScript Control Structure JavaScript Events and Functions
4. JavaScript Validation and implementation in HTML Form
5. Servlet
6. JSP
7. JDBC for Database Connectivity using JSP
8. Java Applet and its implementation through JSP
9. Java Bean Creation
10. Basic Concepts of EJB and RMI and its implementation by creating Bean
11. XML Document Creation, DTD, Schema

Books

1.Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design - Xavier C., New Age Publication.
3. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers

Course Name: OPERATING SYSTEMS LAB					
Course Code: INFO3152					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. Develop and debug programs in UNIX environment.
2. Develop shell scripts to manage the system memory, user, files, and devices.
3. Develop multi-processing and multi-threading environment capable of performing multiple tasks or sub-tasks simultaneously.
4. Apply system calls and signals for user defined purposes
5. Design a synchronized multi-threaded system capable of resource sharing
6. Develop C programs to share information between two process using concepts of IPC.

Syllabus:

1. **Managing Unix/Linux Operating System [8P]:** Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. **Process [4P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3.**Signal [4P]:** 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 [6P]:** programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication [6P]:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Text Books

1. UNIX and Shell Programming, Thomson, 2003. Behrouz A. Forouzan, Richard F. Gilberg,
2. The UNIX Programming Environment, Brian W. Kernighan, Rob Pike, PHI, 1996.
3. Understanding UNIX, K. Srirengan, , PHI 2002.

Reference books

1. Your UNIX- The Ultimate Guide, Sumitabha Das, TMGH, 2002.
2. UNIX Concepts and Applications, Sumitabha Das, Second Edition, TMGH, 2002.

Course Name: DESIGN & ANALYSIS OF ALGORITHMS LAB					
Course Code: INFO3153					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Outcome:

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

1. Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.
2. Reconstruct the solution to a problem to achieve optimum solution in terms of time complexity.
3. Design and implement an algorithm using the technique of divide-and-conquer and greedy method.
4. Design and implement different Graph traversal algorithms (BFS and DFS).
5. Solve different problem using the technique of backtracking and branch and bound algorithms.
6. Solve different problem using the technique of dynamic programming algorithms.

Syllabus:

Programming Language used: C

Lab:1 : Divide and Conquer :
Implement Binary Search using Divide and Conquer approach
Implement Merge Sort using Divide and Conquer approach

Lab:2 : Divide and Conquer :
Implement Quick Sort using Divide and Conquer approach
Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab:3 : Graph Traversal Algorithm :
Implement Breadth First Search (BFS)
Implement Depth First Search (DFS)

Lab:4 : Greedy method:
Fractional Knapsack Problem
Job sequencing with deadlines

Lab:5 : Greedy method (implement any two of the following problems) :
Minimum Cost Spanning Tree by Prim's Algorithm
Minimum Cost Spanning Tree by Kruskal's Algorithm
Single Source shortest Path for a graph (Dijkstra)

Lab:6 : Dynamic Programming :
Find the minimum number of scalar multiplication needed for chain of matrix

Lab:7 : Dynamic Programming :
Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm)
Implement Traveling Salesman Problem

Lab:8*:* Dynamic Programming :
Implement Single Source shortest Path for a graph (Bellman Ford Algorithm)

Lab:9 *:* Backtracking :
Implement 8 Queen problem

Lab:10 *:* Backtracking :
Graph Coloring Problem

Lab:11 *:* Brunch and Bound :
Implement 15 Puzzle Problem.

Books

1. Introduction to Algorithms,T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein,
2. The Design and Analysis of Algorithms,A. Aho, J.Hopcroft and J.Ullman
3. Fundamentals of Computer Algorithms,E.Horowitz and Shani
4. Let Us C, Y. Kanetkar,
5. Programming with C, B. S. Gottfried,
6. The C Programming Language,,B.W. Kernighan and D. M. Ritchie, “

Course Name: SOFTWARE ENGINEERING LAB					
Course Code: INFO3154					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. Prepare SRS document for sample application system as per IEEE guidelines.
2. Design sample software application problem using various UML diagrams (e.g. Class Diagram, Use Case Diagram, Sequence Diagram and activity Diagram) using tools like DIA.
3. Design sample software application problem using Data Flow Diagram (upto level 2) using tools like Libre office.
4. Design sample software application problem using Entity Relationship Diagram using tools like Libreoffice.
5. Prepare test cases for sample application module.
6. Prepare project schedule and staffing plan for sample application system using tools like Planner.

Syllabus:

1. Preparation of SRS document for a sample software project in standard format.
2. Preparation of Project Schedule and Staffing Plan for sample software project using tools.
3. Preparation of DFD (upto level 2) and ERD diagram for sample application problems.
4. Preparation of UML Diagrams for sample application problems – Class Diagrams, Sequence Diagrams, Use Case Diagrams and Activity Diagrams using tools.
5. Preparation of Test Cases for sample application module (small module).

Following projects can be used as dummy projects:

- Library Management System
- Railway Reservation System
- Employee Payroll System
- Online Banking System
- Online Shopping Cart
- Online Examination System

Books

1. UML:A Begginers guide- Jason T. Roff,McGraw Hill,New york
2. The UML User guide- G. Booch,J. Rambaugh, I. Jacobson,Pearson education,New York.
3. Fundamentals of software engineering - Rajiv Mall,PHI learning Pvt Ltd

3rd Year 2nd SEMESTER

Course Name: ECONOMICS FOR ENGINEERS					
Course Code: HMTS3201					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Evaluate a project and estimate the total cost of the project
2. Apply financial analytical methodologies to prepare a report regarding the financial performance of an organization
3. Participate actively in an organization's capital budgeting process
4. Provide vital inputs regarding the pricing of a product
5. Apply the knowledge of the interplay of various economic variables and indicators in workplace
6. Provide insight about different accounting concepts and apply broader concepts like costs, revenues, assets, liabilities, capital, profit, investment and interest

Detailed Syllabus:

MODULE-I [6L]
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.

MODULE-II [4L]
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.

MODULE-III [8L]
Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet. Financial Statement Analysis (Ratio and Cash Flow analysis).

MODULE-IV [6L]
Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs. Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis. Marginal Cost based decisions.

MODULE-V [4L]
Time Value of Money: Present and Future Value, Annuity, Perpetuity. Equity and Debt, Cost of Capital.

MODULE-VI [8L]
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.

Books

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

Course Name: COMPUTER NETWORKS					
Course Code: INFO3201					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the fundamental concepts of data communication and networking, layered models, protocols, networking devices.
2. Understand theoretical basis for data communication, digital and analog transmission, multiplexing, switching, transmission media.
3. Illustrate data link layer services, framing, error control, flow control, data link layer protocols and various channel access protocols.
4. Examine various routing algorithms, addressing schemes and different network layer protocols.
5. Evaluate different Internet transport protocols, techniques for congestion control and QoS provisioning.
6. Design network applications using different application layer protocols.

Detailed Syllabus:

MODULE – I [10L]

Introduction: Data communications, Direction of data flow - Simplex, Half-duplex, Full-duplex, Topology – Bus, Ring, Mesh. Star & Hybrid, Types of Network - LAN, MAN 7 WAN, Protocols, Reference models – OSI & TCP/IP reference model & comparative study.

Physical Layer: Transmission media - Guided & Unguided, Switching – Circuit, Packet & Message, Telephone Network, Network Devices: Repeaters, Hubs, Bridges, Switches, Router and Gateway.

Data link Layer: Types of Errors, Error Detection – Parity, CRC & Checksum, Error Correction – Hamming Code

MODULE – II [10L]

Data link Layer: Flow Control – Stop-n-Wait & Sliding Window Protocol, ARQ Techniques – Stop-n-Wait, Go-Back- N & Selective Repeat, Framing, Bit & Byte Oriented Protocol, HDLC, Point to Point Protocol (PPP), Token Ring, FDDI and Ethernet Protocols, Reservation, Polling, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

MODULE – III [10L]

Network Layer: Internet Protocol (IP), IPv4 vs IPv6, ARP & RARP, IP Addressing – Classful & Classless, Subnetting, VLSM, CIDR. Routing - Techniques, Static, Dynamic & Default Routing, Unicast Routing Protocols - RIP, OSPF, BGP

MODULE – IV [10L]

Transport Layer: Process to Process delivery; UDP; TCP; Congestion Control - Open Loop, Closed Loop, Quality of service, Techniques to improve QoS - Leaky bucket & Token bucket algorithm.
Application Layer Protocols: DNS, SMTP, FTP & DHCP.

Text Books

Computer Networks (4th Ed.) – A. S. Tanenbaum –Pearson Education/PHI

Reference Books

1. Data Communications and Networking (3rd Ed.) – B. A. Forouzan –TMH
2. Data and Computer Communications (5th Ed.) – W. Stallings –PHI/ Pearson Education
3. Computer Networking -A top down approach featuring the internet– Kurose and Rose –Pearson Education
4. Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.) – Comer –Pearson Education/PHI

Course Name: DATA ANALYTICS					
Course Code: INFO3202					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Compare among the different clustering algorithms and apply a suitable algorithm to cluster real life data sets.
2. Apply appropriate classification algorithm to classify an unknown dataset.
3. List the components of Hadoop and Hadoop Eco-System.
4. Access and Process Data on Distributed File System.
5. Analyze the performance of the algorithms.
6. Develop Big Data Solutions using Hadoop Eco System.

Detailed Syllabus:

MODULE-1 [12L]
Un Supervised learning Techniques
Concepts of Data, Multidimensional data, categories of variables: numerical(discrete, continuous), categorical, ordinal:Basic issues in clustering, Clustering Paradigms:Partitioning methods: k-means, expectation maximization (EM):Soft Clustering**:** Fuzzy c means:Density based clustering: DBSCAN:
Hierarchical methods**:** Agglomerative, divisive Approach, ROCK:Problems solving on all the cluster methods

MODULE-II [9L]
Supervised Learning Techniques
Classification: Introduction, concept of training and test datasets, class levels
Decision tree algorithms: ID3, C4.5
Naïve Bayes classification, K nearest neighbors, Concepts of statistical metrics for performance evaluation

MODULE-III [10L]
Introduction to Big Data and Hadoop: Types of Digital Data, Introduction to Big Data, Big Data Properties, Examples of Big data, History of Hadoop, Apache Hadoop, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System. Google file system (GFS).
HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow

Map Reduce Anatomy: Introduction, Mapper concept, Reducer concept, Input splits, Master Processes, Slave processes, Map Reduce Job Run, Job Scheduling, Mapping, Shuffling and Sorting, Reducing, Task Execution, Replicas, Failures, Recovery

MODULE-IV [10L]
NoSQL Databases:
Hbase: Introduction, Hbase vs. RDBMS, HBase architecture, HBase Table design, concept of regions, Hfiles, storage in Hbase, Accessing in HBase
MongoDB: Introduction, RDBMS vs. MongoDB, MongoDB architecture, Table design and Accessing

Text Books

1. Data Mining: Concepts and Techniques, 2nd Edition Han, J. and Kamber, M., , Morgan Kaufmann, 2006 .
2. Data Mining Techniques, K. Pujari : Universities Press.
3. Data Mining Introductory & Advanced Topic, Dunham: Pearson Education.
4. Hadoop: The Definitive Guide, Tom White: O'Reilley.

Reference Books

1. Introduction to Data Mining, P. Tan, M. Steinbach and V. Kumar, Addison Wesley, 2006.
2. Data Science for Business: What you need to know about data mining and data-analytic thinking, Foster Provost & Tom Fawcett: O'Reilley.
3. Agile Data Science: Building Data Analytics Applications with Hadoop, Russell Jurney: O'Reilley.
4. Instant MapReduce Patterns - Hadoop Essentials How-to,Srinath Perera: Packt Publication

Course Name: MULTIMEDIA TECHNOLOGY & APPLICATIONS					
Course Code: INFO3231					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1.Demonstrate activities and applications of device dependant and independent color models, image representation techniques (raster and random graphics), activities of image processing and representation techniques.
2. Compare between image (.bmp, .jpg, .gif, .tiff), audio (.wav, .midi, .mp3), text (.txt, .doc, .pdf) and video (.mpeg, .wmv, .swf) formats according to their way of representing data, merits and demerits
3. Demonstrate image, video, text analysis tools and techniques.
4. Demonstrate and compare compression techniques based on their applications.
5. Explain the storage, indexing and searching process in multimedia database management system and how they are different from their counterparts of conventional DBMS.
6. Understand Multimedia document architecture, importance of synchronization and specific applications of Multimedia.

Detailed Syllabus:

MODULE – I [8L]
Introduction to Multimedia systems, Overview & use of Multimedia, Image, Image Processing, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing; Color Models, lookup table, Histogram; Image representing hardwares: Cathod Ray Tube, LCD & LED Display devices, Scanner, Digital Camera. Gamma, Interlacing, properties of display devices, different image formats. Concepts of Dithering, Image Tones, Layers, Color and Alpha Channels.

MODULE – II [10L]
Text: Different types of text representation, Hypertext, text representation formats.
Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI
Animation: Techniques of 2D & 3D animation, formats of Animation
Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture

MODULE – III [10L]
Compression Techniques: Lossy and Lossless Compressions, RLE, Huffman Encoding, LZW Encoding Techniques, Quantization; JPEG, MPEG compression techniques.
Document Architecture and Content Management: Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

MODULE – IV [10L]

Image and Video Database: Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC,Video Content, querying, video segmentation, indexing

Synchronization: Temporal relationships, synchronization accuracy specification factors, quality of service

Multimedia Applications: Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors.

Text Books

1. Multimedia: Computing, Communications & Applications,Ralf Steinmetz and Klara Nahrstedt , Pearson Ed.
2. Priciples of Multimedia, Ranjan Parekh, Tata McGraw-Hill Education

Reference Books

1. Multimedia Systems Design , Prabhat K. Andleigh & Kiran Thakrar , PHI.
2. Multimedia Information System , Nalin K. Sharda , PHI.
3. Multimedia Communications ,Fred Halsall , Pearson Ed.
4. Multimedia Systems , Koegel Buford , Pearson Ed.
5. Multimedia Literacy , Fred Hoffstetter , McGraw Hill.
6. Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing ,Ralf Steinmetz and Klara Nahrstedt , PHI.
7. Multimedia in Practice: Technology and Application , J. Jeffcoate , PHI.

