



**Heritage Institute of Technology**  
**Anandapur, Kolkata - 700107**

**Department of Information Technology**

**B. Tech.**

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# **PART- I**

## **Structures of Syllabus**

## 1<sup>st</sup> Year

### 1<sup>st</sup> 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	

## 2<sup>nd</sup> 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	

## 2<sup>nd</sup> Year

### 3<sup>rd</sup> Semester Syllabus:

Theory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	MATH2103	Discrete Mathematics	4	0	0	4	4	Basic 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	4	0	0	4	4	Professional Core Courses
6	EVSC2016	Environmental Sciences	2	0	0	2	0	Mandatory Courses
Total Theory			19	0	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			19	0	7	26	20.5	
1	INFO2111	Computer Organization and Architecture	3	0	0	3	3	Honours Course
2	INFO2161	Computer Organization and Architecture Lab	0	0	2	2	1	Honours Course
Total of Semester with Honours			22	0	9	31	24.5	

#### **4<sup>th</sup> 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	Software Engineering	3	0	0	3	3	Professional Core Courses
3	INFO2202	Object Oriented Programming	3	0	0	3	3	Professional Core Courses
4	INFO2203	Design & Analysis of Algorithms	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	INFO2251	Software Engineering Lab	0	0	3	3	1.5	Professional Core Courses
2	INFO2252	Object Oriented Programming Lab	0	0	3	3	1.5	Professional Core Courses
3	INFO2253	Design & Analysis of Algorithms Lab	0	0	4	4	2	Professional Core Courses
4	INFO2254	Database Management Systems Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			0	0	13	13	6.5	
Total of Semester			18	0	13	31	24.5	

### 3<sup>rd</sup> Year

#### 5<sup>th</sup> 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	Computer Networks	3	0	0	3	3	Professional Core Courses
3	INFO3103	Operating Systems	3	0	0	3	3	Professional Core Courses
4	INFO3104	Formal Language & Automata Theory	4	0	0	4	4	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	Computer Networks Lab	0	0	4	4	2	Professional Core Courses
3	INFO3153	Operating Systems Lab	0	0	3	3	1.5	Professional Core Courses
Total Laboratory			0	0	11	11	5.5	
Total of Semester			18	0	11	29	21.5	

#### **Elective I (5<sup>th</sup> Sem)**

1. INFO3131 - Computer Graphics
2. INFO3132 - Distributed Database Management Systems
3. INFO3133 – Cyber Security

**6<sup>th</sup> 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	Cryptography & Network Security	4	0	0	4	4	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	MATH3222/ MATH3223/ ELEC3221/ ECEN322	Open Elective I	3	0	0	3	3	Open Elective courses
Total Theory			16	0	0	16	16	

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

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 without Honours			16	0	7	23	19.5	
1	INFO3211	Digital Image Processing	3	0	0	3	3	Honours Course
2	INF03261	Digital Image Processing Lab	0	0	2	2	1	Honours Course
Total of Semester with Honours			19	0	9	28	23.5	

**Elective II(6th Sem)**

1. INFO3231 – Multimedia Technology & Applications
2. INFO3232 – E-Commerce & ERP
3. INFO3233 – Compiler Design
4. INFO3234 – Information Theory & Coding

**Open Elective I (6<sup>th</sup> Sem)**

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)**



## 4<sup>th</sup> Year

### 7<sup>th</sup> 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 without Honours			12	0	8	20	18	
1	INFO4111	Artificial Intelligence	4	0	0	4	4	Honours Course
Total of Semester with Honours			16	0	8	24	22	

<b><u>Elective III (7<sup>th</sup> Sem)</u></b> <ol style="list-style-type: none"> <li>1. INFO4131 – Introduction to Internet of Things</li> <li>2. INFO4132 – Mobile Computing</li> <li>3. INFO4133 – Real Time Systems</li> </ol>	<b><u>Open Elective II (7<sup>th</sup> Sem)</u></b> <ol style="list-style-type: none"> <li>1. MATH4121 – Methods in Optimization</li> <li>2. AEIE4122 - Linear Control Systems and Applications</li> <li>3. ELEC4121 – Automatic Control System</li> <li>4. ECEN4121- Software Defined Radio</li> <li>5. ECEN4122 - Introduction to Machine Learning</li> <li>6. ECEN4123 - Error Control Coding for Secure Data Transmission</li> <li>7. INFO4122 - Machine Learning</li> <li>8. BIOT4124 - Bio Sensor</li> </ol>
	<b><u>Open Elective III (7<sup>th</sup> Sem)</u></b> <ol style="list-style-type: none"> <li>1. ECEN4126 – Principles of Radar</li> <li>2. ECEN4127 - Ad Hoc Wireless Networks</li> <li>3. AEIE4127 – Introduction to Embedded System</li> <li>4. BIOT4126 - Biopolymer</li> <li>5. MATH4126 - Advanced Linear Algebra</li> <li>6. ELEC4126 - Principles of Electrical Machines</li> </ol>

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

## 8<sup>th</sup> 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	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	
1	HMTS4011*	Disaster Response Services and Technologies	4	0	0	4	4*	Honours Course
Total of Semester with Honours*			13*	0	16	29*	22*	

**\*Only for Lateral Entry Students**

<b><u>Elective IV(8<sup>th</sup> Sem)</u></b> 1. INFO4231 –Blockchain Technology 2. INFO4232 –Internet Technology 3. INFO4233 –Distributed Computing	<b><u>Open Elective IV(8<sup>th</sup> Sem)</u></b> 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
<b><u>Elective V(8<sup>th</sup> Sem)</u></b> 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*	<b>12</b>
2	Basic Science courses	25*	<b>27</b>
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*	<b>24.5</b>
4	Professional core courses	48*	<b>52.5</b>
5	Professional Elective courses relevant to chosen specialization/branch	18*	<b>15</b>
6	Open subjects – Electives from other technical and /or emerging subjects	18*	<b>12</b>
7	Project work, seminar and internship in industry or Elsewhere	15*	<b>17</b>
8	Honours Course	-	<b>24**</b>
9	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	<b>2 non credit subjects</b>
Total		160	<b>184**</b>

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

\*\*An extra Honours Course of 4 Credit Point is assigned in 8<sup>th</sup> Semester Curriculum exclusively for Lateral Entry Students.

## **Honours Credit Chart**

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
1.	1 <sup>st</sup>	HMTS1011	Communication for Professionals	3	0	0	3
2.		HMTS1061	Professional Communication Lab	0	0	2	1
3.	2 <sup>nd</sup>	ECEN1011	Basic Electronics	3	0	0	3
4.		ECEN1061	Basic Electronics Lab	0	0	2	1
5.	3 <sup>rd</sup>	INFO2111	Computer Organization and Architecture	3	0	0	3
6.	3 <sup>rd</sup>	INFO2161	Computer Organization and Architecture Lab	0	0	2	1
7.	4 <sup>th</sup>						
8.	5 <sup>th</sup>						
9.	6 <sup>th</sup>	INFO3211	Digital Image Processing	3	0	0	3
10.	6 <sup>th</sup>	INFO3261	Digital Image Processing Lab	0	0	2	1
11.	7 <sup>th</sup>	INFO4111	Artificial Intelligence	4	0	0	4
12.	8 <sup>th</sup>	HMTS4011*	Disaster Response Services and Technologies	4*	0	0	4*
	Total						24*

\*An extra Honours Course of 4 Credit Point is assigned in 8<sup>th</sup> Semester Curriculum exclusively for Lateral Entry Students.

### **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**

<b>Code</b>	<b>Name</b>	<b>Credit Points</b>	<b>Corresponding Online Course</b>	<b>Offered by</b>	<b>PLATFORM</b>
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	Computer Organization and Architecture	3	Computer Architecture And Organization	IIT Kharagpur	Swayam
INFO2161	Computer Organization and Architecture Lab	1	System Design Through VERILOG	IIT Guwahati	Swayam
INFO3211	Digital Image Processing	3	Digital Image Processing	IIT Kharagpur	NPTEL
INFO3261	Digital Image Processing Lab	1	Digital Image Processing Lab		
INFO4111	Artificial Intelligence	4	Fundamentals of Artificial Intelligence	IIT Guwahati	NPTEL



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## **PART- II**

### **Detailed Syllabus**



## 1<sup>st</sup> Year 1<sup>st</sup> Semester

<b>Course Name: CHEMISTRY-1</b>					
<b>Course Code: CHEM1001</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 characterization 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, Dual 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  $\Psi$ , 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, Collision 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.

<b>Course Name: MATHEMATICS – I</b>					
<b>Course Code: MATH1101</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 convergence: 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).

