



**Heritage Institute of Technology**  
(An Autonomous Institute under MAKAUT)

**Bachelor of Technology**  
**in**  
**Computer Science and Business**  
**Systems (2021 – 2025)**

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**3<sup>rd</sup> Updation: December, 2022**

**4<sup>th</sup> Updation: June, 2023**



# PART- I

## Curriculum

# 1<sup>st</sup> Year

## 1<sup>st</sup> Semester Syllabus:

Theory								Type of Paper
Sl. N	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
<b>Total Theory</b>			<b>9</b>	<b>3</b>	<b>0</b>	<b>12</b>	<b>12</b>	

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
<b>Total Laboratory</b>			<b>1</b>	<b>0</b>	<b>9</b>	<b>10</b>	<b>5.5</b>	
<b>Total of Semester without Honours</b>			<b>10</b>	<b>3</b>	<b>9</b>	<b>22</b>	<b>17.5</b>	
1	HMTS1011	Communication for Professionals	3	0	0	3	3	Honours Course
2	HMTS1061	Professional Communication Lab	0	0	2	2	1	Honours Course
<b>Total of Semester with Honours</b>			<b>13</b>	<b>3</b>	<b>11</b>	<b>27</b>	<b>21.5</b>	

## 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
<b>Total Theory</b>			<b>11</b>	<b>2</b>	<b>0</b>	<b>13</b>	<b>13</b>	

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 Practice	1	0	4	5	3	Engineering Science Course
4	HMTS1252	Language Lab	0	0	2	2	1	Humanities & Social Sciences including Management
<b>Total Laboratory</b>			<b>1</b>	<b>0</b>	<b>13</b>	<b>14</b>	<b>7.5</b>	
<b>Total of Semester without Honours</b>			<b>12</b>	<b>2</b>	<b>13</b>	<b>27</b>	<b>20.5</b>	
1	ECEN1011	Basic Electronics	3	0	0	3	3	Honours Course
2	ECEN1061	Basic Electronics Lab	0	0	2	2	1	Honours Course
<b>Total of Semester with Honours</b>			<b>15</b>	<b>2</b>	<b>15</b>	<b>32</b>	<b>24.5</b>	

**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	Tota		
1	CSBS2101	Fundamentals of Data Structures	4	0	0	4	4	Professional Core Courses
2	MATH2103	Discrete Mathematics	4	0	0	4	4	Basic Science Course
3	HMTS2101	Economics for Engineers	3	0	0	3	3	Humanities & Social Sciences including Management Courses
4	ECEN2104	Digital Logic	3	0	0	3	3	Engineering Science Course
5	HMTS2001	Human Values and Professional Ethics	3	0	0	3	3	Humanities & Social Sciences including Management Courses
<b>Total Theory</b>			<b>17</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>17</b>	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Tota		
1	CSBS2151	Fundamentals of Data Structures Lab	0	0	3	3	1.5	Professional Core Courses
2	ECEN2154	Digital Logic Lab	0	0	2	2	1	Engineering Science Course
<b>Total Laboratory</b>			<b>0</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>2.5</b>	
<b>Total of Semester without Honours</b>			<b>17</b>	<b>0</b>	<b>5</b>	<b>22</b>	<b>19.5</b>	
1	MATH2111	Probability and Statistical Methods	4	0	0	4	4	Honours Course
<b>Total of Semester with Honours</b>			<b>21</b>	<b>0</b>	<b>5</b>	<b>26</b>	<b>23.5</b>	