Course Name: E-COMMERCE & ERP					
Course Code: INFO3232					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the basics of E-commerce system
2. Choose right kind of hardware and software platforms for the E-commerce system they are building
3. Understand EDI, B2B, B2C, C2C, m-commerce, E-Governance – the varied aspects of E-commerce
4. Understand the importance of security in E-commerce
5. Understand E-commerce marketing concepts, dimensions and technologies
6. Define the major ERP components, including Sales and Marketing, Accounting and Finance, Production and Materials Management and the relationship between E-business and ERP

Detailed Syllabus:

MODULE – I [8L]

Electronic Commerce: Overview, Definitions, Advantages & Disadvantages of E – Commerce, Drivers of E – Commerce, Myths, Dot Com Era,E-business. Technologies :Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems, Wireless Application Protocol: Defn. Hand Held Devices, Mobility &Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . Electronic Data Interchange (EDI): Meaning, Benefits, Concepts, Application, EDI Model, EDIFACT standard, Internet EDI

MODULE – II [10L]

Business Models of e – commerce:

Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance, m-commerce. E – strategy: Overview, Strategic Methods for developing E – commerce. B2B E-commerce: Collaborative Commerce Supply Chain Management: E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, effect of different technologies on Supply Chain Mnagement.

MODULE – III [10L]

E – Payment Mechanism: Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. E – Marketing: Home –shopping, E-Marketing, Tele-marketing

Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

MODULE – IV [8L]

Enterprise Resource Planning (ERP): Features, capabilities and Overview of Commercial Software, reengineering work processes for IT applications, Business Modules: Sales and Marketing with a special focus on Customer Relationship Management (CRM), Accounting and Finance, Production and Materials Management with a special focus on SCM & SRM.

ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Business, ERP and Internet, Future Directions in ERP.

Text Books

1. E-Commerce Business. Technology. Society by Kenneth C. Laudon, Carol G. Traver, Pearson Education
2. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
3. Enterprise Resource Planning by Mary Sumner, Pearson Education

Reference Book

Electronic Commerce 2010 A Managerial Perspective by Efraim Turban, David King, Jae Lee, Ting-Peng Liang, Deborrah Turban

Course Name: CRYPTOGRAPHY & NETWORK SECURITY					
Course Code: INFO3233					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Define the concepts of Network security. Classify different types of attack on Network security. Recall the principles of security.
2. Classify different kinds of Substitution techniques and Transposition techniques and illustrate the concepts of Symmetric key cryptography and Asymmetric key cryptography. Discuss in detail DES, RSA, IDEA and RC5 algorithm.
3. Solve numerical based on DES and RSA. Analyze the concept of SSL, PGP and PEM. Explain VPN. Compare MAC, Message Digest and Hash function.
4. Analyze MD5 Message Digest algorithm and HMAC algorithm. Illustrate Digital Signature.
5. Explain Authentication token and Classify between different types of Authentication tokens. Compare Certificate based authentication and Biometric Authentication
6. Explain the concepts of Firewall and DMZ Network. Compare between Packet filtering router, Application-level gateway and Circuit-level gateway. Classify between different Firewall Configurations.

Detailed Syllabus:

MODULE – I [8L]

Network Security and Cryptography- Concepts and Techniques

Need for Security, Security approaches, Principles of Security, Types of Active attack and Passive attack. Introduction to cryptography, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Types of Cipher, Cryptanalysis and Brute-force attack, Type of attacks on encrypted text, Symmetric & Asymmetric key Cryptography.

MODULE – II [10L]

Symmetric Key Algorithms

Algorithm types & Modes, Overview of Symmetric Key Cryptography, Diffie-Hellman key exchange algorithm, Digital Envelope, DES(Data Encryption Standard) algorithm & its variant, IDEA(International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm.

MODULE – III [11L]

Asymmetric Key Algorithms, Digital Signature and User Authentication

Overview of Asymmetric key Cryptography, RSA algorithm, Digital Signature, Basic concepts of Message Authentication code, Message Digest and Hash Function. MD5 and HMAC algorithm. Authentication Basics, Password, Authentication Token, Certificate based Authentication and Biometric Authentication.

MODULE – IV [11L]

Electronic mail security, SSL and Firewall

Basics of e-mail security, PEM & PGP. Introduction to Virtual Private Network (VPN). Secure Socket Layer (SSL) protocol. Introduction to Firewall, Characteristics of Firewall, Types of Firewall: Packet filtering router, Application-level gateway and Circuit-level gateway. Bastion Host, Firewall Configurations and DMZ Network.

Text Books

1. "Cryptography and Network Security", William Stallings, 3rd Edition, Pearson Education Asia
2. Cryptography & Network Security: Atul Kahate, TMH.

Reference Books

1. "Cryptography and Network Security", Behrouz A. Forouzan, Special Indian Edition, 2007, TMH
2. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
3. "Cryptography and Security", C K Shyamala, N Harini and Dr T R Padmanabhan, Wiley India
4. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson.

Course Name: DIGITAL IMAGE PROCESSING					
Course Code: INFO3234					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Review the fundamental concepts of a digital image processing system.
2. Apply different techniques employ for the enhancement of images in spatial domain.
3. Explain different causes for image degradation and apply image restoration techniques.
4. Apply different techniques employ for the enhancement of images in frequency domain.
5. Understand the need for image compression and explain different techniques of image compression.
6. Apply different feature extraction techniques for image analysis and recognition.

Detailed Syllabus:

MODULE – I [9L]

Introduction: Overview of Image Processing, Application area of image processing, Digital Image Representation, Sampling & quantization. Spatial and Intensity resolution, interpolation, Relationship between pixels – Neighbors, Adjacency, connectivity, Regions, Boundaries and Distance,

Image Enhancement in Spatial Domain: Image Quality and Need for image enhancement, Intensity transformation – negative, log, power-law and contrast stretching (linear and non-linear) Histogram based techniques, Spatial Filtering concepts, Spatial Convolution and Correlation, Image smoothing and Sharpening spatial filters

MODULE – II [9L]

Image Enhancement in Frequency Domain: Properties of 1-D and 2-D Discrete Fourier Transform (DFT), Basic of filtering in the frequency domain. Image smoothing and sharpening in frequency domain.

Image Restoration: Introduction to degradation, Types of Image degradations, image degradation models, noise modeling, Estimation of degradation functions, Image restoration in presence of noise only – spatial filtering, Periodic noise and band – pass and band reject filtering.

MODULE – III [10L]

Image Compression: coding redundancy, Image compression model, Compression Methods – Huffman coding, Arithmetic coding, LZW coding, Run-length coding, Predicative coding and Vector quantization

MODULE – IV [10L]

Image Segmentation: Introduction, Detection of Discontinuities, Point Detection, Line Detection and Edge Detection, Thresholding – Local, Global, Optimum, Multiple and Variable, Hough Transforms, Principle of region – growing, splitting and merging.

Text Books

1. Digital Image Processing, Rafael C. Gonzalez, Richard E woods, Pearson.

Reference Books

1. Fundamentals of Digital Image Processing, Anil K Jain, Pearson.
2. Digital Image Processing, S. Sridhar, OXFORD University Press, Second Edition.
3. Digital Image Processing and Analysis, Bhabatosh Chanda, Dwijesh Dutta Majumder, Prentice Hall of India

Course Name: ADVANCED PROBABILITY AND INFORMATION THEORY					
Course Code: MATH3222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

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 selecting the preferred one in a specific context.
3. Formulate predictive models to tackle situations where deterministic algorithms are intractable.
4. Quantifies the amount of uncertainty involved in the value of a random variable or the outcome of a random process.
5. Apply the data processing inequality to data science, machine learning and social science.
6. Develop the concept of data compression in the process of encoding information in signal processing.

Detailed Syllabus:

MODULE – I

Single and Bivariate Probability Distributions

- Review of basic probability : Axiomatic definition,Addition and Multiplication law, Conditional probability and Bayes' Theorem
- Expectation and Variance of single variable discrete and continuous distributions
- Covariance and variance of sums of random variables
- Moment generating functions
- Markov's inequality, Chebyshev's inequality and law of large numbers
- Joint distribution using joint probability mass/density function
- Finding marginal pmf/pdf from joint distribution
- Multiplicative property of joint pmf/pdf in case of independent random variables

MODULE-II

Markov Chains and Statistical Methods

- Markov Chains: Introduction
- Chapman-Kolmogorov equations
- Classification of states
- Some applications: Gambler's Ruin Problem
- Measures of Central tendency: Moments, skewness and Kurtosis

- Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions
- Spearman's Rank Correlation coefficient
- Curve fitting: Straight line and parabolas

MODULE-III

Classical Information Theory-I

- Motivation with some relevant examples
- Entropy : Definition with examples
- Joint Entropy and Conditional Entropy
- Relative Entropy and Mutual Information
- Relationship Between Entropy and Mutual Information
- Chain Rules for Entropy, Relative Entropy and Mutual Information
- Jensen's Inequality and Its Consequences
- Log Sum Inequality and Its Applications

MODULE-IV

Classical Information Theory-II

- Data-Processing Inequality
- Sufficient Statistics
- Fano's Inequality
- Asymptotic Equipartition Property Theorem
- Consequences of the Asymptotic Equipartition Property Theorem: Data compression
- High probability sets and the Typical set

Books

1. "Introduction to Probability Models", S.M.Ross, Elsevier.
2. "Fundamentals of Mathematical Statistics", S.C.Gupta and V.K.Kapoor, Sultan Chand and Sons.
3. "An Introduction to Probability theory and its applications", Vol-I, W. Feller, John Wiley and Sons.
4. "Elements of Information Theory", Thomas M. Cover and Joy A. Thomas, Wiley.
5. "Information Theory and Reliable Communication", Robert G. Gallager, John Wiley and Sons.

Course Name: SCIENTIFIC COMPUTING					
Course Code: MATH3223					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Analyze certain algorithms, numerical techniques and iterative methods that are used for solving system of linear equations.
2. Implement appropriate numerical methods for solving advanced engineering problems dealing with interpolation, integration and differentiation.
3. Apply the knowledge of matrices for calculating eigen values and eigenvectors and their stability for reducing problems involving Science and Engineering
4. Develop an understanding to reduce a matrix to its constituent parts in order to make certain subsequent calculations simpler.
5. Develop the concept of predictor-corrector methods in solving Initial Value Problems numerically.
6. Apply numerical techniques in solving Boundary Value Problems where the analytical methods fail.

Detailed Syllabus:

MODULE – I [9L]
***System of Linear Equations*:**

- Linear systems, solving linear systems
- Gauss elimination, pivoting and scaling, Gauss-Jordan method
- Symmetric positive define systems and indefinite systems, Cholesky factorization
- Iterative method: Gauss Jacobi and Gauss Seidel, Error prediction and acceleration

MODULE – II [9L]
***Eigen Value problems*:**

- QR algorithm
- Power Method
- Linear least square data fitting
- Singular Value Decomposition

MODULE – III [9L]

***Interpolation, Integration & Differentiation*:**

- Purpose of interpolation
- Choice of interpolating function, Polynomial interpolation
- Piecewise polynomial interpolation: cubic spline interpolation
- General form of quadrature rule; Newton-Cotes rule, Gaussian quadrature rule

Numerical Differentiation: Methods Based on Finite Difference approximations

MODULE – IV [9L]

***Initial Value & Boundary Value Problem*:**

- Multistep method to solve Initial Value Problem and its stability
- Predictor-corrector method: Adam Moulton method, Milne's Method
- Solving Boundary Value Problems: Finite Difference Method, Shooting Method

Text Books

1. Numerical Linear Algebra, Trefethen L. N. and Bau D. SIAM
2. Fundamentals of Matrix Computation, Watkins D. S. Wiley
3. Numerical Solutions to Partial Differential Equations,Smith G. D. Oxford University Press
4. Numerical methods for scientific and engineering computation Jain M. K. and Iyengar S.R.K.
5. Elementary Numerical Analysis - An Algorithmic Approach, Conte S. D. and BoorC. D. McGraw Hill
6. Introduction to Numerical Analysis,Atkinson K. E. John Wiley

Reference Books

1. Matrix Computation, Golub G. H. and Van Loan C.F. John Hopkins U. Press, Baltimore
2. Introduction to Matrix Computations, Stewart G. W. Academic Press
3. Applied numerical linear algebra, Demmel J.WSIAM, Philadelphia
4. Numerical Solutions of Differential Equations Jain M.K.
5. Numerical solutions of partial Differential Equations (Finite difference methods)Smith,
6. Scientific Computing: An Introductory Survey, Heath M. T., McGraw Hill
7. Numerical Methods for Engineers and Scientists, Joe D. Hoffman, McGraw Hill
8. Numerical Linear Algebra.W. Layton and M. Sussman,

Course Name: FUNDAMENTALS OF CIRCUIT THEORY					
Course Code: ELEC3221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Develop basic concepts of circuit analysis using different mathematical approaches
2. Make use of network theorems to solve electrical circuits having both dependent and independent sources.
3. Understand different electrical waveforms, signals and their applications to analyze electrical circuits
4. Apply Laplace Transform technique for solving transient problems of electrical circuits.
5. Analyze electrical circuits using the concept of graph theory.
6. Obtain the equivalent representation of electrical circuits using two-port network parameter representation.

Detailed Syllabus:

MODULE-I [8L]
Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis of electrical circuits.
Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer theorem applied to circuits containing dependent sources.

MODULE-II [8L]
Laplace Transform: Concept of complex frequency. Properties of Laplace transform: linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents. Transient and steady state response of switching circuit containing RL, RC, LC and RLC with or without stored energy.

MODULE-III [8L]
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.

MODULE-IV [8L]
Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance.

Text Books

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis, M.E. Valkenburg, Pearson Education
3. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference Books

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 Name: DESIGNING WITH PROCESSORS AND CONTROLLERS					
Course Code: ECEN3222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand microprocessors and microcontrollers – their operation and programming.
2. Identify RISC processors from CISC processors and apply them in circuits.
3. Analyze operations of different serial and parallel buses and interrupts.
4. Evaluate different hardware designs and memory configurations.
5. Write RTOS for complex processor-based designs.
6. Design processor and controller based intelligent systems for real life problems.