<b>Course Name: BASIC ELECTRICAL ENGINEERING</b>					
<b>Course Code: ELEC1001</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: CHEMISTRY-I LAB</b>					
<b>Course Code: CHEM1051</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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  $\text{Fe}^{2+}$ ,  $\text{Cu}^{2+}$  and  $\text{Cl}^-$  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  $\text{KmnO}_4$  self indicator.
2. Iodometric estimation of  $\text{Cu}^{2+}$ .
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.

<b>Course Name: BASIC ELECTRICAL ENGINEERING LAB</b>					
<b>Course Code: ELEC1051</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: ENGINEERING GRAPHICS &amp; DESIGN</b>					
<b>Course Code: MECH1052</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 1<sup>st</sup> Year 1<sup>st</sup> Semester**

<b>Course Name: COMMUNICATION FOR PROFESSIONALS</b>					
<b>Course Code: HMTS1011</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 Delhi 2011.
2. Effective Technical Communication, Rizvi, Ashraf, M., McGraw Hill Education (India) Pvt.Ltd. Chennai, 2018.
3. Technical Communication: Principles and Practice, <sup>2nd</sup> Ed., 2011, Raman, M. and Sharma, S.

<b>Course Name: PROFESSIONAL COMMUNICATION LAB</b>					
<b>Course Code: HMTS1061</b>					
<b>Contact Hours per week</b>	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, 3<sup>rd</sup> Ed., 2004.
3. Guide to Managerial Communication: Effective Business Writing and Speaking, Munter, M., Prentice Hall, 5<sup>th</sup> 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.



## 1<sup>st</sup> Year 2<sup>nd</sup> Semester

<b>Course Name: Mathematics – II</b>					
<b>Course Code: MATH1201</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: PHYSICS – I</b>					
<b>Course Code: PHYS1001</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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;  $F = -\text{grad } V$ , 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 its 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.

<b>Course Name: PROGRAMMING FOR PROBLEM SOLVING</b>					
<b>Course Code: CSEN1001</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: BUSINESS ENGLISH</b>					
<b>Course Code: HMTS1202</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 of a 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. Business English, Hauppauge, Geffner, Andrew P. New York: Barron's Educational Series.
4. Business Communication, Kalia, S. & Agarwal, S., Wiley India Pvt. Ltd., New Delhi, 2015
5. Business Communication- Connecting at work., Mukherjee, H.S., Oxford University Press. 2<sup>nd</sup> Edition. 2015
6. Technical Communication: Principles and Practice, 2<sup>nd</sup> Ed., Raman, M. and Sharma, S., 2011.



<b>Course Name: PHYSICS – I LAB</b>					
<b>Course Code: PHYS1051</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 Poiseuille'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.

#### **Text Books**

1. Advanced Practical Physics (Vol.1 and Vol.2), B.Ghosh and K.G.Mazumdar.
2. Advanced Course in Practical Physics, D.Chattopadhyay and P.C.Rakshit.

#### **Reference 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, N.K. Bajaj.
4. Principles of Physics, David Halliday, Robert Resnick Jearl Walker, 10ed, 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, C.L.Arora, Vol1 and Vol 2.

<b>Course Name: PROGRAMMING FOR PROBLEM SOLVING LAB</b>					
<b>Course Code: CSEN1051</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: WORKSHOP/ MANUFACTURING PRACTICES LAB</b>					
<b>Course Code: MECH1051</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: LANGUAGE LAB</b>					
<b>Course Code: HMTS1252</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 superficial listening, 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, 3<sup>rd</sup> Ed., 2004.
3. Guide to Managerial Communication: Effective Business Writing and Speaking, Munter, M., Prentice Hall, 5<sup>th</sup> Ed., 1999.
4. Communication and Language Skills, Sen, S.,Mahendra, A. &Patnaik,P., Cambridge UniversityPress, 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 1<sup>st</sup> Year 2<sup>nd</sup> Semester

<b>Course Name: BASIC ELECTRONICS</b>					
<b>Course Code: ECEN1011</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 analyze 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.

<b>Course Name: BASIC ELECTRONICS LAB</b>					
<b>Course Code: ECEN1061</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Electronics Fundamentals and Applications, D. Chattopadhyay, P. C Rakshit.
2. Electronics Laboratory Primer, B Sasikala.

## 2<sup>nd</sup> Year 1<sup>st</sup> Semester

<b>Course Name: DISCRETE MATHEMATICS</b>					
<b>Course Code: MATH2103</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	4	0	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.

<b>Course Name: ANALOG CIRCUITS</b>					
<b>Course Code: ECEN2101</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, Adel S. Sedra, Kenneth C. Smith.
2. Electronics Devices and Circuits, Robert L. Boylestad, Louis Nashelskey.
3. Fundamentals of Microelectronics, Behzad Razavi.
4. Integrated electronics, Jacob Millman, Christos C. Halkias.

<b>Course Name: DIGITAL SYSTEMS DESIGN</b>					
<b>Course Code: ECEN2002</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, Morris 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, Floyd & Jain- Pearson.



<b>Course Name: HUMAN VALUES AND PROFESSIONAL ETHICS</b>					
<b>Course Code: HMTS2001</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, Utilitarianism, 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, Kurzweil, 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 13<sup>th</sup> Edition).

<b>Course Name: FUNDAMENTALS OF DATA STRUCTURE &amp; ALGORITHMS</b>					
<b>Course Code: INFO2101</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	4	0	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.

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

### **Course Outcome:**

The subject code EVSC2016 corresponds to basic environmental chemistry for the 2<sup>nd</sup> 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 PublishingHouse 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.

<b>Course Name: ANALOG CIRCUITS LAB</b>					
<b>Course Code: ECEN2151</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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



<b>Course Name: DIGITAL SYSTEMS DESIGN LAB</b>					
<b>Course Code: ECEN2052</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 multiplexer 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.

<b>Course Name: FUNDAMENTALS OF DATA STRUCTURE &amp; ALGORITHMS LAB</b>					
<b>Course Code: INFO2151</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	0	0	3	3	1.5

### **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 identify 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: BreadthFirstSearch Techniques, DepthFirstSearch Techniques.

### **Books**

1. The CProgramming 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. DataStructures, Seymour Lipschutz, Schaum's Outlines Series, Tata McGraw-Hill.
5. Fundamentals of Data Structures in C, EllisHorowitz, Satraj Sahnian, Susan Anderson-Freed, W.H.Freeman andCompany.
6. How to Solve it by Computer, R.G.Dromey, Prentice-HallofIndia.
7. Data Structures using C, Reema Thareja, Oxford University Press.

## Honours Course for 2<sup>nd</sup> Year 1<sup>st</sup> Semester

Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE					
Course Code: INFO2111					
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 instruction formats and addressing modes in the context of computer architecture.
2. Design the ALU for different arithmetical and logical problems and apply the knowledge of different multiplication and division algorithm.
3. Understand the memory hierarchy (Register, Cache, Primary and Secondary).
4. Analyze different memory technologies and related replacement techniques.
5. Analyze the types of pipeline including instruction pipeline and arithmetic pipeline.
6. Understand different types of Multiprocessor architectures and types of Control Units.

### Detailed Syllabus:

#### **MODULE-I [8L]**

##### **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, Ripple carry adder, Carry Look-ahead adder, Multiplication algorithm, Division algorithm, 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, Introduction to ILP and techniques to improve ILP, Arithmetic pipeline, Types of Pipeline hazards and its countermeasures, Superscalar and VLIW architecture. Array and Vector processor.

#### **MODULE-IV [8L]**

##### **Multiprocessor Architecture and Control Unit:**

Taxonomy of parallel architectures, Types of Multiprocessor architectures, Multicomputer Architecture, Centralized and Distributed shared memory architecture, Cluster computer, RISC and CISC architecture. Introduction to Control unit, Hardwired CU and Micro programmed CU.

### Books

1. Advanced Computer Architecture, Kai Hwang, TMH.
2. Computer Architecture: A Quantitative approach, Patterson and Hennessy, Morgan Kaufmann.
3. Computer Architecture, T.K.Ghosh, TMH.
4. Computer System Architecture, Morris Mano, PHI.
6. Computer Organization, Carl Hamacher, McGraw Hill.

<b>Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE LAB</b>					
<b>Course Code: INFO2161</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	0	0	2	2	1

### **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: (Chip based realization and Xilinx based synthesis and simulation)**

1. Logic Gates
2. Adders: Half-Adder, Full Adder
3. Subtractors: Half Subtractor, Full Subtractor
4. Horizontal and Vertical Expansion of RAM
5. Combinational Circuit Designs
6. Multiplexers: 4:1 and 8:1, 8:1 using 4:1 and 2:1
7. Code Converters: 4-Bit Binary to Gray, 4-bit Gray to Binary
8. 7-Segment Display
9. 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.