## 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	CSBS2201	Operating System Concept	4	0	0	4	4	Professional Core Courses
2	CSBS2202	Computer Organization and Architecture	4	0	0	4	4	Professional Core Courses
3	CSBS2203	Design and Analysis of Algorithms	4	0	0	4	4	Professional Core Courses
4	CSBS2204	Introduction to Innovation and Entrepreneurship	4	0	0	4	4	Professional Core Courses
5	CSBS2205	Managerial Economics	3	0	0	3	3	Professional Core Courses
6	EVSC2016	Environmental Sciences (MANDATORY)	2	-	-	2	-	Mandatory Courses
<b>Total Theory</b>			<b>21</b>	<b>0</b>	<b>0</b>	<b>21</b>	<b>19</b>	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CSBS2251	Operating System Concept Lab	0	0	3	3	1.5	Professional Core Courses
2	CSBS2252	Computer Organization and Architecture Lab	0	0	3	3	1.5	Professional Core Courses
3	CSBS2253	Design and Analysis of Algorithms Lab	0	0	3	3	1.5	Professional Core Courses
<b>Total Laboratory</b>			<b>0</b>	<b>0</b>	<b>9</b>	<b>9</b>	<b>4.5</b>	
<b>Total of Semester</b>			<b>21</b>	<b>0</b>	<b>9</b>	<b>30</b>	<b>23.5</b>	

**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	CSBS3101	Computer Networks	4	0	0	4	4	Professional Core Courses
2	CSBS3102	Database Management Systems	4	0	0	4	4	Professional Core Courses
3	CSBS3103	Formal Language & Automata Theory	4	0	0	4	4	Professional Core Courses
4	HMTS3101	Principles of Management	3	0	0	3	3	Humanities & Social Sciences including Management Courses
5	CSBS3131 - CSBS3134	Professional Elective – I	3	0	0	3	3	Professional Elective Courses
	CSBS3131 CSBS3132 CSBS3133 CSBS3134	Computer Graphics E-Commerce Soft Computing Image Processing						
<b>Total Theory</b>			<b>18</b>	<b>0</b>	<b>0</b>	<b>18</b>	<b>18</b>	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CSBS3151	Computer Networks Lab	0	0	3	3	1.5	Professional Core Courses
2	CSBS3152	Database Management Systems Lab	0	0	3	3	1.5	Professional Core Courses
<b>Total Laboratory</b>			<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>3</b>	
<b>Total of Semester</b>			<b>18</b>	<b>0</b>	<b>6</b>	<b>24</b>	<b>21</b>	

## 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	CSBS3201	Software Engineering	4	0	0	4	4	Professional Core Courses
2	CSBS3202	Object Oriented Programming	4	0	0	4	4	Professional Core Courses
3	CSBS3203	Enterprise System and IT Solutions	3	0	0	3	3	Professional Core Courses
4	CSBS3231- CSBS3234	Professional Elective-II	3	0	0	3	3	Professional Elective Courses
	CSBS3231 CSBS3232 CSBS3233 CSBS3234	Mobile Computing Machine Learning Compiler Design Blockchain Technology and Applications						
5		Open Elective-I	3	0	0	3	3	Open Elective Courses
	AEIE3221 ECEN3222 MATH3221 HMTS3221	Fundamentals of Sensors and Transducers Designing with Processors and Controllers Computational Mathematics Human Resource Management						
6	INCO3016	Indian Constitution and Civil Society (MANDATORY)	2	-	-	2	-	Mandatory Courses
<b>Total Theory</b>			<b>19</b>	<b>0</b>	<b>0</b>	<b>19</b>	<b>17</b>	

Laboratory								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1.	CSBS3251	Software Engineering Lab	0	0	3	3	1.5	Professional Core Courses
2.	CSBS3252	Object Oriented Programming Lab	0	0	3	3	1.5	Professional Core Courses
<b>Total Laboratory</b>			<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>3</b>	

Sessional								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CSBS3293	Term Paper and Seminar	0	0	4	4	2	Seminar
<b>Total Sessional</b>			<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>2</b>	
<b>Total of Semester</b>			<b>19</b>	<b>0</b>	<b>10</b>	<b>29</b>	<b>22</b>	

\*\* Open Elective-I offered by CSBS Department is: **Introduction to E-Commerce (CSBS3221)**