Detailed Syllabus:

MODULE – I [8L]
Designing with microprocessors and microcontrollers- the issues and solutions, Embedded systems VS General computing systems, Purpose of Embedded systems, optimizing design metrics, prominent processor and controller technology, RISC vs CISC.

MODULE – II [10L]
Devices and Communication Buses: 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. 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, few types of Sensors and actuators.

MODULE – III [10L]
Memory: SRAM, DRAM, EEPROM, FLASH, CACHE memory organizations, (direct, associative,set associative mapping), Virtual memory, organization, mapping and management techniques,Fundamental issues in Hardware software co-design, Unified Modeling Language (UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system. Introduction to ARM architecture, Processor design, ARM organization and implementation.

MODULE – IV [8L]
Real Time Operating Systems : Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS. Resource Management/scheduling paradigms: static priorities, static schedules, dynamic scheduling, best effort current best practice in scheduling (e.g. Rate Monotonic vs. static schedules), Real-world issues: blocking, unpredictability, interrupts, caching, Examples of OSs for embedded systems - RT Linux, VRTX, Mobile phones, RFID.

Books

1. "The Art of Designing Embedded Systems", Jack Ganssle, (Newnes), 1999.
2. "An Embedded Software Primer", (Addison Wesley), David Simon, 2000.
3. RTS: Real-Time Systems, by C.M. Krishna and Kang G. Shin, McGraw-Hill, 1997,ISBN 0-07-057043.
4. Advances in Hard Real-Time Systems, IEEE J. A. Stankovic and K. Ramamritham, Computer Society Press, Washington DC, September 1993, 777 pages.Selected papersand references
5. Introduction to Embedded Systems :Shibu K. V. (TMH)
6. Embedded System Design – A unified hardware and software introduction: Frank Vahid, Tony Givargis, (John Wiley)
7. Embedded Systems :Rajkamal (TMH)
8. Embedded Systems : L. B. Das (Pearson)
9. Embedded System design : S. Heath (Elsevier)
10. Embedded microcontroller and processor design: G. Osborn (Pearson)
11. ARM System-on-Chip Architecture, Steve Furber, (Pearson)

Course Name: COMPUTER NETWORKS LAB					
Course Code: INFO3251					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcome:

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

1. Understand the concepts of NIC installation and configuration.
2. Demonstrate Socket programming to design client server environment.
3. Develop an application to execute command remotely using socket programming.
4. Develop a file transfer application using socket programming.
5. Learn to gather network information using socket programming.
6. Develop different ARQ techniques using socket programming.

Syllabus:

1. NIC Installation & Configuration
2. TCP/UDP Socket Programming – Introduction
3. Sockets – Operation, Socket types, Domains, Closing Sockets
4. Client/Server Models - Usage
5. Connection Based Services - Client and Server actions
6. Connectionless Services - Client and Server actions
7. Access Network Database - Host Information, Network Information, Protocol Information
8. Implement Multicasting / Broadcasting socket I/O.
9. Implement ARQ techniques.

Books

1.Unix Network Programming, Richard Stevens, Bill Fenner, and Andrew M. Rudoff, Volume1, 3rd Edition, A ddison-Wesley, 2004.

Course Name: DATA ANALYTICS LAB					
Course Code: INFO3252					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes

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

1. Learn core programming basics and program design with functions using Python programming language.
2. Implement Python programs to solve real world problems
3. Use the Numpy and pandas for performing complex numerical analysis tasks
4. Produce high quality 2D data visualizations using Matplotlib
5. Analyse real world datasets and apply suitable clustering algorithms to group data based on similarity
6. Develop models to classify an unknown dataset

Syllabus:

Unit - I
Introduction to python, Installing python, Basics of python.
Decision Structures: if, if-else, if-elif-else Statements, Nested Decision Structures,
Repetition Structures: Introduction, while loop, for loop, Nested Loops.
Functions and Modules, Useful Built-in Functions.

Unit - II
Strings Handling, Regular Expressions
Copying Lists, Processing Lists, Two-Dimensional Lists.
Tuples Sequences, Tuples, Dictionaries and Sets.
Introduction to math library, Handling random numbers

Unit – III
Understanding the Data, Python Packages for Data Science, Importing and Exporting Data in Python, Creating, loading and accessing csv files
Numpy: Creation of arrays, Array types and attributes, Indexing, slicing, Aggregations: max, min, sum, mean, standard deviation
Pandas: Creation of Data Frames, Accessing columns and rows of a data frame, Summary statistics, Missing data,Converting columns from one type to another
Matplotlib: Simple figure, Subfigures, Other data visualization libraries for Python

Unit – IV
Data Analysis: Loading and Preprocessing sample dataset
Clustering Dataset: Partitioning, Hierarchical techniques, plotting
Classifying Dataset: Preparing training and test dataset, Preparing Models using Supervised learning techniques, summary statistics

Text Books

1. The Fundamentals of Python: First Programs, 2011, Kenneth A. Lambert, Cengage Learning.
2. Python for Data Analysis, by Wes McKinney, 2nd Editions, O'Reilly, 2017.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing

Reference Books

2. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
3. Beginning Python using Python 2.6 and Python 3, James Payne, Wrox publishing
4. Practical Programming: An Introduction to Computer Science using Python 3Paul Gries, ,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)
5. Python Data Science Essentials, Third Edition, by Alberto Boschetti and Luca Massaron, Packt Publishing, 2018.

Course Name: TERM PAPER AND SEMINAR					
Course Code: INFO3293					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Outcomes

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

1. Demonstrate the presentation skills.
2. Demonstrate the discussion skills.
3. Acquire the listening skills.
4. Acquire the argumentative skills and critical thinking.
5. Demonstrate the questioning skills.
6. Acquire the interdisciplinary inquiry.

Open Elective -1 (to be offered by IT Department)

Course Name: INTRODUCTION TO E-COMMERCE					
Course Code: INFO3221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the basics of E-commerce system
2. Choose right kind of hardware and software platforms for the E-commerce system they are building
3. Understand EDI, B2B, B2C, C2C, m-commerce, E-Governance – the varied aspects of E-commerce
4. Understand the importance of security in E-commerce
5. Understand E-commerce marketing concepts, dimensions and technologies
6. Understand how different emerging technologies are reshaping E-commerce

Detailed Syllabus:

MODULE – I [8L]
Electronic Commerce: Overview, Definitions, Advantages & Disadvantages of E – Commerce, Drivers of E – Commerce, Myths, Dot Com Era,E-business. Technologies :Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems, Wireless Application Protocol: Defn. Hand Held Devices, Mobility &Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . Electronic Data Interchange (EDI): Meaning, Benefits, Concepts, Application, EDI Model, EDIFACT standard, Internet EDI

MODULE – II [10L]
Business Models of e – commerce:
Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance, m-commerce. E – strategy: Overview, Strategic Methods for developing E – commerce. B2B E-commerce: Collaborative Commerce Supply Chain Management: E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, effect of different technologies on Supply Chain Mnagement.

MODULE – III [10L]
E – Payment Mechanism: Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. E – Marketing: Home –shopping, E-Marketing, Tele-marketing
Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

MODULE – IV [8L]
Emerging technologies like Virtual/Augmented Reality, Blockchain, Internet of Things, AI and Machine Intelligence – how these technologies are influencing E-commerce.

Text Books

1. E-commerce Business. Technology. Society by Kenneth C. Laudon, Carol G. Traver, Pearson Education.
2. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH.

Reference Book

1. Electronic Commerce 2010 A Managerial Perspective by Efraim Turban, David King, Jae Lee, Ting-Peng Liang, Deborrah Turban.

4th Year 1st SEMESTER

Course Name: PRINCIPLES OF MANAGEMENT					
Course Code: HMTS4101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Study the evolution of Management.
2. Understand various management functions and has some basic knowledge on different aspects of management.
3. Understand the planning process in an organization.
4. Understand the concept of organizational structure.
5. Demonstrate the ability to direct, lead and communicate effectively.
6. Analyse and isolate issues and formulate best control methods.

Detailed Syllabus:

MODULE-I [8L]

Introduction

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.

Types of Business organization -Sole proprietorship, partnership, company-public and private sector enterprises -Organization culture and Environment –Current trends and issues in Management.

MODULE-II [8L]

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

Organizing: Nature and Purpose-Formal and informal, organizational chart, organization structure-types-line and staff authority, departmentalization, delegation of authority, centralization and decentralization.

Controlling: Concept, planning-control relationship, process of control, Types of Control, Control Techniques

Human Resource Management-HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

MODULE-III [8L]

Directing: Foundations of individual and group behavior –motivation –motivation theories –motivational-Techniques –job satisfaction –job enrichment –leadership –types and theories of leadership –Communication –process of communication –barrier in communication –effective communication –communication and IT

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

Coordinating: Concepts, issues and techniques.

MODULE-IV [8L]

Leading: Managing Communication: Nature & function of communication, methods of interpersonal communication, barriers of effective communication, direction of communication flow, role of technology in managerial communication

Motivating Employees: Define motivation, compare and contrast early theories of motivation, compare and contrast contemporary theories of motivation & current issues.

Being an Effective Leader Define leader/ leadership, compare and contrast early theories of leadership, understand three contingency theories, understand modern views on leadership. Motivation, Leadership, Communication, Teams and Teamwork.

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

Books:

1. Stephen P. Robbins and Mary Coulter, "Management", Pearson Education, 2017, 13th edition
2. Koontz H. and Weihrich H., "Essentials of Management", Mcgraw Hill Int. Ed., 2015, 10th edition
3. Bhat A. and Kumar A. "Management: Principles, Processes & Practices", Oxford University Press, 2016, 2nd edition
4. Robbins, Coulter and DeCenzo, "Fundamentals of Management", Pearson Education, 2016, 9th edition
5. Richard L. Daft, "Management", Cengage Learning, 10th edition

Course Name: INTRODUCTION TO INTERNET OF THINGS					
Course Code: INFO4131					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand general concepts of Internet of Things (IoT) (Understand)
2. Recognize various devices, sensors and applications (Knowledge)
3. Apply design concept to IoT solutions (Apply)
4. Analyze various M2M and IoT architectures (Analyze)
5. Design and program IoT devices (Design)
6. Evaluate design issues in IoT applications (Evaluate)
7. Create IoT solutions using sensors, actuators and Devices (Create)

Detailed Syllabus:

MODULE-I [7L]

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics, IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

MODULE-II [13L]

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.
M2M vs IoT An Architectural Overview–Building architecture, Main design principles and needed capabilities, IoT architecture outline, standards considerations, Reference Architecture and Reference Model of IoT, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Technical design Constraints.

MODULE-III [9L]

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

MODULE-IV [7L]

IOT Applications and case study

Case Study:

i) Smart Parking (case study) ii) Smart water management (case study) iii) IOT for smart cities (Case study Smart city Barcelona)

Applications:

i) IOT for financial inclusion. ii) IOT for rural empowerment. iii) Challenges in IOT implementation. iv) Big Data Management. v) Connectivity challenges. vi) Mission critical applications) vii) IOT and Aadhaar viii) IOT for health services.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014
2. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World"

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications
3. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media
4. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer
6. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press
7. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley

Course Name: MOBILE COMPUTING					
Course Code: INFO4132					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand cellular network concept and can classify different generation of cellular networks.
2. Understand 5G system concept and 5G architecture.
3. Gather knowledge about 5G Machine-type communications (MTC), Device-to-device (D2D) communications and Millimeter wave communications.
4. Understand 5G radio-access technologies, Massive multiple-input multiple-output (MIMO) systems and Coordinated multi-point transmission in 5G.
5. Understand 5G Relaying and wireless network coding.
6. Understand 5G Interference management, mobility management, and dynamic reconfiguration.

Detailed Syllabus:

MODULE-I [10L]

Fundamentals of Mobile Computing and 5G:
Fundamentals of wireless LANs, PANs, WANs, MANs. Cellular concept and architecture; First, second, third, fourth and fifth generation cellular networks. 5G use cases, 5G system concept.

5G architecture: High-level requirements for the 5G architecture, Functional architecture and 5G flexibility, Physical architecture and 5G deployment.

MODULE-II [10L]

Machine-type communications: Fundamental techniques for MTC, Massive MTC, Ultra-reliable low-latency MTC.
Device-to-device (D2D) communications: D2D: from 4G to 5G, Radio resource management for mobile broadband D2D, Multi-hop D2D communications for proximity and emergency services, Multi-operator D2D communication.
Millimeter wave communications: Hardware technologies for mmW systems, Architecture and mobility, Beamforming, Physical layer techniques.

MODULE-III [10L]

5G radio-access technologies: Access design principles for multi-user communications, Multi-carrier with filtering: a new waveform, Non-orthogonal schemes for efficient multiple access, Radio access for dense deployments, Radio access for V2X communication, Radio access for massive machine-type communication.
Massive multiple-input multiple-output (MIMO) systems: Pilot design for massive MIMO, Resource allocation and transceiver algorithms for massive MIMO, Fundamentals of baseband and RF implementations in massive MIMO.
Coordinated multi-point transmission in 5G: JT CoMP enablers, JT CoMP in conjunction with ultra-dense networks, Distributed cooperative transmission, JT CoMP with advanced receivers, Channel models.

MODULE-IV [10L]

Relaying and wireless network coding: The role of relaying and network coding in 5G wireless networks, Multi-flow wireless backhauling, Highly flexible multi-flow relaying, Buffer-aided relaying.
Interference management, mobility management, and dynamic reconfiguration: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

Books:

1. Jonathan Rodriguez , "Fundamentals of 5G Mobile Networks", Wiley.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambrige University Press
3. Kaveh Pahlavan, Prashant Krishnamoorthy, “Principles of Wireless Networks, - A united approach”, Pearson Educatio
4. Jochen Schiller, “Mobile Communications”, Pearson Education
5. T. S. Rappaport, "Wireless Communications: Principles & Practice", Prentice-Hall
6. C.Siva Ram Murthy, B.S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Pearson Education

Course Name: REAL TIME SYSTEMS					
Course Code: INFO4133					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Define the concept of Real time system. Sketch the model of a Real time system. Explain the characteristics of Real time system.
2. Classify different types of Timing constraints. Discuss different types of Real time tasks. Construct different types of Timing constraints
3. Compare between the types of Real time tasks. Solve numerical based on scheduling techniques.
4. Differentiate between different resource sharing protocols in real time systems.
5. Explain different Dynamic task allocation algorithms. Differentiate between types of Clock synchronization.
6. Classify different types of network and traffic in real time communication. Explain Quality of Service.