## 2<sup>nd</sup> Year 2<sup>nd</sup> 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.

<b>Course Name: SOFTWARE ENGINEERING</b>					
<b>Course Code: INFO2201</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	3	0	0	3	3

### **Course Outcome:**

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

1. Understand the basic concept of SDLC stages and different SDLC models.
2. Model function-oriented software design.
3. Develop object-oriented software design.
4. Analyze different approaches of testing methodology in software system.
5. Estimate size, effort, cost and time related to a software project.
6. Work out software project schedule and staffing plan.

### **Detailed Syllabus:**

#### **MODULE-1[10L]**

##### **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 [9L]**

##### **Design Phase:**

**[3L]**

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 [9L]**

##### **Coding or Programming:**

**[2L]**

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

##### **Review and Testing:**

**[7L]**

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 [10L]**

##### **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:**

**[3L]**

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.

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

### **Course Outcome:**

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

1. Understand the basic concepts and fundamentals of platform independent object oriented programming language and its specialties.
2. Use the syntax and semantics of Java programming language and basic concepts of OOP to write programs relating to the real world in an Object Oriented paradigm.
3. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
4. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
5. Apply the knowledge of Input Output System handling to write user interactive programs.
6. Design event driven GUI and applets which mimic the real world scenarios.

### **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, CLASSPATH. Implementation of different relationships in OOPs.

#### **MODULE-III [8L]**

##### **Exception handling and Multithreading:**

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread joining, thread synchronization, inter-thread communication, deadlocks for threads.



## **MODULE-IV [8L]**

### **I/O and Applet & Swing Programming:**

Input Output stream structure, Wrapper class, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes, I/O class hierarchy with the use of DataInputStream, DataOutputStream, PrintWriter. File Handling.

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, Rumbaugh, 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.

<b>Course Name: DESIGN &amp; ANALYSIS OF ALGORITHMS</b>					
<b>Course Code: INFO2203</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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:**

Properties of an algorithm, Patterns in algorithm, Time and Space Complexity, Different Asymptotic notations – their mathematical significance, The Master theorem, Generating Functions. [3L]

##### **Divide and Conquer:**

Basic method, Binary Search, Merge Sort, Quick Sort and their complexity. [2L]

##### **Matrix Manipulation Algorithm:**

Strassen's matrix manipulation algorithm. [1L]

##### **Heapsort:**

Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues. [2L]

##### **Lower Bound Theory:**

$O(n \lg n)$  bound for comparison sort. Set manipulation algorithm like UNION-FIND. [1L]

#### **MODULE – II [12L]**

##### **Graph Traversal Algorithm:**

Introduction of Graph, Breadth First Search (BFS), Depth First Search (DFS), Best First Search, Bidirectional Search. [5L]

##### **Network Flow:**

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration). [3L]

##### **Backtracking:**

Basic method, 8 queens problem, Graph coloring problem. [4L]

#### **MODULE – III [12L]**

##### **Greedy Method:**

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 [4L]

##### **Dynamic Programming:**

Basic method, All pair shortest paths, Single source shortest path, Matrix Chain Manipulation, Travelling salesperson problem. [8L]

## **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**

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

<b>Course Name: DATABASE MANAGEMENT SYSTEMS</b>					
<b>Course Code: INFO2204</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, and Deduce the constraints , i.e., the candidate keys, super-keys, that exists in a given real world problem
2. 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 [8L]**

##### **Introduction and Conceptual Modeling**

##### **Database Model, Schema and Architecture:**

Concept & Overview of database and DBMS, Advantages of using DBMS approach, Database Users and Types, Database Applications. Data Models, Schema, Instances, Three Schema architecture of DBMS, Data Independence, Introduction to Big Data.

##### **Entity-Relationship Model:**

Basic concepts, Design Issues, Super Keys, Candidate keys, Concept of Composite Keys, Cardinality, 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. Problem Solving.

#### **MODULE-II [10L]**

##### **Relational Model**

##### **Schema Design:**

Mapping of ER model to Relational Model. Different Constraints: Check, Primary Key, Not Null, Referential Integrity Constraint, Unique.

##### **Relational Algebra:**

Fundamental Operations in relational algebra: select, project, rename, set difference, union, cartesian product, Additional Operations: Natural Join, Theta Join, Division, Set Intersection, Assignment  
Extended Operations: Generalized Projection, Aggregate Functions, Outer Join

**Introduction to Database languages:**

SQL: Concept of DDL, DML, DCL, TCL, DQL. Creation, Alteration, Dropping of Objects. Adding Constraints, Modifying Constraints, Dropping Constraints. Different Data Access Patterns, and modifications. Single Row Functions, Group Functions. Join and SubQuery. Creating Users and adding Privileges. Top N Analyses, View  
PL/SQL: Basic Structure, Control Structures, Procedures, Exceptions, Implicit and Explicit Cursor, Triggers.

**MODULE-III [13L]****Relational Database Design****Functional Dependencies:**

Basic concept of Functional Dependency, Axioms, Closure, Attribute closure, Equivalent set of FD, Cover, Canonical cover. Problem Solving.

**Normalization:**

Different Methods of Determining candidate keys from given FD set. Why Normalization Required. Different Anomalies in Designing a Database. First, Second and Third Normal Form, Boyce-Codd Normal Form, Dependency Preservation, Lossless Decomposition. Normalization using Multi-Valued Dependencies and Join Dependency. Designing Normalized Databases, Given a Problem.

**MODULE-IV [13L]****Transaction Processing, Indexed Data Storage****Transaction processing concepts:**

Transaction Properties and States. Serial vs. Concurrent Execution. Conflict and View Serializability, Problem Solving. Concurrency Control techniques and Recovery Management

**File Organization & Index Structures:**

File & Record Concept, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

**Text 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 C. J. date, Pearson Edition.

**Reference Books**

1. Database Management System, Ramakrishnan, McGraw-Hill.
2. Transaction Processing: Concepts and Techniques Gray Jim and Reuter Address, Moragan Kauffman Publishers.

<b>Course Name: SOFTWARE ENGINEERING LAB</b>					
<b>Course Code: INFO2251</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 software project as per IEEE guidelines.
2. Prepare project schedule and staffing plan for sample software project.
3. Design sample software project using Entity Relationship Diagram.
4. Design sample software project using Data Flow Diagram.
5. Design sample software project using various UML diagrams.
6. Prepare test cases for sample software project.

### **Syllabus:**

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

<b>Course Name: OBJECT ORIENTED PROGRAMMING LAB</b>					
<b>Course Code: INFO2252</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, String Buffer, Array List and Linked List 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, Buffered Reader, Print Writer. 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, Rumbaugh, 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.



<b>Course Name: DESIGN &amp; ANALYSIS OF ALGORITHMS LAB</b>					
<b>Course Code: INFO2253</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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

#### **Lab1: Divide and Conquer:**

Implement Binary Search using Divide and Conquer approach

Implement Merge Sort using Divide and Conquer approach

#### **Lab2: 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

#### **Lab3: Graph Traversal Algorithm:**

Implement Breadth First Search (BFS)

Implement Depth First Search (DFS)

#### **Lab4: Greedy method:**

Fractional Knapsack Problem

Job sequencing with deadlines

#### **Lab5: 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)

#### **Lab6: Dynamic Programming:**

Find the minimum number of scalar multiplication needed for chain of matrix

#### **Lab7: Dynamic Programming:**

Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm)

Implement Traveling Salesman Problem

**Lab8:** Dynamic Programming:

Implement Single Source shortest Path for a graph (Bellman Ford Algorithm)

**Lab9:** Backtracking:

Implement 8 Queen Problem

**Lab10:** Backtracking:

Graph Coloring Problem

**Lab11:** 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.

<b>Course Name: DATABASE MANAGEMENT SYSTEMS LAB</b>					
<b>Course Code: INFO2254</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, Ivan Bayross.
2. SQL The Complete Reference, Groff James.
3. Oracle PL/SQL Programming, Feuerstein, Steven.

### **3<sup>rd</sup> Year 1<sup>st</sup> Semester**

<b>Course Name: ADVANCED JAVA &amp; WEB TECHNOLOGY</b>					
<b>Course Code: INFO3101</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	3	0	0	3	3

#### **Course Outcome:**

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

1. Design static and dynamic web pages using HTML and CSS.
2. Apply JavaScript for client and server side scripting.
3. Understand servlet and JSP technologies.
4. Implement server side program using Servlet and JSP.
5. Understand the use of Java Server Faces framework and RESTful Web Services for Java-based web applications.
6. Understand the concept of Enterprise Java Beans and its types.

#### **Detailed Syllabus:**

##### **MODULE – I [8L]**

**Static Web Pages:** Web Pages - Types and issues, Tiers Architecture, 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).