**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	CSBS 4101	Business Environment, Functions and Corporate Strategy	3	0	0	3	3	Professional Core Courses
2	CSBS4131- CSBS4135	Professional Elective-III	3	0	0	3	3	Professional Elective Courses
	CSBS4131 CSBS4132 CSBS4133 CSBS4134 CSBS4135	Operations Management Marketing Management Financial Management Web Technology Data Analytics						
3		Open Elective-II	3	0	0	3	3	Open Elective Courses
	AEIE4122 CHEN4123 ECEN4122 ECEN4123 MATH4121	Linear Control Systems and Applications Industrial Total Quality Management Software Defined Radio Error Control Coding Methods in Optimization						
4		Open Elective-III	3	0	0	3	3	Open Elective Courses
	AEIE4127 MATH4122 BIOT4124 HMTS4125	Introduction to Embedded System Advanced Linear Algebra Biosensor Marketing Research						
<b>Total Theory</b>			<b>12</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>12</b>	

Sessional								Type of Paper
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points	
			L	T	P	Total		
1	CSBS4191	Industrial Training / Internship	-	-	-	-	2	Internship in industry or Elsewhere
2	CSBS4195	Project-I	0	0	8	8	4	Project work, internship in industry or Elsewhere
<b>Total Sessional</b>			<b>0</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>6</b>	
<b>Total of Semester</b>			<b>12</b>	<b>0</b>	<b>8</b>	<b>20</b>	<b>18</b>	

\*\* Open Elective-III offered by CSBS Department is: **Soft Computing Fundamentals (CSBS4121)**

**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	CSBS4231- CSBS4233	Professional Elective-IV	3	0	0	3	3	Professional Elective Courses
	CSBS4231 CSBS4232 CSBS4233	Consumer Behavior Digital Marketing Advanced Business Research						
2	CSBS4241- CSBS4245	Professional Elective-V	3	0	0	3	3	Professional Elective Courses
	CSBS4241 CSBS4242 CSBS4243 CSBS4244 CSBS4245	Introduction to Cognitive Science Cyber Security Business Analytics Natural Language Processing Distributed Database						
3		Open Elective-IV	3	0	0	3	3	Open Elective Courses
	AEIE4221 BIOT4222 HMTS4226 HMTS4225	Process Instrumentation Non-conventional Energy Advanced Finance Organizational Behavior						
<b>Total Theory</b>			<b>9</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>9</b>	

  

Sessional								
1	CSBS4295	Project-II	0	0	16	16	8	Project work, internship in industry or Elsewhere
2	CSBS4297	Comprehensive Viva-voce	-	-	-	-	1	
<b>Total Sessional</b>			<b>0</b>	<b>0</b>	<b>16</b>	<b>16</b>	<b>9</b>	
<b>Total of Semester</b>			<b>9</b>	<b>0</b>	<b>16</b>	<b>25</b>	<b>18</b>	

\*\* Open Elective-IV offered by CSBS Department is: **Introduction to Industrial Sociology (CSBS4281)**

## **Credit points distribution**

<b>Sl. No.</b>	<b>Category</b>	<b>Credit Points</b>
1	Humanities and Social Sciences including Management Courses	<b>12</b>
2	Basic Science Courses	<b>23</b>
3	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	<b>20</b>
4	Professional Core Courses	<b>61</b>
5	Professional Elective Courses relevant to chosen Specialization / Branch	<b>15</b>
6	Open Subjects – Electives from other Technical and/or Emerging Subjects	<b>12</b>
7	Project Work, Seminar and Internship in industry or elsewhere	<b>17</b>
8	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	<b>0</b>
	Total	<b>160</b>
9	Honours Courses	<b>20</b>
	Grand Total	<b>180</b>

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

## Honours Credit Chart

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
1.	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>	MATH2111	Probability and Statistical Methods	4	0	0	4
	Total						12

### **Definition of Credit (as per AICTE):**

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

### **Range of Credits (as per AICTE):**

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



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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:

- CHEM1001.1 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.
- CHEM1001.2 An ability to analyze microscopic chemistry in terms of atomic and molecular orbitals and inter molecular forces for engineering applications.
- CHEM1001.3 Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.
- CHEM1001.4 Understanding of bulk properties and processes using thermodynamic considerations.
- CHEM1001.5 Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.
- CHEM1001.6 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 Broglie'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. P.W. Atkins, "Atkins' Physical Chemistry", 10th Edition.
2. I. L. Finar, "Organic Chemistry", Vol-1 (6th Edition).
3. Jain & Jain, "Engineering Chemistry", 16th Edition.
4. A. K. Das, "Fundamental Concepts of Inorganic Chemistry", 2nd Edition.
5. GourkrishnaDasmohapatra, "Engineering Chemistry –I", 3rd Edition.