Detailed Syllabus:

MODULE-I [8L]

Introduction to Real Time systems
Definition of real time, applications of real-time systems, A basic Model of a real time systems, characteristics of real-time systems, Safety and Reliability, Types of real-time tasks, Timing constraints, Classification of Timing constraints and Modelling timing constraints.

MODULE-II [12L]

Real Time task scheduling
Real-time task scheduling: Some important concepts, Types of real time tasks and their characteristics, Task scheduling, Clock-driven scheduling: Table-driven scheduler and Cyclic scheduler, Hybrid scheduling: Time sliced Round-Robin scheduler, Event-driven scheduling: Earliest deadline first (EDF) and Rate monotonic Algorithm.

MODULE-III [10L]

Resource Sharing and Task allocation
Introduction to Resource sharing among real time tasks, Priority inversion, priority inheritance protocol, Highest locker protocol, Priority ceiling protocol, Different types of Priority inversions under PCP, Important features of PCP. Dynamic allocation of tasks: Focussed Addressing and Bidding algorithm and Buddy algorithm.

MODULE—IV [10L]

Clock Synchronization and Real Time Communication

Clocks in Distributed real-time systems, Centralized clock synchronization and Distributed Clock synchronization. Features of a Real Time operating system. Applications requiring real-time communications, Types of network in real-time communications, Quality of Service(QoS), Hard real-time communication and Soft real-time communication. Traffic categorization and Real-time communication in LAN.

Text Books:

1. Rajib Mall, "Real time system theory & practice", Pearson Education Asia
2. Jane W.S. Liu, "Real time system", Pearson Education Asia

Reference Books:

1. R. Bennett, "Real-time computer control", Prentice-hall
2. Shem Toy Levi & Ashok K. Agrawala, "Real time system design", Mcgraw Hill Publishing company
3. C.M. Krishna and Kang O. Shin, "Real time systems", Mcgraw Hill companies Inc

Course Name: METHODS IN OPTIMIZATION					
Course Code: MATH4121					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Describe the way of writing mathematical model for real-world optimization problems.
2. Identify Linear Programming Problems and their solution techniques.
3. Categorize Transportation and Assignment problems.
4. Apply the way in which Game theoretic models can be useful to a variety of real-world scenarios in economics and in other areas.
5. Apply various optimization methods for solving realistic engineering problems and compare their accuracy and efficiency.
6. Convert practical situations into non-linear programming problems and solve unconstrained and constrained programming problems using analytical techniques.

Detailed Syllabus:

MODULE-I [10L]

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.

MODULE-II [10L]

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.
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 [10L]

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 [10L]

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.

Text Books:

1. J. G. Chakraborty and P. R. Ghosh, "Linear Programming and Game Theory", Moulik Library
2. Kanti Swarup, P. K. Gupta and Man Mohan, "Operations Research", S. Chand and Sons
3. S. S. Rao, "Engineering Optimization", New Age Techno Press

Reference Books:

1. R. P. Brent, "Algorithms for Minimization without Derivative", Prentice Hall
2. J. K. Sharma, "Operations Research: Theory and Applications", Laxmi Publications
3. T. Veerarajan, "Operations Research", The Orient Blackswan

Course Name: LINEAR CONTROL SYSTEMS AND APPLICATIONS					
Course Code: AEIE4122					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Derive mathematical model of physical and simulated systems.
2. Execute block diagram reduction and signal flow graph to calculate overall system gain.
3. Investigate the time response of systems and calculate performance indices.
4. Analyze the stability of linear systems using Routh stability criterion and root locus method.
5. Explain frequency response of a process and determine stability using Bode plot.
6. Understand the concept and utility of control actions and its usages.

Detailed Syllabus:

MODULE-I [9L]

Concepts of control systems: open loop and closed loop control systems, effect of feedback in control system; mathematical model of physical system: differential equation representation of physical systems, transfer function, block diagram representation and reduction, signal flow graphs.

MODULE-II [8L]

Standard test signals, time response analysis: transient and steady state response of first order and second order processes, steady state error coefficients, performance indices, effect of pole–zero addition in system response.

MODULE-III [10L]

Stability analysis: characteristic equation and concept of stability; Routh stability criterion; root locus technique and stability analysis from root locus plot.

Introduction to frequency domain analysis; Bode plot for stability analysis: minimum and non minimum phase system, concept of phase margin and gain margin.

MODULE-IV [9L]

Control elements: dc servomotors, ac servomotors, dc motor speed and position control.
Basic control actions: P, PI, PD and PID controller and applications. Case study: Level and flow control.

Books:

1. Nagrath I. J. and Gopal M., "Control System Engineering", 5th Ed., New Age International Private Ltd. Publishers.
2. Kuo B. C., "Automatic Control Systems", 8th Ed., Wiley India
3. Ogata K., "Modern Control Engineering", 4th Ed., Pearson Education.
4. Dorf R. C. and Bishop R. H., "Modern Control Systems", Pearson Education.
5. Norman S. N., "Control Systems Engineering", 4th Ed., Wiley India.
6. B.W. Bequette, "Process Control Modeling, Design and Simulation", Prentice Hall of India, New Delhi.

Course Name: AUTOMATIC CONTROL SYSTEM					
Course Code: ELEC4121					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand fundamental concepts of control system.
2. Construct mathematical model of systems.
3. Analyze time domain response of system and infer about its stability.
4. Examine the relative stability of system in the frequency domain by various approaches.

Detailed Syllabus:

MODULE-I [9L]

Review of Laplace Transform.

Introduction to control system: Concept of feedback and automatic control, Effects of feedback, Objectives of control system, Types of control system, examples of feedback control systems. Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Transfer function concept. Poles and Zeros of a transfer function.
Control system components: Potentiometer, Synchro, Resolver, Tacho-generator, Actuator, Servomotor.

MODULE-II [9L]

Mathematical modeling of systems: Translational systems, Rotational systems, Mechanical coupling Electrical analogy of Spring-Mass-Dashpot system.
Representation of systems: Block diagram representation of control systems. Block diagram reduction techniques. Signal flow graph. Mason's gain formula.

MODULE-III [9L]

Time domain analysis: Time domain analysis of first and second order closed loop system. Time domain performance parameters: undamped natural frequency, damping ratio, overshoot, rise time, peak time, settling time and steady state error.

Stability Analysis: Routh-Hurwitz criteria. Root locus techniques, construction of Root Loci.

MODULE-IV [9L]

Frequency domain analysis of linear system: Bode plot, determination of phase and gain margins from Bode plot. Polar plot, Nyquist stability criteria.

Text Books:

1. I.J. Nagrath & M. Gopal, "Control System Engineering", New Age International.
2. M. Gopal, "Digital Control & State Variable Methods", 2nd Edition, TMH
3. D. Roy Chowdhuri, "Control System Engineering", PHI

Reference Books:

1. M Gopal, "Control Systems: Principles and Design", TMH
2. Ananda Natarajan, P. Ramesh Babu, "Control System Engineering", Scitech
3. Ogata; Katsuhiko, "Modern Control Engineering", PHI

Course Name: SOFTWARE DEFINED RADIO					
Course Code: ECEN4121					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the technological differences between families of radios.
2. Explain the function of reconfigurable hardware.
3. Analyze the processing techniques required for software defined radio.
4. Evaluate the effects of probability in communication reliability.
5. Analyze the synchronization requirements in SDR and SDR based networks.
6. Analyze functioning of different families of radios.

Detailed Syllabus:

MODULE – I [10L]

Introduction to SDR, Brief history of development of SDR, RF architectures applied in SDR, Processing architectures suitable for SDR, Software environment for SDR.
SDR- benefits, problems, GNU radio design.

MODULE –II [12L]

Signals and Systems in relation to SDR, Probability in Communications- the effects on reliability, Understanding SDR hardware, Timing and Carrier synchronization, Frame synchronization, Channel coding. Receive techniques for SDR, Transmit Power, Bandwidth, Spectral Efficiency, Interference.

MODULE –III [8L]

OFDM, introduction and implementation of the general model, Channel estimation, Equalization, Power allocation techniques for bits.

MODULE – IV [6L]

SDR – some applications, future directions.
SDR-3000 series Software Defined Radio Transceiver Systems
Smart Antenna API for SDR
Networking and SDR- some case histories, Vehicular networking.

Text Books:

1. T.Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski, “Software Defined Radio for Engineers” Artech House
2. Cognitive Radio Techniques: Spectrum Sensing, Interference Mitigation and Localization- By Sithamparanathan, Kandeepan; Giorgetti, Andrea, Artech House, 2012
3. Cognitive Radio Technology- By Bates, Martin; Fettee, Bruce A, Elsevier Science & Technology
4. Software Defined Radios: From Smart(er) to Cognitive By Liesbet Van Der Perre, Michael Timmers and SofiePollin, Springer

N. B.:- The titles (2) and (3) are available with British Council Library- on line.

Course Name: INTRODUCTION TO MACHINE LEARNING					
Course Code: ECEN4122					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Select an appropriate Machine Learning tool for analyzing data in a given feature space.
2. Apply machine learning techniques such as regression, classification, clustering, and feature selection to detect patterns in the data.
3. Distinguish between supervised, and unsupervised learning.
4. Outline solution for classification and regression approaches in real-world applications.
5. Formulate a machine learning problem.
6. Determine cutting edge technologies related to machine learning applications.

Detailed Syllabus:

MODULE –1 [10L]

Introduction: Foundations for ML: What is Machine Learning, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces and Candidate Elimination Algorithm, Data Normalization, Feature Reduction/Dimensionality reduction, Validation Techniques (Cross-Validations), Bias-Variance Trade-off.

Supervised Learning:

Classification: Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Generalization error bounds: VC Dimension, Regression and Classification Trees, Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions.

MODULE – II [10L]

Supervised Learning:

Regression: Ordinary Least Squares, Linear Regression, Multiple Linear Regression: Ridge Regression, Lasso Regression, Non-Linear Regression: Logistic Regression.

Ensemble Learning: Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost.

Reinforcement Learning: Introduction to reinforcement learning, Defining reinforcement learning Framework and Markov Decision Process, Tabular methods: Planning through the use of Dynamic Programming and Monte Carlo.

MODULE –III [8L]

Unsupervised Learning: Introduction to clustering, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models.

MODULE –IV [7L]

Feature Selection and Dimensionality Reduction: Principal Components Analysis (PCA), Independent Component Analysis (ICA), and Linear Discriminate Analysis (LDA).

Deep Learning: Autoencoder, Convolutional Neural Networks, Recurrent Neural Networks.

Text Books:

1. Ethem Alpaydin, 'Introduction to Machine Learning", MIT Press, Prentice Hall of India
2. R.O.Duda, P.E.Hart, and D.G.Stork, "Pattern Classification", John Wiley
3. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer
4. Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie, "The Elements of Statistical Learning"

Reference Books:

1. T. M. Mitchell, "Machine Learning", McGraw Hill Education
2. Murphy, Kevin, "Machine learning: a probabilistic perspective", MIT press
3. Stuart Russell, and Peter Norvig, "Artificial intelligence: a modern approach", Prentice Hall
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville "Deep Learning"
5. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press.

Course Name: ERROR CONTROL CODING FOR SECURE DATA TRANSMISSION					
Course Code: ECEN4123					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Find the equations for entropy, mutual information and channel capacity for all types of channels, utilizing their knowledge on the elements.
2. Analyse a discrete memory less channel, given the source and transition probabilities.
3. Demonstrate encoder and decoders for Linear Block Codes, Cyclic codes, etc.
4. Apply the concept of modern linear algebra for the error control coding technique.
5. Select decoding algorithms for efficient decoding of Block codes and Convolution codes.
6. Develop overall understanding about different types of codes applied to both source and channel end during data transmission.

Detailed Syllabus:

MODULE-I [10L]

Information theory : Uncertainty and information, measure of information, Self and conditional Information, mutual information and entropy, Fixed length code, Variable length code, Prefix code, Instantaneous code, Kraft Inequality.

Source Code: Source coding theorem, Huffman codes, Shanon- Fano coding, Arithmetic code, Lempel-Ziv algorithm.

Channels: Discrete memory less channel, Channel matrix for different channel models- Lossless channel, Deterministic channel, Noise-less channel, Deterministic channel capacity, channel coding, information capacity theorem, The Shannon limit.

MODULE-II [7L]

Block code: Hamming codes Minimum distance, Error detecting and Error-correcting capabilities of block code.

Linear Block Code: Definition & properties of linear block codes, Generator and parity check matrices, Encoding of a linear block code, Decoding of a linear block code, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities.

MODULE-III [10L]

Cyclic Code: Definition & properties of cyclic codes, Code Polynomials, Generator Polynomials, Division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes.

Galois Field: Introduction to Linear Algebra: Groups, Fields, binary field arithmetic, Introduction to Galois Field, Primitive elements, generator polynomials in terms of minimal polynomials, Calculation of minimal polynomial.

BCH Code: Concept of BCH Codes, Encoding and Decoding, Reed Solomon Codes.

MODULE-IV [8L]

Convolution code: Polynomial description of convolution codes, Distance notions for convolution codes and the generating function. Encoding of convolution codes: Systematic and Non-systematic convolution Codes.

Decoding of convolution codes: Viterbi decoder, distance and performance bounds for convolution codes. Structural properties of convolution codes: state diagram, state table, state transition table, tree diagram, and trellis diagram.

Text Books:

1. S Gravano, “Introduction to Error Control Codes”, Oxford Press
2. Ranjan Bose, “Information theory, coding and cryptography”, TMH
3. N Abramson, “Information and Coding”, McGraw Hill

Reference Books:

1. M Mansurpur,”Introduction to Information Theory”, McGraw Hill
2. R B Ash,”Information Theory”, Prentice Hall
3. Shu Lin and D J Costello Jr,”Error Control Coding”, Prentice Hall.