**Active Web Pages:** Need of active web pages; Java Swing.

##### **MODULE – II [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, De-structuring assignment, Symbol, Maps and Sets, for-of, Spread operator, Classes, Module loaders, Typed Arrays.

##### **MODULE – III [10L]**

**Java Servlet:** Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

**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, using include and forward action, Introduction to JDBC, prepared statement and callable statement.

## **MODULE – IV [8L]**

**JavaServer Faces:** Facelets, Resource Handling, Composite Components, Request Processing Life-Cycle Phases, HTTP GET.

**RESTful Web Services:** Resources, Binding HTTP Methods, Multiple Resource Representations, Binding a Request to a Resource, Entity Providers, Entity Providers.

**Enterprise Java Beans:** An overview of EJB, Session Beans, Entity Bean and Message Driven Bean.

### **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.
4. Java EE Essential, Arup Gupta, O'Reilly.

### **Reference Books**

1. Advanced Java Programming, Uttam Kumar Roy, Oxford University Press.

<b>Course Name: COMPUTER NETWORKS</b>					
<b>Course Code: INFO3102</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	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 & 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**

1. 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.



<b>Course Name: OPERATING SYSTEMS</b>					
<b>Course Code: INFO3103</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Apply multiprocessing and multithreading architectures enabled with inter-process /thread communication and synchronization to improve the performance of the system.
4. Compare the different levels 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, Milenkovic M., McGraw Hill.
2. Operating System Design & Implementation, Tanenbaum A.S., Prentice Hall NJ.
3. Operating System Concepts, Silberschatz 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.

<b>Course Name: FORMAL LANGUAGE &amp; AUTOMATA THEORY</b>					
<b>Course Code: INFO3104</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	4	0	0	4	4

### **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  $\hat{I}$  transitions - Significance, acceptance of languages.

##### **Conversions and Equivalence:**

Equivalence between NFA with and without  $\lambda$ -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 Greibach 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 Chandrashekar, 2<sup>nd</sup> 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.

<b>Course Name: COMPUTER GRAPHICS</b>					
<b>Course Code: INFO3131</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 hardware: 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.

<b>Course Name: DISTRIBUTED DATABASE MANAGEMENT SYSTEMS</b>					
<b>Course Code: INFO3132</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 understand the various architectures of DDBMS.
2. Able to deduce a mathematical tool using relational algebra and design a normalized Database based on real-world situations, maintaining all constraints.
3. Design and Apply various distribution fragmentation and Allocation techniques, given a problem
4. Apply the different distributed transaction protocols and recovery techniques.
5. Analyze and apply query optimization algorithms.
6. Design a normalized centralized database, and can convert it into distributed database with respect to a given Problem.

### **Detailed Syllabus:**

#### **MODULE-I [8L]**

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 [11L]**

##### **Distributed Databases: An Overview**

Definition, Features of Distributed Database, The need for Distributed Database, Centralized vs. Distributed DBMS, Distributed Database on a geographically dispersed network, Distributed Database on a local network

##### **Levels of Distribution Transparency**

Reference Architecture for Distributed Databases: Global Schema, Fragmentation Schema, Allocation Schema, Local Mapping Schema. Distribution transparency: Location Transparency, Fragmentation Transparency, Replication Transparency, Local Mapping Transparency, Replication Transparency, Applications

##### **Data Fragmentation**

Rules of Fragmentation, Horizontal Fragmentation, Vertical Fragmentation, Derived Horizontal Fragmentation, Mixed Fragmentation

##### **Distributed Fragment Design**

Objectives of Design, Design of Horizontal Fragments: Simple Predicate, Minterm Predicates, Complete and Minimal Rules, Problem Solving. Design of Vertical Fragments and Derived Horizontal Fragments. Problem Solving.

## **MODULE-III [11L]**

### **Allocation Design**

Redundant and Non Redundant Allocation, Measures of Cost and Benefits of Fragment Allocation, Problem Solving

### **Query Processing**

Overview of Query Processing Steps: Parsing and Translation, Optimization and Evaluation  
Measures of Query Cost, Selection Operation, Sorting, Join Operation: Nested Loop Join Algorithm, Block Nested Loop Join Algorithm, Hash Join Algorithm, Problem Solving. Evaluation of Expressions, Translation of Global Queries to Fragment Queries

### **Query Optimization**

Overview, Transformation of Relational Expressions: Equivalence Rules, Problem Solving, Join Ordering, Estimating Statistics of Expression, Choice of Evaluation Plans, Problem Solving

## **MODULE-IV [10L]**

### **Distributed Transactions and Management**

Overview of Distributed Transactions, Applications, Atomicity in Distributed Transaction: Several Communication Failures in Distributed Transactions, Reference Models of Distributed Transactions Recovery, 2 - Phase Commitment Protocol, its behavior with Different kinds of Failures, 3 - Phase Commitment Protocol

### **Distributed Concurrency Control**

Objectives of Distributed Concurrency Control, Concurrency Control based on Locking, Reference Model for Distributed Concurrency Control, Serializability in Distributed Database, Problem Solving

### **Distributed Deadlocks**

Overview, Distributed and Local Wait for Graphs, Distributed Deadlock Detection Algorithms, False Deadlocks, Deadlock Prevention, Problem Solving

### **Text Books**

1. Distributed Databases Principles and Systems, Stefano Ceri and Giuseppe Pelagatti, McGraw Hill Education.
2. Principles of Distributed Database Systems, Ozsu, Pearson Publication.
3. Database System Concepts, Silberschatz–Korth–Sudarshan , The McGraw–Hill.
4. Distributed Databases, Sachin Deshpande, Dreamtech.
5. An Introduction to Database Systems, Christopher J. Date, Pearson Publication.



<b>Course Name : CYBER SECURITY</b>					
<b>Course Code: INFO3133</b>					
<b>Contact Hours</b>	L	T	P	Total	CreditPoints
<b>per week:</b>	3	0	0	3	3

### **Course Outcome:**

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

1. Define the concept of Cybercrime, Classify types of Cybercrime and Cybercriminals.
2. Discuss the phases in planning cybercrime, Explain Cyber Stalking and different tools for Active attack and Passive attack.
3. Discuss the security challenges posted by mobile devices, Compare the attacks on mobile/Cell phones and Differentiate between techniques of Credit Card fraud. Compare the attacks on Bluetooth technologies.
4. Explain the stages of Network attack, Differentiate between Proxy Server and Anonymizer, Classify password cracking attacks, Explain types of Virus and Worms, Differentiate between Trojan Horse and Backdoor.
5. Classify and discuss Denial of Service (DOS) attacks, Explain DDOS attack and discuss SQL injection.
6. Explain Phishing and Identity theft and Discuss steps and tools for Digital Forensic Analysis.

### **Detailed Syllabus:**

#### **MODULE-I [8L]**

##### **Introduction of Cybercrime:**

Definition of Cybercrime, Classifications of Cybercrime, Techno-crime and Techno-vandalism, Botnet Menace, Types of Cybercriminals, Phases of Cybercrime, Tools for Active attacks and Tools for passive attacks, Cyberstalking.

#### **MODULE-II [8L]**

##### **Cybercrime Mobile & Wireless devices:**

Techniques of Credit Card Frauds, Security challenges posted by mobile devices, Attacks on mobile/cell phones, Attacks on Bluetooth technologies, Bluetooth hacking tools, Guidelines for implementing Mobile device Security. Stages of Network attack.

#### **MODULE-III [10L]**

##### **Tools and Methods used in Cyber crime:**

Proxy servers and Anonymizer, Classification of Password cracking attacks, Keyloggers and Spywares, Types of Virus, Types of Worms, TrojanHorses and Backdoors, DOS & DDOS attacks, SQL injection.

#### **MODULE-IV [11L]**

##### **Phishing & Identity Theft:**

Methods of Phishing, Techniques of Phishing, Spear Phishing and Whaling, Types of Phishing Scams, Countermeasures of Phishing, Types of Identity Theft, Techniques of Identity theft, Geotagging, Tools for protecting online identity.

**Digital Forensic:** Introduction to Digital Forensic, Steps of Forensic investigation, Tools for Digital forensic analysis and Organizational guidelines for Cell phone Forensics.

### **Text Books**

1. Cyber Security, Nina Gobole & Sunit Belapune, Wiley India.

<b>Course Name: INDIAN CONSTITUTION AND CIVIL SOCIETY</b>					
<b>Course Code: INCO3016</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.Elliott, (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.

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

### **Course Outcome:**

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

1. Design static web pages using HTML.
2. Implement CSS to design dynamic HTML pages.
3. Implement JavaScript client and server side scripting.
4. Developed Servlet based web application.
5. Developed JSP based web application.
6. Design Java-based web applications using JavaServer Faces framework.

### **Syllabus:**

1. HTML.
2. CSS [Inline, External].
3. JavaScript Control Structure and Functions.
4. JavaScript Events.
5. JavaScript Objects and Arrays.
4. JavaScript Validation and implementation in HTML Form.
5. Servlet.
6. Java Server Pages.
7. JDBC for Database Connectivity.
8. Java Server Faces Framework.

### **Books**

1. Web Technologies, Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design, Xavier C., New Age Publication.
3. JavaScript: The Definitive Guide by David Flanagan 7th Edition, O'Reilly Media.
4. Java EE Essential by Arup Gupta, O'Reilly.

<b>Course Name: COMPUTER NETWORKS LAB</b>					
<b>Course Code: INFO3152</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	0	0	4	4	2

### **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, Addison-Wesley, 2004.

<b>Course Name: OPERATING SYSTEMS LAB</b>					
<b>Course Code: INFO3153</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 subtasks 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. **Shell Programming [3P]:** Shell Commands, Creating a shell script, making a script executable, shell syntax (variables, conditions, control structures).
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 sem\_init, sem\_wait, sem\_post, sem\_destroy).
5. **POSIX Threads [6P]:** programming with pthread functions (viz. pthread\_create, pthread\_join, pthread\_exit)
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, Behrouz A. Forouzan, Richard F. Gilberg, Thomson, 2003.
2. The UNIX Programming Environment, Brian W. Kernighan, Rob Pike, PHI, 1996.
3. Understanding UNIX, K. Srengan, 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.

### 3<sup>rd</sup> Year 2<sup>nd</sup> Semester

<b>Course Name: ECONOMICS FOR ENGINEERS</b>					
<b>Course Code: HMTS3201</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: CRYPTOGRAPHY &amp; NETWORK SECURITY</b>					
<b>Course Code: INFO3201</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	4	0	0	4	4

### **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.
3. Discuss in detail DES, RSA, IDEA and RC5 algorithm. Solve numerical based on DES and RSA algorithms. Explain Diffie-Hellman Key exchange algorithm and Digital Envelope.
4. Compare MAC, Message Digest and Hash function. 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. Explain Kerberos Authentication protocol.
6. Analyze the concept of SSL, PGP and PEM. Explain VPN. 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. Kerberos Authentication protocol.



## **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, 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.

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

### **Course Outcome:**

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

1. Apply the different clustering algorithms to cluster real life datasets.
2. Apply appropriate classification algorithm to classify an unknown dataset.
3. Analyze the performance of the Clustering or Classification Algorithms.
4. Identify the need of Big Data Paradigms, and will be able to Store and Process Data on Hadoop Distributed File System.
5. Identify the need of No-SQL Databases and be able to Convert Relational Model to different No-SQL Data Models.
6. Create Appropriate Classifiers or Clustering Models for Analyses of Big Data using Hadoop Eco System.

### **Detailed Syllabus:**

#### **MODULE-I [12L]**

##### **Un Supervised learning Techniques:**

Concepts of Data, Multidimensional data, Categories of Variables: Numerical (discrete, continuous), Categorical, Ordinal, Normalizing Data, Outlier Concept.

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 clustering methods. Problem Solving using the above Clustering Approaches.

#### **MODULE-II [9L]**

##### **Supervised Learning Techniques:**

Classification: Introduction, Concept of Training and Test Datasets.

Decision tree algorithms: ID3, C4.5

Naïve Bayes classification, K Nearest Neighbors, Concept of Statistical Metrics for Performance Evaluation

Problem Solving using the above Classification Algorithms.

#### **MODULE-III [10L]**

**Introduction to Big Data and Hadoop:** Types of Digital Data, Introduction to Big Data, Big Data Properties, Examples of Big data.

Hadoop: 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.
5. HBase: The Definitive Guide, Lars Georg, O'Reilley.
6. MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, 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 Journey: O'Reilley.
4. Instant MapReduce Patterns - Hadoop Essentials How-to, Srinath Perera: Packt Publication.

<b>Course Name: MULTIMEDIA TECHNOLOGY &amp; APPLICATIONS</b>					
<b>Course Code: INFO3231</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Principles 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.

<b>Course Name: E-COMMERCE &amp; ERP</b>					
<b>Course Code: INFO3232</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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 Mangement.

#### **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, Kenneth C. Laudon, Carol G. Traver, Pearson Education.
2. E-Commerce-Strategy, Technologies & Applications, David Whitley, TMH.
3. Enterprise Resource Planning, Mary Sumner, Pearson Education.

### **Reference Book**

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

<b>Course Name: COMPILER DESIGN</b>					
<b>Course Code: INFO3233</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	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 Design Top Down and Bottom 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.

<b>Course Name: INFORMATION THEORY &amp; CODING</b>					
<b>Course Code: INFO3234</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	3	0	0	3	3

### **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, Shannon 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.

<b>Course Name: ADVANCED PROBABILITY AND INFORMATION THEORY</b>					
<b>Course Code: MATH3222</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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
- 146 | Page HIT(K) / ECE
- 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.

<b>Course Name: SCIENTIFIC COMPUTING</b>					
<b>Course Code: MATH3223</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	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 definite 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 Boor C. 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.

<b>Course Name: FUNDAMENTALS OF CIRCUIT THEORY</b>					
<b>Course Code: ELEC3221</b>					
<b>Contact Hours per week</b>	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.



<b>Course Name: DESIGNING WITH PROCESSORS AND CONTROLLERS</b>					
<b>Course Code: ECEN3222</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, David Simon, Addison Wesley, 2000.
3. RTS: Real-Time Systems, 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 papers and 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.

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

## **Course Outcomes**

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

1. Learn to build core programming logics for hard and soft clustering techniques.
2. Implement python programs to solve real world problems, and Access Databases
3. Performing complex numerical analysis tasks
4. Produce high quality 2D Data Visualizations
5. Analyse real world datasets and apply suitable clustering algorithms to group
6. Build Classifiers with real life dataset

## **Syllabus:**

### **Unit - I**

1. Building Efficient **Programming Logics** for Different Hard Clustering Techniques using **C**
2. Building Efficient **Programming Logics** for Different Soft Clustering Techniques using **C**
3. Performance Analyses
4. **Basics of python** - Introduction to Python, Decision Structures, Repetition Structures, Creating User Defined Functions and Modules, Useful Built-in Functions.

### **Unit - II**

1. Python String Handling, Regular Expressions, Lists, Tuples, Dictionaries and Sets.
2. Introduction to math library, Handling Random Numbers
3. **Understanding Data**, Python Packages for Data Science
4. **Numpy**: Creation of arrays, Array types and attributes, Indexing, slicing, Aggregations: max, min, sum, mean, standard deviation
5. **Matplotlib**: Simple figure, Subfigures, Other data visualization libraries for Python
6. **Pandas**: Creation of Data Frames, Accessing columns and rows of a data frame, Summary statistics, Missing data, Converting columns from one type to another

### **Unit – III**

Creating Database using python's sqlite3

Accessing Database Objects

1. Creating Objects
2. Insertion
3. Different access patterns
4. Conditional Updation, Deletions
5. Programming Constructs based Modification

## **Unit – IV**

1. Importing and Exporting Data in Python, Creating, loading and accessing csv files
2. Introduction to **sklearn library**
3. **Clustering Dataset:** Using sklearn-Partitioning, Hierarchical techniques
4. **Classifying Dataset:** Using sklearn-Preparing Training and Test Dataset, Preparing Models using Supervised Learning Techniques, Summary Statistics
5. Performance Comparisons
6. Building Classifiers on different **Real Life Problems**

## **Text Books**

1. Python Programming, A Modular Approach, Sheetal Taneja and Naveen Kumar, Pearson.
2. The Fundamentals of Python: First Programs, 2011, Kenneth A. Lambert, Cengage Learning.
3. Python for Data Analysis, Wes McKinney, 2nd Editions, O'Reilly, 2017.
4. Think Python First Edition, Allen B. Downey, Orielly Publishing.

## **Reference Books**

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

<b>Course Name: TERM PAPER AND SEMINAR</b>					
<b>Course Code: INFO3293</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

## **Honours Course for 3<sup>rd</sup> Year 2<sup>nd</sup> Semester**

<b>Course Name: DIGITAL IMAGE PROCESSING</b>					
<b>Course Code: INFO3211</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	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.

<b>Course Name: DIGITAL IMAGE PROCESSING LAB</b>					
<b>Course Code: INFO3261</b>					
<b>Contact Hours per week</b>	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. Learn basic MATLAB functions to process an image.
2. Apply different spatial domain image enhancement techniques to preprocess an image.
3. Compare the effectiveness of different filters employ on an image in frequency domain.
4. Apply different noise removal techniques to remove noise from an image.
5. Apply feature extraction algorithm to represent an image in feature space.
6. Develop an image processing application.