Course Name: MACHINE LEARNING					
Course Code: INFO4122					
Contact Hours per week	L	T	P	Total	Credit Point
	3	0	0	3	3

Course Outcomes:

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

1. Learn the basics of machine learning paradigm.
2. Understand various machine learning algorithms.
3. Mathematically Analyze various machine learning approaches and paradigms
4. Understand the concept of deep learning
5. Analyze various machine learning techniques to get an insight of when to apply a particular machine learning approach.
6. Apply Machine Learning algorithms in practice and implementing their own using real-world data.

Detailed Syllabus:

MODULE-I [10L]

Introduction: Basic Concept of Learning**,** Example of Learning, Components of Learning, Simple Model of Learning, Supervised vs Unsupervised Learning, Introduction to Decision Tree.

Regression: Input Representation, Linear Classification, Linear and Logistic Regression, Nonlinear Transformation, Likelihood measure, Gradient Descent.

MODULE-II [9L]

Clustering: Hierarchical Clustering, K-Means and Fuzzy C-Means clustering algorithms.

Dimensionality Reduction: Introduction to LDA, Principal Component Analysis (PCA).

Support Vector Machines (SVM): Margin, Maximum Margin Linear Separators, Quadratic Programming Solution, Support Vectors, Kernels for learning non-linear functions.

MODULE-III [8L]

Neural Model I: Structure and function of biological neuron, Artificial neuron, Definition of Artificial Neural Network (ANN), Taxonomy of neural networks, Difference between ANN and
Human brain, Characteristics and applications of ANN, Single layer network, Multilayer Perceptron (MLP), Linear separability, Different activation functions, Back propagation algorithm.

MODULE-IV [9L]

Neural Model II: Introduction to Radial Basis Function, Convolution Neural Network and Deep Neural Network.

Deep Learning: The basics of Deep Learning, SoftMax Function, One-Hot encoding, Cross Entropy, Classification using Deep Learning.

Text Books:

1. Konar, "Computational Intelligence Principles, Techniques and Applications", Springer, 2012
2. T. Mitchell, "Machine Learning", First Edition, McGraw-Hill, 1997

Reference Books:

1. S. Haykin, "Neural Networks and Learning Machines", Third Edition, PHI Learning, 2009
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2010
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach, "Deep Learning", MIT Press, 2017

Course Name: BIO SENSOR					
Course Code: BIOT4124					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. State types of bio-recognition elements and describe the fundamental components required to make a viable biosensor.
2. Illustrate types of enzyme immobilization methods used to make a biosensor and immobilize it to a transducer for the construction of biosensor.
3. Describe each types of biosensing element in relation to their uses in biosensors.
4. Understand the classification, construction and working principle of various transducers.
5. Understand the concepts, types, working principles and practical applications of important biosensors.
6. Explain the working principle of different types of inhibition based biosensors.

Detailed Syllabus:

MODULE-I [10L]

Introduction to biological system and Biosensors

Biosensor: principle, general characteristics; Proteins and enzymes: basic properties, denaturation and renaturation, immbobilization of enzymes; Advantages and limitations of biosensors; Classification of biosensors based on bioreceptor; Immobilization and coupling of bioreceptors.

MODULE-II [10L]

Bio-recognition based sensors

Principle, operation and limitation of: Microbial sensor, Immunological sensor, Nucleic acid sensor. Other bioreceptors (e.g. animal, plant tissue); Different types of inhibitors: principles, operations, applications and limitations.

MODULE-III [10L]

Biosensor based on transducer

Classification of biosensor based on transducer; Calorimetric, Electrochemical (potentiometric, amperometric), Optical, Piezoelectric, Semiconductor biosensor: principle, construction, calibration and limitations.

MODULE-IV [10L]

Application of biosensor

Clinical and diagnostics sector, Industrial sector: Food, Environmental, defense sector; Commercially available biosensor.

Books:

1. Tran Minh Canh, “Biosensors”, London. Chapman and Hall
2. Turner, A.P.F, Karube.I.,and Wilson, G.S, “Biosensors Fundamentals and applications”, Oxford Univ. Press.
3. Ajit Sadana..San Diego, “Engineering Biosensors, kinetics and design applications”, Academic Press,
4. D.Thomas and J.M. Laval – Enzyme Technology in concepts in Biotechnology by Balasubramaniam et al, Univ. Press, 1996.

Course Name: PRINCIPLES OF RADAR					
Course Code: ECEN4126					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the concept and characteristics of Radar operation.
2. Know the role of probability in the Radar communication.
3. Understand the importance of shape and material for Radar targets.
4. Develop the idea of Radar Transmission and Reception and in what aspects it is different from data communication.
5. Classify between different types of Radars and their distinct areas of application.
6. Have the concept of the specific design considerations of the antennas under the use for Radar communication.

Detailed Syllabus:

MODULE-I [8L]

Introduction to radar: Basic radar equation and block diagram, Types of radar, Information available from a radar, Effects of operating frequency on radar, Applications of radar, Detection of signals in noise, Receiver noise and Signal-to-Noise Ratio, Probability Density Functions, Probabilities of Detection and False Alarm.

MODULE-II [8L]

Atmospheric attenuation and refraction of radar waves, Attenuation, back scatter and Doppler effects in rain, clouds and snow, Radar Cross Section(RCS) of targets, Control of RCS, Body shaping, Radar absorbing materials, Enhancement of RCS by multiple scattering, RCS prediction techniques, RCS measurement techniques, Radar echo suppression.

MODULE-III [8L]

Types of radar transmitters, Gyrotrons, Modulators, Choice of RF power source, Radar receiver configurations, Bandwidth considerations, Receiver front end, Digital receivers, Automatic detection, Practical detectors, Optimal detectors, Automatic tracking, Range and velocity tracking.

MODULE-IV [8L]

MTI radar, Adaptive MTI radar, Air-borne MTI radar, Pulse Doppler radar, Detection algorithm, Radar reflector antennas, Reflector feed design considerations, Phased Array antennas, Beam formers, Beam steering, Mutual coupling, Phase shifters.

Books:

1) M Skolnik, “Introduction to Radar Systems”, McGraw Hill

Course Name: AD HOC WIRELESS NETWORKS					
Course Code: ECEN4127					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the under lying technologies of wireless communication networks.
2. Analyze the various design issues and challenges of Ad hoc Networks.
3. Different routing protocols and their operations will be clear to them.
4. Learn about the contention in MAC layer and ways to solve them.
5. Familiar with the network design strategies to assure adequate QoS.
6. Apply their knowledge to develop new and improved applications.

Detailed Syllabus:

MODULE-I [10L]

Introduction [2L]

Ad hoc wireless networks, Applications of Ad hoc wireless networks. Issues in Ad hoc wireless networks, Static and mobile Ad hoc network, Indoor Outdoor network model.

MAC Protocols [8L]

Issues in designing a MAC protocol for Ad hoc wireless Networks, Hidden and Exposed terminal problem, Contention based protocols with reservation mechanisms and scheduling mechanisms, MAC protocols using directional antennas, IEEE802.11 in Ad hoc mode.

MODULE-II [8L]

Routing Protocols [8L]

Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Proactive & Reactive routing protocol, Unicast & Multicast routing algorithm. Location aided routing, Link reversal routing, Hybrid routing algorithm, Energy aware routing algorithm, Hierarchical routing, QoS aware routing.

MODULE-III [6L]

Transport Layer Protocols [6L]

Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks.

MODULE-IV [12L]

QoS in Ad hoc wireless network [8L]

Issues and challenges in providing QoS in Ad hoc wireless networks, Classification of QoS solutions, QoS in wireless ad hoc network – analysis of degradation of receiver sensitivity, practical solutions.

Energy Management Schemes [4L]

Battery management, transmission power management, System power management schemes.

Text Books:

1. C.Siva Ram Murthy and B.S. Manoj, ”Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education.

Reference Books:

1. Chai K. Toh, “Ad Hoc Mobile Wireless Networks – Protocols and Systems”, Prentice Hall
2. Xiuzhen Cheng, Xiao Hung, DingZhu Du, “Ad hoc wireless Networking”, Kluwer Academic publishers
3. Stefano Basagni, Marco Conti, Silvia Giardano, Ivan Stojmenovic, “Mobile Ad Hoc Networking”, Wiley India

Course Name: INTRODUCTION TO EMBEDDED SYSTEM					
Course Code: AEIE4127					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Explain the definitions, components and requirements of the Embedded System.
2. Acquire knowledge in the area of embedded system using AVR microcontroller.
3. Develop the interfacing and communication techniques of the Embedded System.
4. Learn the basic concept of RTOS.
5. Understand the message passing technique, task synchronization techniques.
6. Develop algorithms for real time applications of Embedded System.

Detailed Syllabus:

MODULE-I [10L]

Introduction to an embedded system : Definition Of Embedded Systems, Embedded System V/S General Computing System, Challenges In Embedded System Design, Design Process, Requirements, Examples Of Embedded Systems. Embedded System Architecture: Harvard Vs Princeton, CISC Vs RISC. Introduction to AVR, PIC, ARM and Arduino based systems.

MODULE-II [10L]

Overview of AVR microcontroller: Introduction to AVR (ATmega328p-pu) microcontroller, pin layout, architecture, program memory, Data Direction register (DDRx), Port Registers (PORTx), PWM registers (8-bit), ADC registers, interrupts, basics of communication, overview and interfacing I/O devices with I^2C Bus, UART and Serial Peripheral Interchange (SPI) bus.

MODULE-III [8L]

Embedded operating systems: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling; task communication: shared memory, message passing, remote procedure call and sockets, task synchronization: task communication/synchronization issues, task synchronization techniques, device drivers, how to choose an RTOS.

MODULE-IV [8L]

Hardware Interfacing and Programming with ATmega 328p: Interfacing of LCD, interfacing with analog sensors (i.e LM35, ADXL 335 accelerometer), interfacing of stepper motor, interfacing with a keyboard and MPU6050 (MEMS Accelerometer and Gyroscope) using I^2C bus.

Books:

1. Raj Kamal, "Embedded System-Architecture, Programming, Design", Mc Graw Hill
2. Shibu K.V, "Introduction to Embedded Systems", Tata McGraw Hill
3. Elliot Williams, "AVR Programming: Learning to Write Software for Hardware", Maker Media, Incorporated
4. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C", Pearson
5. Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", McGraw Hill Education,
6. Silberschatz Galvin Gagne, "Operating System Concepts", WILEY

Course Name: BIOPOLYMER					
Course Code: BIOT4126					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Acquire basic knowledge of biopolymer and can classify biopolymer according to their composition.
2. Familiar with the structures, properties and applications of different protein based biomaterial.
3. Explain the structures, properties and applications of different carbohydrate based biomaterial.
4. Comprehend the knowledge of different type and applications of bioplastics.
5. Learn about the different composite material that can be used as biomaterial. They will be familiar with the applications, advantages and disadvantages of bioplastics and composite materials.
6. Classify biodegradable polymer and will analyze the biodegradation techniques.

Detailed Syllabus:

MODULE-I [10L]

Introduction to biopolymers and protein biopolymers

Classification of Biopolymers; Collagen, Keratin and Fibroin: Structure, production (conventional and cloning method), properties and its use (Tissue regeneration scaffolds and others).

MODULE-II [10L]

Carbohydrates as Biomaterials

Carbohydrate (Starch, Alginate, Chitin, Agarose) and modified carbohydrates (modified starch, polydextrose, chitosan etc.): Structure, production, properties and applications.

MODULE-III [10L]

Application of Bioplastics and composite materials

Definition of bioplastics, Types of bioplastics such as starch-based, cellulose-based plastics and some aliphatic polyesters (PLA, PHB), polyamides, bio-based composites from soybean oil and chicken feathers, bio-derived polyethylene and genetically modified bioplastics. Composite theory of fiber reinforcement (short and long fibers, fibers pull out); applications and limitations of bioplastics and composite materials.

MODULE-IV [10L]

Polymer biodegradation

Classification of biodegradable polymers (Natural, Synthetic and modified naturally modified); Techniques for analysis of biodegradation of polymers- Enzyme assays, Plate test, Respiratory test, Gas evolution test (CO_2 & CH_4), Field trial.

Books:

1. Ratledge C and Kristiansen B, "Basic Biotechnology", Cambridge University Press, 2nd Edition, 2001.
2. Doi Y, "Microbial Polyesters", VCH Weinheim, 1990.

Course Name: ADVANCED LINEAR ALGEBRA					
Course Code: MATH4126					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Explain concepts of diagonalization, orthogonal diagonalization and Singular Value Decomposition (SVD).
2. Discuss basis, dimension and spanning sets.
3. Design Gram-Schmidt Orthogonalization Process and QR decomposition using concepts of inner product spaces.
4. Analyze Least squares solutions to find the closest line by understanding projections.
5. Define linear transformations and change of basis.
6. Illustrate applications of SVD such as, Image processing and EOF analysis, applications of Linear algebra in engineering with graphs and networks, Markov matrices, Fourier matrix, Fast Fourier Transform and linear programming

Detailed Syllabus:

MODULE-I [9L]

Characteristic equations, Eigen Values and Eigen vectors, Diagonalization, Applications to differential equations, Symmetric matrices, Positive definite matrices, similar matrices, Singular Value Decomposition, Generalized Inverses.

MODULE- II [9L]

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.

MODULE- III [9L]

Inner Product Spaces, Concept of Norms, Orthogonality, Projections and subspaces, Orthogonal Complementary Subspaces, Orthogonal Projections, Gram-Schmidt Orthogonalization Process, Least square approximations, QR decomposition.

MODULE- IV [9L]

Linear Transformations, kernels and images, The Rank-Nullity-Dimension Theorem. Matrix representation of a Linear Transformation, Change of Basis, Linear space of linear mappings.

Text Books:

1. Gilbert Strang, “Linear Algebra and its Applications”, Thomson Brooks/Cole Cengage Learning

Reference Books:

1. Gene H. Golub, Charles F. Van Loan, “Matrix Computations”, JHU Press
2. Kenneth M. Hoffman, Ray Kunze, “Linear Algebra”, Prentice-Hall
3. S. Kumaresan, “Linear Algebra A Geometric Approach”, PHI

Course Name: PRINCIPLES OF ELECTRICAL MACHINES					
Course Code: ELEC4126					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Acquire knowledge of the constructional details and operating principle of DC generator and analyze the performance under various operating conditions.
2. Understand the operating principle of DC motor and analyze the performance.
3. Acquire knowledge about the constructional details, principle of operation, performance analysis and testing of single phase transformers.
4. Understand operating principle and analyze the performance of Three Phase Induction Motors.
5. Understand working of Alternators and its applications.
6. Understand working of synchronous motor and its applications.