### **Syllabus:**

1. Introduction – MATLAB image processing toolbox
2. Transformation – negative, log, power-law
3. contrast stretching - linear and non-linear
4. Histogram of an image and Histogram Equalization
5. Spatial Filters – Box, mean, max and median etc.
6. Fourier Transformation of an image
7. Implement high-pass, low-pass and band-pass filters
8. Remove the noise from the input images
9. Point Detection, Line Detection and Edge Detection
10. Thresholding – Local, Global, Optimum, Multiple and Variable,
11. Implement region growing, splitting and merging algorithms.
12. Project on image processing

### **Books**

1. Digital Image Processing Using MATLAB, Rafael C. Gonzalez, Richard E woods, Gatesmark Publishing.



## 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 Management.

#### **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, Kenneth C. Laudon, Carol G. Traver, Pearson Education.
2. E-Commerce-Strategy, Technologies & Applications, David Whitley, TMH.

### **Reference Book**

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

## 4<sup>th</sup> Year 1<sup>st</sup> Semester

<b>Course Name: PRINCIPLES OF MANAGEMENT</b>					
<b>Course Code: HMTS4101</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Management, Stephen P. Robbins and Mary Coulter, Pearson Education, 2017, 13<sup>th</sup> edition.
2. Essentials of Management, Koontz H. and Weihrich H., McGraw Hill Int. Ed., 2015, 10<sup>th</sup> edition.
3. Management: Principles, Processes & Practices, Bhat A. and Kumar A., Oxford University Press, 2016, 2<sup>nd</sup> edition.
4. Fundamentals of Management, Robbins, Coulter and DeCenzo, Pearson Education, 2016, 9<sup>th</sup> edition.
5. Management, Richard L. Daft, Cengage Learning, 10<sup>th</sup> edition.

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

### **Course Outcome:**

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

1. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
2. Recognize the building blocks of Internet of Things.
3. Apply design concept to IoT solutions.
4. Analyze various M2M and IoT architectures.
5. Explain IoT protocols at different layers of IoT network.
6. Examine the scopes of using IoT in various application domains.

### **Detailed Syllabus:**

#### **MODULE-I [8L]**

**Introduction to IoT:** What is the IoT, Predecessors of IoT – WSN, M2M, CPS; Elements of an IoT ecosystem; Technology drivers; Business drivers; IoT Challenges.

#### **MODULE-II [12L]**

**IoT Network Architecture and Design:** Drivers behind new network architecture – scale, security, constrained device and networks, data etc.; A simplified IoT Architecture: The core IoT Functional stack – Things, communications network layer, Applications and analytics layer; IoT data management and compute stack.

#### **MODULE-III [12L]**

**Engineering IoT Network:** Smart objects, Connecting smart objects; IoT network layer; Application protocols for IoT; Data and Analytics for IoT; Privacy and Security Issues in IoT.

#### **MODULE-IV [8L]**

**IoT Applications:** Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

### **Text Books**

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1<sup>st</sup> Edition, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743).
2. Introduction to IoT, S. Misra, A. Mukherjee, and A. Roy, Cambridge University Press.

### **Reference Books**

1. Internet of Things, Srinivasa K G, CENGAGE Learning India, 2017.
2. Getting Started with the Internet of Things, Cuno Pfister, O'Reilly Media.
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press.

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

### **Course Outcome:**

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

1. Understand the fundamental concepts of wireless and mobile networking
2. Understand the evolution of different generations of mobile networks.
3. Analyze MAC related challenges and solutions in wireless mobile networks.
4. Remember the standards and architecture of Wireless LAN, PAN etc.
5. Justify the modifications necessary in normal IP and TCP protocols to make them mobility enabled.
6. Describe the concepts, characteristics, architecture, applications and routing protocols of WSN and MANET.

### **Detailed Syllabus:**

#### **MODULE-I [10L]**

##### **Computing Technologies:**

Evolutions in Computing Paradigm, Telecommunication Networks – Wired vs. Wireless, Types of Wireless Networks, Features of Radio communications, Components of a Wireless Communication System, Wireless networking standards, WLAN, Bluetooth

##### **Introduction to Mobile Computing and Wireless Networking:**

Introduction to Mobile Computing, Mobile Computing vs. Wireless Networking, Mobile Computing Applications, Characteristics of Mobile Computing

#### **MODULE-II [10L]**

##### **Cellular Mobile Communication:**

Generations of Cellular Communication Technologies, Services and architecture of GSM, GPRS, UMTS, Software Defined Radio

##### **Wireless MAC Protocols:**

Issues and Challenges, Motivation for a specialized MAC (Hidden and exposed station problem, Near-far station), Taxonomy of MAC Protocols, Channel Assignment schemes: Fixed assignment schemes, Random assignment schemes, Reservation based schemes

#### **MODULE-III [10L]**

##### **Mobile Network Layer:**

Mobile IP (Goals, Assumptions, Entities and terminology), IP packet delivery, Agent advertisement and discovery, Registration, Route optimizations

##### **Mobile Transport Layer:**

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/Fast Recovery, Transmission /Time-out Freezing, Selective Retransmission, Transaction Oriented TCP

## **MODULE-IV [10L]**

### **Wireless Sensor Networks:**

WSN vs. MANET, Applications, Architecture of the Sensor Node, Challenges in the Design of an Effective WSN, WSN Routing Protocols

### **Mobile Ad-Hoc Networks:**

Ad-Hoc: basic concepts, Characteristics, Applications, MAC and routing protocols for MANET

### **Text Books**

1. Fundamentals of Mobile Computing, P. K. Pattnaik, R. Mall, PHI Learning Pvt. Ltd.
2. Mobile Communications, J. H. Schiller, Pearson Education.

### **Reference Books**

1. Principles of Mobile Computing, U. Hansmann, L. Merk, M. S. Nicklons and T. Stober, Springer.
2. Introduction to Wireless and Mobile systems, D. P. Agarwal, Qing and An Zeng, Thomson Asia Pvt Ltd.
3. Ad Hoc Mobile Wireless Networks, C. K. Toh, Pearson Education.
4. Mobile Computing, Sipra Das Bit, Biplab K. Sikdar, PHI Learning Pvt. Ltd.



<b>Course Name: REAL TIME SYSTEMS</b>					
<b>Course Code: INFO4133</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Real time system theory & practice, Rajib Mall, Pearson Education Asia.
2. Real time system, Jane W.S. Liu, Pearson Education Asia.

### **Reference Books**

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

<b>Course Name: METHODS IN OPTIMIZATION</b>					
<b>Course Code: MATH4121</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Linear Programming and Game Theory, J. G. Chakraborty and P. R. Ghosh, Moulik Library.
2. Operations Research, Kanti Swarup, P. K. Gupta and Man Mohan, S. Chand and Sons.
3. Engineering Optimization, S. S. Rao, New Age Techno Press.

### **Reference Books**

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

<b>Course Name: LINEAR CONTROL SYSTEMS AND APPLICATIONS</b>					
<b>Course Code: AEIE4122</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Control System Engineering, Nagrath I. J. and Gopal M., 5th Ed., New Age International Private Ltd. Publishers.
2. Automatic Control Systems, Kuo B. C., 8th Ed., Wiley India
3. Modern Control Engineering, Ogata K., 4th Ed., Pearson Education.
4. Modern Control Systems, Dorf R. C. and Bishop R. H., Pearson Education.
5. Control Systems Engineering, Norman S. N., 4th Ed., Wiley India.
6. Process Control Modeling, Design and Simulation”, B.W. Bequette, Prentice Hall of India, New Delhi.

<b>Course Name: AUTOMATIC CONTROL SYSTEM</b>					
<b>Course Code: ELEC4121</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Control Systems: Principles and Design, M Gopal, TMH.
2. Control System Engineering, Ananda Natarajan, P. Ramesh Babu, Scitech.
3. Modern Control Engineering, Ogata; Katsuhiko PHI.



<b>Course Name: SOFTWARE DEFINED RADIO</b>					
<b>Course Code: ECEN4121</b>					
<b>Contact Hours per week</b>	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. Software Defined Radio for Engineers, T.Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski, Artech House.
2. Cognitive Radio Techniques: Spectrum Sensing, Interference Mitigation and Localization, Sithamparanathan, Kandeepan, Giorgetti, Andrea, Artech House, 2012.
3. Cognitive Radio Technology, Bates, Martin; Fettee, Bruce A, Elsevier Science & Technology.
4. Software Defined Radios: From Smart(er) to Cognitive, Liesbet Van Der Perre, Michael Timmers and SofiePollin, Springer.