Detailed Syllabus:

MODULE-I [9L]

Construction of DC machine, Different methods of excitation of DC machine.

DC Generators- EMF equation. Concept of armature reaction, Voltage build-up of shunt Generator, Characteristics of DC Generator.

D.C. Motors- Principle of operation, Back EMF, Torque equation, Characteristics of DC motors, Speed control of DC motor, Starting of DC shunt motor.

Losses and Efficiency of DC Machine, Application of DC Machine

MODULE-II [9L]

Single phase Transformers- Construction of Transformer. Operating principle of 1-ph transformer, Emf Equation, Equivalent circuit and Phasor diagram of ideal and practical transformer, Losses and efficiency, Open & short circuit tests, Voltage regulation.

MODULE-III [9L]

Three phase Induction Motor:- Construction, Production of rotating magnetic field. Working principle. Slip, frequency of rotor current, Equivalent circuit and phasor diagram. Torque-speed characteristic, Methods of improving the starting torque, Different methods of speed control.

MODULE-IV [9L]

Alternator:- Construction, Excitation Systems, E.M.F equation, Pitch factor and Distribution factor, Armature reaction- Lagging, Leading, Unity p.f load, Phasor diagrams, Open circuit and short circuit test, Use of salient pole and cylindrical rotor alternator.

Synchronous Motor:- Principle of operation, Phasor diagram, Effect of varying field current- v curve, synchronous condenser, Starting of synchronous motor, Hunting. Application of synchronous motor.

Text Books:

1. Dr. P.S. Bimbhra, "Electrical Machinery", Khanna Publisher.
2. S. K. Bhattacharya, "Electrical Machines", McGraw-Hill Education.
3. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai Publications

Reference Books:

1. J.B.Gupta, "Theory & Performance of Electrical Machines", S.K. Kataria & Sons.
2. Abhijit Chakarabarti and Sudipta Debnath, "Electrical Machines", McGraw-Hill Education.

Course Name: PROJECT I					
Course Code: INFO4195					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	8	8	4

Course Outcomes

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

1. Recall knowledge of the selected project topic.
2. Identify the problem to solve.
3. Design the solution of the problem by using software/ hardware skills.
4. Apply modern Information Technology tools and techniques for implementing solution.
5. Prepare report after implementing the project.
6. Demonstrate the project work.

Open Elective -III (to be offered by IT Department)

Course Name: FUNDAMENTALS OF CLOUD COMPUTING					
Course Code: INFO4121					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.
5. Explain AWS, Google App Engine, Microsoft Azure
6. Understand different web services techniques to provide SaaS.

Detailed Syllabus:

MODULE-I [7L]

Overview of Computing Paradigm: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing

Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing

MODULE-II [11L]

Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services

Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS)

Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud

Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM)

Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service)

Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers

MODULE-III [11L]

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA)

Cloud Platform and Management: Computation, Storage

Examples: Google App Engine, Microsoft Azure

Software as a Servic (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS

MODULE-IV [12L]

Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously

Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing

Cloud Security: Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

Books:

1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing Black Book", dreamtech Press
2. A. Srinivasan, J. Suresh, "Cloud Computing A practicle approach for learning and implementation", Pearson
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India
4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011
5. Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications", Nikos Springer, 2012
6. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India, 2010

4th Year 2nd Semester

Course Name: FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY					
Course Code: INFO4231					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the abstract models for Blockchain Technology, its benefits and challenges
2. Learn the use the basic crypto primitives to secure Blockchain
3. Describe the functional/operational aspects of cryptocurrency ecosystem
4. Explain the features and functional aspects of smart contract ecosystem
5. Discuss the practical use-cases of Blockchain
6. Identify the major research challenges in Blockchain domain

Detailed Syllabus:

MODULE-I [10L]

Blockchain Basics: Introduction, Generic elements of a Blockchain, Advantage over Conventional Distributed Database and limitations, Tiers of Blockchain Technology, Features of a Blockchain, Types of Blockchain, Concept of Consensus

Basic Crypto primitives behind the Blockchain technology: Cryptographically secured Hash functions, Puzzle friendly hash, Collision resistant hash, Secure hash algorithm, Hash pointers, Merkel Tree, Blockchain as a Hash chain, Digital signatures

MODULE-II [10L]

Blockchain 1.0 – Crypto currency: Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Distributed consensus in a Bitcoin network

MODULE-III [8L]

Blockchain 2.0- Smart Contracts: Evolution of Blockchain paradigm beyond cryptocurrency, Smart Contracts overview, Ethereum concepts- Smart contract, Ethereum virtual machine, GAS, DAPP, DAO, Solidity for Ethereum smart contract, smart contract use cases, issues and challenges, Blockchain 3.0- the future

MODULE-IV [8L]

Blockchain Applications: Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others.

Blockchain Challenges: Blockchain risks, Technological challenges, Scalability issues, Security and privacy, Legal and regulatory problems, Blockchain research issues

Text Books:

1. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing Ltd. 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016.

Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O′Reilly
2. Alan T. Norman, "Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA and Smart Contracts", CreateSpace Independent Publishing Platform
3. Antony Lewis, "The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Derivatives, Digital Assets)"
4. Wattenhofer, "The Science of the Blockchain", CreateSpace Independent Publishing Platform
5. ETHEREUM: A Secure Decentralized Transaction Ledger - Dr. Gavin Wood, Yellow Paper, 2014.

Course Name: INTERNET TECHNOLOGY					
Course Code: INFO4232					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Add interactive behavior to web pages.
2. Create web apps.
3. Use Nodejs for non-blocking, event-driven servers.
4. Use Nodejs for traditional web sites and back-end API services.
5. Create Single Page Application in a very clean and maintainable way using AngularJS.
6. Write client side applications using AngularJS in a clean Model View Controller (MVC) way.

Detailed Syllabus:

MODULE-I [10L]

Overview of JavaScript:

What is JavaScript? Brief history. Common use-cases. Runtime environments. ECMA Script standards. Basic syntax, Arrays and Objects, Functions, Document Object Model, String interpolation, let and const, Arrow functions, Destructuring , Symbol, Maps and Sets, for-of , Spread operator , Classes , Module loaders, Typed Arrays.

MODULE-II [10L]

Javascript Context, Closures & Asynchronous JavaScript:

Object method invocation, implicit parameter variable, Event handlers and callbacks, Usage of call and apply, Binding context, new keyword. Lexical scope, Inner functions, Closure scope. Asynchronous Programming with Callbacks, Promises, async and await, Asynchronous Iteration.

MODULE-III [10L]

TypeScript: Introduction to TypeScript, From TS to JS, Types and Type Inference, Classes, Interfaces, Modules.

Server-Side JavaScript with NodeJS: Node programming basics, Buffers, Events and EventEmitter, Streams, Process, CPU and Operating System Details, Working with files, HTTP Clients and Servers, Non-HTTP Network Servers and Clients, Working with child Processes, Worker threads.

MODULE-IV [10L]

Client-Side JavaScript with AngularJS: Angular programming basics, Angular components, Expressions, Data binding, Built-in directives, Events and change detection, Implementing Angular services in web applications.

Books:

1. Douglas Crockford, "JavaScript: The Good Parts", O'Reilly Media
2. David Flanagan, "JavaScript: The Definitive Guide", 7th Edition, O'Reilly Media
3. Green and Brad, "Angular JS", O'Reilly
4. Valeri Karpov, Diego Netto, "Professional AngularJS", WROX
5. Brad Dayley,Brendan Dayley,Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Addison Wesley

Course Name: DISTRIBUTED COMPUTING					
Course Code: INFO4233					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Define the concept of Distributed Computing system. Classify different types of models in Distributed Computing system. Describe Distributed Operating system.
2. Explain the design issues of Distributed operating system and differentiate between Shared data approach and Message passing approach. Explain Buffering strategies, Group communication and Failure Handling.
3. Sketch the implementation mechanism of RPC. Explain call semantics and communication protocols of RPC. Explain Callback RPC, Broadcast RPC and Batch-mode RPC.
4. Explain DSM architecture and Compare between different design issues of DSM. Describe Consistency models, Clock synchronization and Event ordering.
5. Discuss Task Assignment, Load Balancing and Load Sharing.
6. Describe File Models, File Caching and File Replication.

Detailed Syllabus:

MODULE – I [8L]

Introduction to Distributed Computing

Concept of Distributed Computing system, Models of Distributed Computing system, Advantages of Distributed Computing system, Distributed Operating system, Design issues of Distributed operating system.

MODULE – II [12L]

Message Passing and RPC

Shared-data approach and Message-passing approach, Features of Message-Passing system, Polling and Interrupt, Buffering strategies, Failure handling, Group communication.

RPC- concept and mechanism, Call semantics in RPC, Communication protocols for RPC. Callback RPC, Broadcast RPC and Batch-mode RPC.

MODULE – III [12L]

Distributed Shared Memory (DSM) and Clock Synchronization

Distributed Shared Memory-Concept, Architecture of DSM systems, Design Issues in DSM (Granularity, Structure of Shared memory space, Memory Coherence and access synchronization, Data location and access, Replacement strategy and Thrashing), Consistency models in DSM, Advantages of DSM.
Clock synchronization-Concept and types, Clock synchronization algorithms, Happened Before Relation, Logical clock, Implementation of Logical clock, Total ordering of Events.

MODULE – IV [8L]

Resource Management and Distributed File System

Features of Global Scheduling algorithm, Task assignment approach, Load Balancing approach, Load Sharing approach.
File models and File accessing models, File Caching schemes, File Replication- Concept, advantages of replication, Multicopy update problem.

Text Books:

1. Pradeep K. Sinha, "Distributed Operating Systems- Concepts and Design", PHI

Course Name: ARTIFICIAL INTELLIGENCE					
Course Code: INFO4234					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Explore various searching algorithms (uninformed, informed, heuristic, Adversarial Search etc).
4. Represent knowledge using propositional and first-order predicate logic in order to solve complex problems based on the intelligent behavior of humans.
5. Use different machine learning techniques to design AI machine and developing applications for real world problems.
6. Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.

Detailed Syllabus:

MODULE- I [10 L]

Introduction [1L]

Definition of AI, Intelligent Behavior, Turing Test, Typical AI Problems, Various AI Approaches, Limits of AI.

Introduction to Intelligent Agents [2L]

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.

Constraint Satisfaction Problem [3L]

Definition of CSP, Representation of CSP, Formulation of Various popular problems as CSP, Solution methods of CSP – Backtracking & Forward Checking.

MODULE- II [12L]

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.

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.

MODULE-III [10L]

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 [4L]

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

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 [10L]

Planning [3L]

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 [5L]

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

Expert Systems [2L]

Representing and using domain knowledge, expert system shells, knowledge acquisition.

Books:

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

Course Name: SOFT COMPUTING					
Course Code: INFO4241					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand soft computing concepts, technologies and their role in problem solving.
2. Analyze the basic concepts of genetic algorithm and its application.
3. Analyze the genetic algorithms and their applications to solve multi-objective optimization problems.
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
5. Understand the need for approximate analysis and computation methods and use the tenets of rough set theory in developing applications.
6. Assemble different techniques to sketch a hybrid system for better result.

Detailed Syllabus:

MODULE-I [10L]

Introduction: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Genetic algorithm: Basic concepts, working principle, Encoding, Fitness function, Genetic modeling: Inheritance, Selection, Cross over, Mutation, Bitwise operator, Convergence of GA.

Applications of Genetic Algorithm: Genetic Algorithms in search and optimization, GA based clustering Algorithm.

MODULE -II [8L]

Fuzzy Sets and Fuzzy Logic Systems: Classical Sets and Fuzzy Sets, Fuzzy vertex theory, Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.

MODULE-III [9L]

Membership Functions: Features of membership functions, standard forms and boundaries, different fuzzification methods.

Fuzzy to Crisp Conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication, Extension Principle, Fuzzy Rule based Systems: Linguistic Hedges.

MODULE-IV [9L]

Swarm Intelligence Techniques: Introduction, Key Principles of Swarm, Overview of -Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO).

Hybrid Systems: ANN Based Fuzzy Systems, Fuzzy Logic Based Neural Networks

Text Books:

1. Timothy J. Ross, "Fuzzy logic with engineering applications", John Wiley and Sons
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and GeneticAlgorithms", PHI
3. Kumar S. Ray, "Soft Computing and Its Applications, Volume One: A Unified Engineering Concept, Volume 1", CRC Press

Reference Books:

1. Prof. Debasis Samanta, "Introduction to Soft Computing", Computer Science and Engineering, IIT Kharagpur, https://nptel.ac.in/courses/106/105/106105173/
2. Kalyanmoy Deb, "Multi Objective Optimization using Evolutionary Algorithms", John Wiley and Sons (2001)
3. David E. Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning", Pearson India
4. Dilip K. Pratihar, "Soft Computing", Alpha Science International

Course Name: CLOUD COMPUTING					
Course Code: INFO4242					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.
5. Explain Amazon, Google, Microsoft cloud services.
6. Understand different web services techniques to provide SaaS.

Detailed Syllabus:

MODULE-I [7L]

Overview of Computing Paradigm [3L]

Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing

Introduction to Cloud Computing [4L]

Cloud Computing definition, Deployment Models: private, public, hybrid, community cloud. Service Models: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds,

MODULE-II [13L]

Cloud Virtualization [7L]

Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM). Resource Virtualization: Server, Storage, Network

Cloud Computing Architecture [6L]

Assumptions, Recommendations and fundamental requirements for cloud application architecture. SOA for cloud applications. Open-Source Eucalyptus Cloud Architecture. Introduction to PaaS, Introduction to SaaS, Web services, Web 2.0, Web OS

MODULE-III [11L]

Service Management in Cloud Computing [6L]

IT Infrastructure Library based Service Management: Service Strategy, Service Design, Service Transition, Service Operation, Continual Service Improvement Concept of SLA. SLA aspects and requirements

Cloud Risk and Security [5L]

Type of Risk in cloud, Risk management, cloud security services (Confidentiality, Integrity, Availability), application security in IaaS, PaaS, SaaS environment.

MODULE-IV [11L]

Cloud Cost [4L]

Direct and Indirect Cost, Chargeback Models, Methodology, Tools and Solution

Cloud Applications [7L]

Microsoft Cloud Services, Google cloud Services, Amazon Cloud Services, Mobile Cloud

Books:

1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing Black Book", dreamtech Press
2. A. Srinivasan, J. Suresh, "Cloud Computing A practicle approach for learning and implementation", Pearson
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India
4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011
5. Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications", Nikos Springer, 2012
6. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India, 2010

Course Name: PATTERN RECOGNITION					
Course Code: INFO4243					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
2. Compare and parameterize different learning algorithms.
3. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.
4. Analyze classification problem probabilistically and estimate classifiers (Bayesian, kNN, ANN, K-means) performance.
5. Design and compare the machine learning models (nearest-neighbor rule, linear discriminant functions, NN and SVM) and which model is appropriate for a problem or why it is not appropriate.
6. Analyze the performance of different clustering algorithm (k-means, Fuzzy C means and EM) on big data set based on misclassification rate.

Detailed Syllabus:

MODULE – I [10L]

Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Metric and Non-Metric Proximity Measures: Distance between Pattern Collections.

Bayes Decision Theorem: Bayes Classifier, Linear and non-linear Discrimination functions, Minimum error rate classification, Error probability.

MODULE – II [10L]

Parameter Estimation: Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation, Hidden Markov model

Nonparametric Techniques: Parzen-window method, Nearest Neighbor method

MODULE – III [10L]

Nonlinear Classifier: Learning - Supervised and Unsupervised, Perceptron, Decision Tree.

Clustering: Process, Algorithms (basic hierarchical, Agglomerative, Partitional, K-means and Fuzzy C-means)

MODULE – IV [10L]

Feature selection: class Separability Measures – Divergence, Chernoff Bound & Bhattacharyya Distance, Scatter Matrices, Dimensionality reduction, similarity measures, feature selection criteria and algorithms, principal component analysis.

Books:

1. R. O. Duda, P. E. Hart and D. G. Stork, "Pattern Classification", 2nd ed., Wiley.
2. J. T. Tou and R. C. Gonzalez, "Pattern Recognition Principles", Addison-Wesley, London.
3. Christopher M. Bishop, "Neural Networks for Pattern Recognition", Oxford University Press.
4. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer.

Course Name: MEDICAL INSTRUMENTATION					
Course Code: AEIE4222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Explain the fundamental principles and applications of different transducers used for body parameter measurements.
2. Understand the physiology of biomedical systems and different methods in the design of biomedical instruments.
3. Learn the different methods of medical imaging systems, concepts related to the operations and analysis of biomedical instruments.
4. Learn various therapeutic devices.
5. Design various type bio-telemetry systems.
6. Aware of the importance of electrical safety and apply it in the design of different assisting

Detailed Syllabus:

MODULE-I [8L]

Transduction Principles: Transducers- Definition, principles of sensing and transduction, characteristics, classification, concept of signal conditioning; Body Temperature transducers- thermoresistive, thermoelectric, semiconductor, chemical thermometry and operating specifications; Blood Pressure transducer- Strain gauge type, variable capacitance type, LVDT and operating specifications; Blood Flow transducers- based on piezoelectric effects, electromagnetic effects, operating specifications; Acoustic Transducers- Heart sound.

MODULE-II [10L]

Bio-potentials and electrodes: Bio-potentials- Origin and electrical activity of cells, resting and action potentials of cells; Electrodes- Electrode theory and half-cell potential, Electrode-Electrolyte interface, types of electrodes: surface, needle and micro electrodes and respective applications. Electrode impedance, electrode jellies and creams; Measurement of electrical activities in Cardiovascular system- ECG, Einthoven's triangle, electrodes, amplifiers, cardiac pace-maker, defibrillator, Measurement of electrical activities in muscles and brain: EMG, EEG.

MODULE-III [10L]

Biomedical imaging: ultrasound imaging, radiography, CT scan, MRI and applications, Plethysmography; Assisting and therapeutic instruments: Pacemakers, defibrillators, Hearing aids. Ventilators, Heart-lung machine, Diathermy;

MODULE-IV [8L]

Philosophy of biotelemetry and patient safety: transmission and reception aspects of biological signals via long distances; electrical safety of patients; Measurements of blood pH, pCO_2, pO_2.

Books:

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Second edition, Prentice-Hall India, 1997
2. R.S. Khandpur, "Handbook of Biomedical Instrumentation", 2 Edition, Tata McGraw Hill New Delhi, 1987
3. John G. Webster, "Medical Instrumentation application and design", Third edition, Wiley, 1997
4. S. K. Venkata Ram, "Biomedical Electronics and Instrumentation", Galgotia Publication Pvt. Ltd., New Delhi
5. Geddes L.A and Baker L.E, "Principles of Applied Biomedical Instrumentation", Third edition, Wiley-Interscience, 1989.

Course Name: APPLIED ILLUMINATION ENGINEERING					
Course Code: ELEC4221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Apply laws of photometry for calculation of illuminance levels for different lighting applications
2. Understand the principles of operation of different photometers
3. Compare different types of lamps according to their specifications and uses
4. Develop energy efficient indoor lighting installations complying with lighting code
5. Correlate parameters of energy efficient outdoor lighting installations

Detailed Syllabus:

MODULE-I [9L]

Illumination Engineering Basics and Photometers

Visible spectrum of electromagnetic radiation. Radiometric and photometric quantities, visual response curve of standard observer, relation between Lumen and Watt. Laws of Illumination, perfect diffuser, Lambert's law. Bench photometer, luxmeter, integrating sphere.

MODULE-II [9L]

Principle of operation of lamps:

Incandescent lamps, tungsten halogen lamps, fluorescent lamps, low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, metal halide lamps, Light Emitting Diode (LED) lamps.

MODULE-III [9L]

Interior Lighting Design

General requirements and recommendations for working interiors. Recommendations for lighting of industries, offices, hospitals, educational institutes. Design calculations by lumen method in accordance with lighting code.

MODULE-IV [9L]

Outdoor Lighting

Basic concepts of outdoor lighting design- objectives, design parameters, qualitative & quantitative evaluation of outdoor lighting systems. Energy efficient street lighting guidelines. High mast lighting.

Books:

1.R. H. Simons & A.R. Bean, "Lighting Engineering Applied Calculations", Architectural Press
2.Jack L Lindsey, "Applied Illumination Engineering", Second Edition, Prentice Hall
3.J.R.Coaton and A.M.Marsden, "Lamps and Lighting", 4th Edition Arnold
4.IES Lighting Handbook – IES North America.
5.National Lighting Code- Published by Govt. of India,2011

Course Name: LOW POWER HIGH PERFORMANCE DIGITAL VLSI CIRCUIT DESIGN					
Course Code: ECEN4221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1.Learn timing Verification flows
2.Learn Static Timing Analysis Method
3.Learn Interconnect Design
4.Learn Process Variation impact on design
5.Learn Dynamic Power Reduction Techniques
6.Learn Standby Power Reduction Techniques

Detailed Syllabus:

MODULE-I [10L]

VLSI Verification Flows and Timing Analysis:

Unit1: VLSI Design and Verification Cycles: Logic, circuit and Layout design and Verification, pre-layout simulation, parasitic Extraction and Back-annotation, post layout verification

Unit2: Timing Analysis: Dynamic vs Static Timing Analysis. Types of Path for Timing Analysis: Data-path, Clock-path, Clock Gating Path, Asynchronous Path. Flop based Design: Launch path, Capture Path, Longest Path, Shortest Path, Critical Path. Timing checks: Setup (max) check, Hold (min) check, Gated Clock check, Process Variation study with PVT analysis, Clock Skew, Library Cell characterization

MODULE-II [6L]

VLSI Interconnect Design:

Component of Interconnect, Interconnect Cross Section, Wire material, Interconnect Modelling, Interconnect Design Issues and WirePlan: Capacitance, Delay, Lumped Model vs Distributed Model, RC Scaling, Repeater, Interconnect Power, Interconnect Noise: Coupling, Cross Talk

MODULE-III [12L]

Dynamic Power Reduction:

Unit1: Definition of dynamic power, Transition probability, Signal probability, Transition probability of basic gates, Glitch power, sources of switching capacitance

Unit2: Dynamic Power reduction with Vdd, Delay vs Power Trade-off, Dual Vdd, Dynamic Voltage Scaling (DVS), Capacitance Scaling, Transistor sizing, Transition probability reduction by clock gating, Logic restructuring, Input Reordering, Glitch reduction

MODULE-IV [8L]

Standby Power Reduction:

Unit1: Definition of Leakage power: Gate Leakage, Channel Leakage, Junction Leakage. Channel leakage issue with Threshold Voltage Scaling

Unit2: Technology Solution of Gate Leakage reduction: High-K, FinFET, Channel leakage reduction techniques: Multiple Threshold Voltage, Long Channel Transistor, Device Downsizing, Stacking, Power Gating, Dual Vdd, Dynamic Body-Biasing, Technology Solution: FinFET

Text Books:

1. Neil Weste, David Harris, "CMOS VLSI Design, A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, Pearson
2. Gary Yeap, "Practical Low Power Digital VLSI Design", Kluwer academic publishers, 2010

Reference Books:

1. Kuashik Roy and Sharat Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley & Sons, Inc. 2009
2. M. Rabaey, "Digital Integrated Circuit, Design Perspective", Prentice-Hall

COURSE NAME: CELLULAR AND MOBILE COMMUNICATION					
Course Code: ECEN4222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Learn about the evolution of radio communication and fundamental design strategies of cellular network.
2. Appreciate the challenges of RF communication.
3. Understand the concepts of propagation over wireless channels.
4. Learn about the both physical and networking of LTE-4G systems.
5. Understand the functioning of IP technology.
6. Apply their knowledge for research work in communication domain.

Detailed Syllabus:

MODULE-I [11L]

Introduction [2L]

Brief introduction to wireless communication and systems, Evolution of wireless/mobile standards - 1G, 2G, 3G and 4G and related networks, Brief introduction to 5G network, Potential challenges.

Cellular Networks: Design Fundamentals [4L]

Principle of cellular communication, Description of cellular system- Cellular Structure, Cell clustering, and Capacity enhancement techniques for cellular networks, Frequency Reuse- Co-channel and Adjacent channel interferences, Channel Assignment Strategy, Handoff Schemes, Mobility Management- Location, Radio Resource and Power management.

Radio Propagation Path Loss Models: Large Scale and Small Scale [5L]

Introduction to Radio Wave Propagation, Multipath Propagation mechanism and effects on Wireless Communication, Propagation models for Wireless networks- Free space propagation model, Ground reflection (Two-Ray) model, Log distance path loss model, Log normal shadowing model, Small-Scale Multipath Propagation- Influencing factors and Doppler shift, Types of Small Scale Fading, Introduction to antenna systems in mobile radio.

MODULE-II [8L]

Multiple Access Techniques for Wireless Communications [3L]

Introduction to multiple access techniques, Narrow band channelized systems- Frequency Division Duplex and Time Division Duplex Systems, Frequency Division Multiple Access, Time Division Multiple Access, Wideband Systems- Principles of WDM, Spread Spectrum Multiple Access, Space Division Multiple Access, Orthogonal Frequency Division Multiple Access.

GSM& GPRS: Architecture and Protocols- 2G & 2.5G [5L]

Introduction, GSM subsystems, GSM subsystems entities, GSM Air Interface, GSM frequency bands and allocation strategies, GSM channel structure, GSM call set-up procedure, GPRS (2.5G) network architecture, GPRS Attachment and Detachment procedure.

MODULE-III [9L]

Overview of CDMA Systems- 2G [3L]

CDMA Evolution-An overview, CDMA IS-95 systems, CDMA channel concept-Forward and Reverse, Transmission power control- Near Far problem and Multipath Phenomenon, Handoff process.

The Universal Mobile Telecommunication System-3G [2L]

UMTS Network architecture, Frequency allocation strategy, UMTS channels.

LTE 4G [4L]

Introduction to LTE network architecture, Uplink and Downlink frequency bands and allocation strategies, Channel Structure of LTE, Channel dependent multiuser resource scheduling.

MODULE-IV [8L]

Key Enablers for LTE 4G [5L]

Multicarrier concepts, Basics of OFDM, SC-FDE and SC-FDMA, OFDM in LTE, Timing and Frequency synchronization, Multiple Access for OFDM systems, OFDMA and SC-FDMA in LTE, OFDMA system design considerations.

Mobile Internet Protocol [3L]

Basic Mobile IP, Mobile IP Type-MIPv4 and MIPv6, Basic Entities of MIPv4, MIPv4 Operations, Registration, Tunneling and Reverse Tunneling, Triangular Routing.

Text Books:

1. T.S. Rappaport, “Wireless Communications: Principles and Practice”, Pearson Education
2. 3G and Beyond, I.SahaMisra, “Wireless Communication and Networks”, TMH Education
3. Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, “Fundamentals of LTE”, Pearson Education, ISBN-13: 978-0-13-703311-9

Reference Books:

1. K. Feher, “Wireless Digital Communications: Modulations and Spread Spectrum Applications”, Prentice Hall.
2. J.W.Mark and W. Zhuang, “Wireless Communications and Networking”, PHI.

COURSE NAME: OPTICAL FIBER COMMUNICATION					
Course Code: ECEN4223					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Apply the basic idea of electronics, physics and solid state devices and explain the operation of different components in an optical communication system.

2. Understand the properties of optical fiber and categorize the transmission characteristics of a wave through the optical fiber.

3. Analyze the structure of various optical sources and can classify them according to the performance, efficiency and application.

4. Explain the operation of optical detectors and can analyze the performance parameters of a detector.

5. Recognize the current optical technologies used for long distance communication and their application in optical networks.

6. Solve the problems related to optical fiber communication and can justify the physical significance of the solutions.

Detailed Syllabus:

MODULE-I [8L]

Introduction to communication systems: Principles, Components; Different Forms Of Communications, Advantages Of Optical Fiber Communication, Spectral Characteristics.