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

<b>Course Name: INTRODUCTION TO MACHINE LEARNING</b>					
<b>Course Code: ECEN4122</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Machine Learning, T. M. Mitchell, McGraw Hill Education.
2. Machine learning: a probabilistic perspective, Murphy, Kevin, MIT press.
3. Artificial intelligence: a modern approach, Stuart Russell, and Peter Norvig, Prentice Hall.
4. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville.
5. Reinforcement learning: An introduction, Richard S. Sutton and Andrew G. Barto, Second Edition, MIT Press.

<b>Course Name: ERROR CONTROL CODING FOR SECURE DATA TRANSMISSION</b>					
<b>Course Code: ECEN4123</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Introduction to Error Control Codes, S Gravano, Oxford Press.
2. Information theory, coding and cryptography, Ranjan Bose, TMH.
3. Information and Coding, N Abramson, McGraw Hill.

#### **Reference Books**

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

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

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

### **Reference Books**

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



<b>Course Name: BIO SENSOR</b>					
<b>Course Code: BIOT4124</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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, immobilization 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. Biosensors, Tran Minh Canh, London. Chapman and Hall.
2. Biosensors Fundamentals and Applications, Turner, A.P.F, Karube.I. and Wilson, G.S, Oxford Univ.Press.
- 3.Engineering Biosensors, kinetics and design applications, Ajit Sadana, San Diego, Academic Press.
- 4.Enzyme Technology in concepts in Biotechnology, Balasubramaniam et al, D.Thomas and J.M. Laval, Univ. Press, 1996.

<b>Course Name: PRINCIPLES OF RADAR</b>					
<b>Course Code: ECEN4126</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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) Introduction to Radar Systems, M Skolnik, McGraw Hill.

<b>Course Name: AD HOC WIRELESS NETWORKS</b>					
<b>Course Code: ECEN4127</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Ad Hoc Wireless Networks – Architectures and Protocols, C.Siva Ram Murthy and B.S. Manoj, Pearson Education.

### **Reference Books**

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

<b>Course Name: INTRODUCTION TO EMBEDDED SYSTEM</b>					
<b>Course Code: AEIE4127</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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<sup>2</sup>C 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<sup>2</sup>C bus.

### **Books**

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

<b>Course Name: BIOPLOYMER</b>					
<b>Course Code: BIOT4126</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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<sub>2</sub> & CH<sub>4</sub>), Field trial.

### **Books**

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

<b>Course Name: ADVANCED LINEAR ALGEBRA</b>					
<b>Course Code: MATH4126</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Linear Algebra and its Applications, Gilbert Strang, Thomson Brooks/Cole Cengage Learning.

### **Reference Books**

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

<b>Course Name: PRINCIPLES OF ELECTRICAL MACHINES</b>					
<b>Course Code: ELEC4126</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Electrical Machinery, Dr. P.S. Bimbhra, Khanna Publisher.
2. Electrical Machines, S. K. Bhattacharya, McGraw-Hill Education.
3. Electrical Machines, Ashfaq Hussain, Dhanpat Rai Publications.

### **Reference Books**

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

<b>Course Name: PROJECT I</b>					
<b>Course Code: INFO4195</b>					
<b>Contact Hours per week</b>	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.

### **Honours Course for 4<sup>th</sup> Year 1<sup>st</sup> Semester**

<b>Course Name: ARTIFICIAL INTELLIGENCE</b>					
<b>Course Code: INFO4111</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	4	0	0	4	4

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

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

<b>Course Name: FUNDAMENTALS OF CLOUD COMPUTING</b>					
<b>Course Code: INFO4121</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	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 Service (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. Cloud Computing BlackBook, Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, Dreamtech Press.
2. Cloud Computing A practice approach for learning and implementation, A. Srinivasan, J. Suresh, Pearson.
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India.
4. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski Wiley, 2011.
5. Cloud Computing: Principles, Systems and Applications, Antonopoulos, Lee Gillam, Nikos Springer, 2012.
6. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.

## 4<sup>th</sup> Year 2<sup>nd</sup> Semester

<b>Course Name: BLOCKCHAIN TECHNOLOGY</b>					
<b>Course Code: INFO4231</b>					
<b>Contact Hours per week</b>	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. Analyze the features and functional aspects of smart contract ecosystem
5. Design 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. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Antonopoulos, O'Reilly.
2. Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA and Smart Contracts, Alan T. Norman, CreateSpace Independent Publishing Platform.
3. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Derivatives, Digital Assets), Antony Lewis.
4. “The Science of the Blockchain”, Wattenhofer, CreateSpace Independent Publishing Platform.
5. ETHEREUM: A Secure Decentralized Transaction Ledger, Dr. Gavin Wood, Yellow Paper, 2014.

<b>Course Name: INTERNET TECHNOLOGY</b>					
<b>Course Code: INFO4232</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	3	0	0	3	3

### **Course Outcome:**

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

1. Apply asynchronous JavaScript for web based application.
2. Apply TypeScript for web based application.
3. Use Nodejs for non-blocking, event-driven server applications.
4. Use Nodejs for traditional web sites and back-end API services.
5. Write 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]**

##### **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-II [10L]**

**TypeScript :** Introduction to TypeScript, Primitive Types, Narrowing, More on Functions, Object Types, Creating Types from Types, Generics, Keyof type operator, Typeof Type operator, Indexed Access Types, Conditional Types, Mapped Types, Template Literal Types, Classes, Modules.

#### **MODULE-III [10L]**

**NodeJS :** The Node Module System, The Node Programming Model, Events and Timers, JavaScript Object Notation, The Command Line Interface, The File System, Streams, Binary Data, Executing Code, Network Programming, HTTP, The Express Framework.

#### **MODULE-IV [10L]**

**AngularJS:** MVC and MVW architecture, Expression, Modules, Directives , Model, Data Binding, Controller, Scope, Filter, Services, \$http service, DOM, Events, Forms, Form validation, Includes, Routing.

### **Books**

1. JavaScript: The Definitive Guide, David Flanagan 7th Edition, O'Reilly Media.
2. TypeScript Handbook.
3. Pro Node.js for Developer, Colin Ihrig, Appress.
4. Angular JS, Green and Brad, O'Reilly.
5. Node.js, MongoDB and Angular Web Development, Brad Dayley, Brendan Dayley, Caleb Dayley, Addison-Wesley.

<b>Course Name: DISTRIBUTED COMPUTING</b>					
<b>Course Code: INFO4233</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Distributed Operating Systems- Concepts and Design, Pradeep K. Sinha, PHI.



<b>Course Name: SOFT COMPUTING</b>					
<b>Course Code: INFO4241</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran and G.A.V.Pai, PHI.
3. Soft Computing and Its Applications, Volume One: A Unified Engineering Concept, Volume 1, Kumar S. Ray, CRC Press.

### **Reference Books**

1. Introduction to Soft Computing, Prof. Debasis Samanta, Computer Science and Engineering, IIT Kharagpur, <https://nptel.ac.in/courses/106/105/106105173/>.
2. Multi Objective Optimization using Evolutionary Algorithms, Kalyanmoy Deb, John Wiley and Sons (2001).
3. Genetic Algorithms in search, Optimization & Machine Learning, David E. Goldberg, Pearson India.
4. Soft Computing, Dilip K. Pratihar, Alpha Science International.

<b>Course Name: CLOUD COMPUTING</b>					
<b>Course Code: INFO4242</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Cloud Computing Black Book, Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, Dreamtech Press.
2. Cloud Computing A practical approach for learning and implementation, A. Srinivasan, J. Suresh, Pearson.
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India.
4. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011.
5. Cloud Computing: Principles, Systems and Applications, Antonopoulos, Lee Gillam, Nikos Springer, 2012.
6. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.

<b>Course Name: PATTERN RECOGNITION</b>					
<b>Course Code: INFO4243</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Pattern Classification, R. O. Duda, P. E. Hart and D. G. Stork, 2nd ed., Wiley.
2. Pattern Recognition Principles, J. T. Tou and R. C. Gonzalez, Addison-Wesley, London.
3. Neural Networks for Pattern Recognition, Christopher M. Bishop, Oxford University Press.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer.

<b>Course Name: MEDICAL INSTRUMENTATION</b>					
<b>Course Code: AEIE4222</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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<sub>2</sub>, pO<sub>2</sub>.

### **Books**

1. Biomedical Instrumentation and Measurements, Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Second edition, Prentice-Hall India, 1997.
2. Handbook of Biomedical Instrumentation, R.S. Khandpur, 2<sup>nd</sup> Edition, Tata McGraw Hill New Delhi, 1987.
3. Medical Instrumentation application and design, John G. Webster, Third edition, Wiley, 1997.
4. Biomedical Electronics and Instrumentation, S. K. Venkata Ram, Galgotia Publication Pvt. Ltd., NewDelhi.
5. Principles of Applied Biomedical Instrumentation, Geddes L.A and Baker L.E, Third edition, Wiley-Interscience, 1989.