Optical Fiber: Cylindrical Wave Guide Structure (qualitative discussions only), Fabrication and Related Parameters, Single and Multimode Operation; Attenuation and losses, Material and Wave Guide Dispersion. Fiber Splices, Fiber Optic Connectors, OTDR.

MODULE-II [10L]

Optical Sources: Light Emitting Diode: Principle, Structures, Power And Efficiency, Surface Emitting LED And Edge Emitting LED, Super Luminescent Diode (SLD), Coupling of LEDs to Fibers. Laser diodes: Principle, Modes, Double Heterostructure, Gain and Index Guiding, Distributed Lasers, Narrow Line Width Lasers.

MODULE-III [12L]

Detectors & Other Network Components

Photo Detectors: Photo Diodes, Optical Detection Principles, Efficiency, Responsively, Bandwidth.

WDM System: Preamplifiers; Noise Sources, Wavelength Division Multiplexing: Building Blocks; Multiplexing; Intensity Modulation/Direct Detection System; Principle of Regeneration.

Optical amplifiers& Filters: EDFA, SOA, Raman Amplifier, Fabry-Perot Filters.

MODULE-IV [6L]

Optical Network

Network Topologies: LAN, MAN, WAN; Topologies: Bus, Star, Ring; Ethernet; FDDI;

Telecom Networking: SDH/SONET, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer

Text Books:

1. R. P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press
2. John M. Senior , "Optical Fiber Communication", Pearson
3. Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki, "Optical Networks – A Practical Perspective" Morgan-Kaufman
4. John Gawar, "Optical Communication Systems", PHI

Reference Books:

1. Gerd Kaiser, "Optical Fiber Communication", TMH

Course Name: COMPUTATIONAL BIOLOGY					
Course Code: BIOT4221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Acquire basic understanding of structures and functions of different biomolecules.
2. Obtain knowledge about the different metabolic pathways.
3. Explain different biological data and biological databases.
4. Understand classification of databases and how the biological data are stored in those databases.
5. Obtain the knowledge of different algorithms and programming languages to manage biological data.
6. Apply different tools and software for analysis of biological data.

Detailed Syllabus:

MODULE-I [10L]

Introduction to Biomolecules
Introduction to biochemistry and molecular biology; Biomolecules: structure, function and metabolic pathways.

MODULE-II [10L]

Scope of Computational Biology
Definition of computational biology; origin and development of computational biology; Nature and Types of biological data; Data Structures: Sequences (GENbank files), Secondary structures, Super-secondary structures (Motifs), Tertiary structures (Pubchem and PDB structure files); Interaction Networks, Photographic Data: Fingerprints (DNA and MS), Microarray data; Biological databases.

MODULE-III [10L]

Preferred Algorithms, Programming languages and Operating systems

Principles of Pattern recognition: Use of Hidden Markov Model and Artificial Neural Networks in computational biology; Significance of Python and C/C++; Operating system: Bio-Linux (Selected Bioinformatics packages)

MODULE-IV [10L]

Applications of Computational biology

Molecular Modeling and Dynamics: introduction to Open MM library; GROMACS as an example of GUI in the public domain; computer based drug design (public domain and proprietary); Mathematical modeling of cell growth kinetics; Embedded systems for computational biology: High throughput data collection, processing and analysis; LC-MS, DNA microarrays and other applications (e.g. mobile microscopy and high throughput micro-PCR); Systems biology and Metabolic Engineering.

Text Books:

1. Arthur M. Lesk, "Introduction to Bioinformatics", International Fourth Edition 2014, Oxford University Press
2. Jin Xiong, "Essential Bioinformatics", Cambridge University Press (2006).

Reference Books:

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", 7th edition, Academic Press.
2. T K Attwood, D J Parry-Smith and S. Phukan, "Introduction to Bioinformatics", Pearson
3. R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", 5th Edition,
4. Baldi and Brunak, "Bioinformatics-A Machine Learning Approach", 2nd Edition (2006), John Wiley Inc
5. J. Andrew McCammon and Stephen C. Harvey, "Dynamics of Proteins and Nucleic Acids", Cambridge University Press (1998)
6. Andrew R. Leach, "Molecular Modelling: Principles and Applications", 2nd Edition, Pearson (2016)
7. K.Anand Solomon, "Molecular Modelling and Drug Design",1st edition (2011), MJP Publishers.

Course Name: NON-CONVENTIONAL ENERGY					
Course Code: BIOT4222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the concept and necessity of non-conventional energy as an alternative source of energy.
2. Comprehend and apply the concepts of solar energy to design Photovoltaic cells and wind energy to design wind turbine.
3. Classify and design different biogas production processes.
4. Design a production process for biodiesel.
5. Understand the concept of hydrogen energy as a clean fuel and characterize the hydrogen production process.
6. Comprehend the importance and classification of hydrogen fuel cells.

Detailed Syllabus:

MODULE-I [10L]

Non-conventional energy: Different forms

Solar energy: Solar energy balance, production of electricity, photovoltaic systems.

Wind Energy: Wind energy conversion systems, power generation. Calculations on wind turbine.

Hydro thermal energy: Basics of hydro thermal energy. Energy from waves and tides.

MODULE-II [10L]

Biogas

Biomass as a renewable energy source; types of biomass – forest, agricultural and animal residues, industrial and domestic organic wastes.
Classification of biogas production processes: combustion, pyrolysis, gasification and other thermo-chemical processes.
Production of alcohol and biogas from biomass. Biogas from anaerobic digestion.

MODULE-III

Bio-diesel [10L]

Bio-diesel: Fundamentals; Trans-esterification of vegetable oils for biodiesel production; Characterization of biodiesel; Biodiesel from different sources; Economics, current trends and future prospects in usage of biodiesel.

MODULE-IV [10L]

Hydrogen as energy source

Hydrogen energy: Hydrogen energy system and analysis; Hydrogen infrastructure; Safety, codes and standards. Hydrogen production: Electrolysis; Thermochemical; Hydrogen from fossil fuel, biomass and renewable sources of energy. Problems on combustion of fuels.

Hydrogen storage: Carbon storage materials; Metal hydrides and chemical hydrides; Cryogenic hydrogen storage.

Hydrogen fuel cells: Principle, importance and classification.

Books:

1. J.E. Smith, "Biotechnology", 3rd ed., Cambridge University Press.
2. S. Sarkar, "Fuels and combustion", 2nd ed., University Press.
3. Donald L. Klass, "Biomass for renewable energy, fuels and chemicals", Academic Press.

Course Name: BIOLOGY FOR ENGINEERS					
Course Code: BIOT4223					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Understand the basic structure and function of cells and cellular organelles.
2. Understand the fundamental concepts of cellular reproduction and cell metabolism.
3. Characterize the different types of proteins, lipids and carbohydrates.
4. Analyze the mechanism of inheritance of characters through generations.
5. Understand and implement the working principles of enzymes and their applications in biological systems and industry.
6. Design and evaluate different environmental engineering projects with respect to background knowledge about bioresources, biosafety and bioremediation.

Detailed Syllabus:

MODULE-I [9L]

BASIC CELL BIOLOGY

Prokaryotic and Eukaryotic cells, Cell theory; Cell structure and function, Cell organelles, Structure and function of DNA and RNA, Central Dogma; Genetic code and protein synthesis, differences between eukaryotic and prokaryotic protein synthesis

MODULE-II [9L]

BIOCHEMISTRY AND CELLULAR ASPECTS OF LIFE

Biochemistry of carbohydrates, proteins and lipids; Cell metabolism – Glycolysis, TCA cycle, Fermentation; Cell cycle and cell death; Stem cells and their applications, Basics of Mendelian Genetics

MODULE-III [9L]

ENZYMES AND INDUSTRIAL APPLICATIONS

Enzymes – significance, co-factors and co-enzymes, classification of enzymes; Enzyme kinetics, enzyme inhibition, models for enzyme action; Restriction enzymes; industrial applications of enzymes; enzymes in human gene therapy and disease diagnostics

MODULE-IV [8L]

BIODIVERSITY AND BIOENGINEERING INNOVATIONS

Molecular motors, Basics of neural networks; Tissue Engineering; Basic concepts of environmental biosafety, bioresources, biodiversity, bioprospecting, bioremediation, biosensors; recent advances in engineering designs inspired by examples in biology

Text Books:

1. Wiley Editorial, "Biology for Engineers: As per Latest AICTE Curriculum", Wiley-India, 2018.
2. S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "Biology for Engineers", Tata McGraw-Hill, New Delhi, 2012.

Reference Books:

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "Molecular Biology", MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "Biosensors A Practical Approach", Bellwether Books**,** 2004.
4. Martin Alexander, "Biodegradation and Bioremediation", Academic Press, 1994.
5. Kenneth Murphy, "Janeway's Immunobiology", Garland Science; 8th edition, 2011.

Course Name: INTRODUCTION TO FRENCH LANGUAGE					
Course Code: HMTS4222					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Write simple sentences
2. Engage in interpersonal interaction in basic French.
3. Communicate about day to day activities, participate in formal interactions.
4. Learn the standard pronunciation Parisienne.
5. Construct expressions using basic vocabularies and simple grammatical structures.
6. Acquire the elementary language skills of speaking, reading and writing.

Detailed Syllabus:

MODULE-I [9L]

The French Alphabet, the vowels, pronunciation rules, stress and accents
Greetings, giving and requesting personal details
The numbers, nationalities, professions
Gender
The three conjugations: **-er**,**-ir, -re**
The verbs **Etre**, **Avoir**and **S'appeller**
Vocabulary Resources: the days of the week, the parts of the day, about habits
Expressing frequency
Asking and telling the time

MODULE-II [9L]

The **presente indicative**
Some uses of **à, de, en.**
The definite article: **Le, La, Les**
The indefinite article: **Un, Une , Des**
Reflexive verbs
Expressing existence and location
Vocabulary Resources: leisure activities, the weather, geography, tourist attractions
Speaking about physical appearance and character
Expressing and comparing likes, dislikes and interests, one's profession
Asking about likes and dislikes
Speaking about personal relationships, the family, daily activities.
Adjectives to describe character, music

MODULE-III [9L]

AdjectifInfterrogatif : **Quand, Comment, Où, Pourquoi, Combien, Quel/Quelle**
Identifying objects
Expressing needs
Shopping: asking for items, asking about prices, etc.
Talking about preferences

The numbers over 100
The colours, clothes, everyday objects
Demonstratives: **Ce, Cette, Ces**

MODULE-IV [9L]

The verb **Aimer, Adorer, Préférer, Détester**
Quantifiers (**Beaucoup, unpeu, bien**)
Possessives
Reflexive verbs
Direction (Près, Loin, à côtéde)
Ordering and giving information about food
Speaking about different culinary habits
Describing districts, towns and cities
Adjectives to describe a district

Books:

1) Cosmopolite 1 (Text Book, Work Book).
2) Webster's French grammar and vocabularies.
3) Collin's easy learning French Grammar and Practice.

Course Name: PROJECT II					
Course Code: INFO4295					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	16	16	8

Course Outcomes

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

1. Recall knowledge of the selected project topic.
2. Identify the problem to solve.
3. Design the solution of the problem by using software/ hardware skills.
4. Apply modern Information Technology tools and techniques for implementing solution.
5. Prepare report after implementing the project.
6. Demonstrate the project work.

Open Elective -IV (to be offered by IT Department)

Course Name: FUNDAMENTALS OF CRYPTOGRAPHY					
Course Code: INFO4221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

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

1. Define the concepts of Network security. Classify different types of attack on Network security. Recall the principles of security.
2. Classify different kinds of Substitution techniques and Transposition techniques and Describe the concepts of Symmetric key cryptography and Asymmetric key cryptography. Discuss in detail DES, RSA and IDEA algorithm.
3. Solve numerical based on DES and RSA. Analyze the concept of SSL, PEM and PGP. Compare MAC, Message Digest and Hash function.
4. Analyze HMAC algorithm. Describe Digital Signature.
5. Explain Authentication token and Classify between different types of Authentication tokens. Compare Certificate based authentication and Biometric Authentication
6. Explain the concepts of Firewall and DMZ Network. Compare between Packet filtering router, Application-level gateway and Circuit-level gateway. Classify between different Firewall Configurations.

Detailed Syllabus:

MODULE – I [8L]

Network Security and Cryptography- Concepts and Techniques

Need for Security, Security approaches, Principles of Security, Types of Active attack and Passive attack. Introduction to cryptography, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Types of Cipher, Cryptanalysis and Brute-force attack, Type of attacks on encrypted text, Symmetric & Asymmetric key Cryptography.

MODULE – II [10L]

Symmetric Key Algorithms

Algorithm types & Modes, Overview of Symmetric Key Cryptography, Diffie-Hellman key exchange algorithm, Digital Envelope, DES(Data Encryption Standard) algorithm & its variant and IDEA(International Data Encryption Algorithm) algorithm.

MODULE – III [11L]

Asymmetric Key Algorithms, Digital Signature and User Authentication

Overview of Asymmetric key Cryptography, RSA algorithm, Digital Signature, Basic concepts of Message Authentication code, Message Digest and Hash Function. HMAC algorithm. Authentication Basics, Password, Authentication Token, Certificate based Authentication and Biometric Authentication.

MODULE – IV [11L]

Electronic mail security, SSL and Firewall

Basics of e-mail security, PEM, PGP, Secure Socket Layer (SSL) protocol. Introduction to Firewall, Characteristics of Firewall, Packet filtering router, Application-level gateway, Circuit-level gateway, Bastion Host, Firewall Configurations and DMZ Network.

Text Books:

1. William Stallings, "Cryptography and Network Security", 3rd Edition, Pearson Education Asia
2. Atul Kahate, "Cryptography & Network Security", TMH

Reference Books:

1. Behrouz A. Forouzan, "Cryptography and Network Security", Special Indian Edition, 2007, TMH
2. William Stallings, "Network Security Essentials: Applications and Standards", Pearson.
3. C K Shyamala, N Harini and Dr T R Padmanabhan, "Cryptography and Security", Wiley India
4. C. Kaufman, R. Perlman and M.Speciner, "Network Security private communication in a public world", Pearson.