<b>Course Name: APPLIED ILLUMINATION ENGINEERING</b>					
<b>Course Code: ELEC4221</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	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. Lighting Engineering Applied Calculations, R. H. Simons & A.R. Bean, Architectural Press.
2. Applied Illumination Engineering, Jack L Lindsey, Second Edition, Prentice Hall.
3. Lamps and Lighting, J.R.Coaton and A.M.Marsden, 4th Edition Arnold.
4. IES Lighting Handbook – IES North America.
5. National Lighting Code- Published by Govt. of India, 2011.

<b>Course Name: LOW POWER HIGH PERFORMANCE DIGITAL VLSI CIRCUIT DESIGN</b>					
<b>Course Code: ECEN4221</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. CMOS VLSI Design, A Circuits and Systems Perspective, Neil Weste, David Harris, 4<sup>th</sup> Edition, Addison-Wesley, Pearson.
2. Practical Low Power Digital VLSI Design, Gary Yeap, Kluwer academic publishers, 2010.

### **Reference Books**

1. Low Power CMOS VLSI Circuit Design, Kuashik Roy and Sharat Prasad, John Wiley & Sons, Inc.2009.
2. Digital Integrated Circuit, Design Perspective, M. Rabaey, Prentice-Hall.

<b>COURSE NAME: CELLULAR AND MOBILE COMMUNICATION</b>					
<b>Course Code: ECEN4222</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Wireless Communications: Principles and Practice, T.S. Rappaport, Pearson Education.
2. Wireless Communication and Networks, 3G and Beyond, I.SahaMisra, TMH Education.
3. Fundamentals of LTE, Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Pearson Education, ISBN-13: 978-0-13-703311-9.

### **Reference Books**

1. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
2. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

<b>COURSE NAME: OPTICAL FIBER COMMUNICATION</b>					
<b>Course Code: ECEN4223</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Fiber Optics and Optoelectronics, R. P. Khare, Oxford University Press.
2. Optical Fiber Communication, John M. Senior, Pearson.
3. Optical Networks – A Practical Perspective, Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki, Morgan-Kaufman.
4. Optical Communication Systems, John Gawar, PHI.

### **Reference Books**

1. Optical Fiber Communication, Gerd Kaiser, TMH.

<b>Course Name: COMPUTATIONAL BIOLOGY</b>					
<b>Course Code: BIOT4221</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Introduction to Bioinformatics, Arthur M. Lesk, International Fourth Edition 2014, Oxford University Press.
2. Essential Bioinformatics, Jin Xiong, Cambridge University Press (2006).

### **Reference Books**

1. Biochemistry, Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, 7th edition, Academic Press.
2. Introduction to Bioinformatics, T K Attwood, D J Parry-Smith and S. Phukan, Pearson.
3. Fundamentals of Database Systems, R. Elmasri and S.B. Navathe, 5th Edition.
4. Bioinformatics-A Machine Learning Approach, Baldi and Brunak, 2nd Edition (2006), John Wiley Inc.
5. Dynamics of Proteins and Nucleic Acids, J. Andrew McCammon and Stephen C. Harvey, Cambridge University Press (1998).
6. Molecular Modelling: Principles and Applications, Andrew R. Leach, 2nd Edition, Pearson (2016).
7. Molecular Modelling and Drug Design, K.Anand Solomon, 1<sup>st</sup> edition (2011), MJP Publishers.

<b>Course Name: NON-CONVENTIONAL ENERGY</b>					
<b>Course Code: BIOT4222</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Biotechnology, J.E. Smith, 3rd ed., Cambridge University Press.
2. Fuels and combustion, S. Sarkar, 2nd ed., University Press.
3. Biomass for renewable energy, fuels and chemicals, Donald L. Klass, Academic Press.

<b>Course Name: BIOLOGY FOR ENGINEERS</b>					
<b>Course Code: BIOT4223</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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. Biochemistry, Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Molecular Biology, Robert Weaver, MCGraw-Hill, 5th Edition, 2012.
3. Biosensors A Practical Approach, Jon Cooper, Bellwether Books, 2004.
4. Biodegradation and Bioremediation, Martin Alexander, Academic Press, 1994.
5. Janeway's Immunobiology, Kenneth Murphy, Garland Science; 8th edition, 2011.

<b>Course Name: INTRODUCTION TO FRENCH LANGUAGE</b>					
<b>Course Code: HMTS4222</b>					
<b>Contact</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
<b>Hours per week</b>	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]**

Adjectif Interrogatif: **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, un peu, bien**)

Possessives

Reflexive verbs

Direction (**Près, Loin, à côté de**)

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.

<b>Course Name: PROJECT II</b>					
<b>Course Code: INFO4295</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.

<b>Course Name: DISASTER RESPONSE SERVICES AND TECHNOLOGIES</b>					
<b>Course Code: HMTS4011</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	4	0	0	4	4

### **Course Outcomes:**

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

1. Recall the basic concepts and terminologies of disaster and disaster management.
2. Understand disaster risk assessment, risk reduction and community preparedness plans.
3. Interpret and characterize hazards, vulnerabilities and strategies for disaster mitigation.
4. Examine techniques for post disaster situation awareness, damage and need assessment.
5. Evaluate post disaster remedial measures and long-term recovery planning.
6. Design emergency communication infrastructures, technologies and services.

### **Detailed Syllabus:**

#### **Module-I [10L]**

##### **Introduction**

Definition of disaster, types of disasters, phases of disasters, factors contributing to disaster impact and severity, disaster profile of India, definition of disaster management, disaster management cycle, Disaster Management Act 2005, organizations involved in disaster management.

#### **Module -II [10L]**

##### **Pre Disaster Services for Risk Reduction**

###### **Disaster Preparedness:**

Disaster risk assessment, disaster risk reduction, preparedness plans, community preparedness, and emergency resource networks.

###### **Disaster Mitigation:**

Concepts of hazard, hazard, hazard and hazard as part of safety and risk management; types of vulnerabilities, vulnerability assessment, strategies for disaster mitigation, structural mitigation and non-structural mitigation, disaster mitigation initiatives in India.

#### **Module-III [10L]**

##### **Post Disaster Services for Recovery**

###### **Disaster Response:**

Need for coordinated disaster response, SPHERE standards in disaster response, role of government, international agencies and NGOs, post disaster situation awareness, post disaster damage and need assessment.

###### **Disaster Recovery and Reconstruction:**

Post disaster effects and remedial measures, creation of livelihood options, disaster resistant house construction, sanitation and hygiene, education and awareness, dealing with victims' psychology, long-term counter disaster planning.

## **Module-IV [10L]**

### **Disaster Management Technologies:**

Emergency communication infrastructures; emerging technologies for disaster resilience - drones, VR/AR, social media technologies, real-time mapping system; examples of disaster management information systems; examples of Smartphone/ web based applications for disaster management.

### **Reference Books**

1. Disaster Management in India: Perspectives, issues and strategies, R. Nishith, Singh AK, New Royal Book Company.
2. Post-disaster Navigation and Allied Services over Opportunistic Networks, Bhattacharjee Suman, Roy Siuli, Das Bit Sipra, Springer Verlag, Singapore.
3. Reliable Post Disaster Services over Smartphone Based DTN: An End-to-End Framework, Basu Souvik, Roy Siuli, Das Bit Sipra, Springer, Singapore.
4. Disaster Mitigation Experiences and Reflections, Sahni, Pardeepet.al. (Eds.), Prentice Hall of India, New Delhi.
5. Disaster Administration And Management Text and Case Studies, Goel S. L., Deep & Deep Publication Pvt. Ltd., New Delhi.
6. Smart Technologies for Emergency Response and Disaster Management, Liu Zhi, Ota Kaoru, IGI Global.
7. Disaster Risk Reduction - Methods, Approaches and Practices, Rajib Shaw, Springer Verlag, Singapore.

## Open Elective -IV (to be offered by IT Department)

<b>Course Name: FUNDAMENTALS OF CRYPTOGRAPHY</b>					
<b>Course Code: INFO4221</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	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.
3. Discuss in detail DES, RSA, and IDEA algorithm. Solve numerical based on DES and RSA algorithms. Explain Diffie-Hellman Key exchange algorithm and Digital Envelope.
4. Compare MAC, Message Digest and Hash function. Analyze 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. Analyze the concept of SSL, PGP and PEM. 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 [10L]**

##### **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 [10L]**

### **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. Cryptography and Network Security, William Stallings, 3<sup>rd</sup> 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, 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.