### **Reference Books:**

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

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

### Course Outcome:

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

- MATH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations
- MATH1101.2 Develop the concept of eigen values and eigen vectors
- MATH1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals
- MATH1101.4 Analyze the nature of sequence and infinite series
- MATH1101.5 Choose proper method for finding solution of a specific differential equation
- MATH1101.6 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. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
3. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence., "Mathematical Methods for Physics and Engineering", Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, "Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
8. M. R. Spiegel, Seymour Lipschutz, Dennis Spellman, "Vector Analysis (Schaum's outline series)", McGraw Hill Education.
9. S. S. Sastry, "Engineering Mathematics", PHI.
10. M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), "Advanced Engineering Mathematics", Indian Edition.
11. Seymour Lipschutz, Marc Lipson, "Linear Algebra (Schaum's outline series)", McGraw Hill Education.

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

**Course Outcome:**

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

- ECEN1001.1 Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.
- ECEN1001.2 Analyse DC Machines; Starters and speed control of DC motors.
- ECEN1001.3 Analyse magnetic circuits.
- ECEN1001.4 Analyse single and three phase AC circuits.
- ECEN1001.5 Analyse the operation of single phase transformers.
- ECEN1001.6 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. D.P Kothari & I.J Nagrath, “Basic Electrical Engineering”, TMH, Second Edition.
2. V.N Mittle & Arvind Mittal, “Basic Electrical Engineering”, TMH, Second Edition.
3. Hughes, “Basic Electrical Engineering”.
4. Surinder Pal Bali, “Electrical Technology”, Vol-I, Vol-II, Pearson Publication.
5. B.L. Theraja, A.K. Theraja, “A Text Book of Electrical Technology”, Vol. I & II, 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:

- CHEM1051.1 Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
- CHEM1051.2 Estimation of ions like  $\text{Fe}^{2+}$ ,  $\text{Cu}^{2+}$  and  $\text{Cl}^-$  present in water sample to know the composition of industrial water.
- CHEM1051.3 Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
- CHEM1051.4 Handling 23hysic-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
- CHEM1051.5 Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
- CHEM1051.6 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. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, "Vogel's Textbook of Quantitative Chemical Analysis".
2. S. C. Das, "Advanced Practical Chemistry".
3. P. S. Sindhu, "Practicals in Physical Chemistry".

<b>Course Name: BASIC ELECTRICAL ENGINEERINGLAB</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:**

- ELEC1051.1 Get an exposure to common electrical apparatus and their ratings.
- ELEC1051.2 Make electrical connections by wires of appropriate ratings.
- ELEC1051.3 Apply various network theorems in Electrical Circuits
- ELEC1051.4 Understand the application of common electrical measuring instruments.
- ELEC1051.5 Understand the basic characteristics of different electrical machines.
- ELEC1051.6 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:**

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



<b>Course Name: ENGINEERING GRAPHICS &amp; DESIGN LAB</b>					
<b>Course Code: MECH1052</b>					
<b>Contact Hours per week</b>	L	T	P	Total	Credit Points
	1	0	4	5	3

### Course Outcome:

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

- MECH1052.1 To understand the meaning of engineering drawing.
- MECH1052.2 To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
- MECH1052.3 To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
- MECH1052.4 To read and understand projection drawings.
- MECH1052.5 To draw the section view and true shape of a surface when a regular object is cut by a section plane.
- MECH1052.6 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. Bhatt, N.D., Panchal V.M. & Ingle P.R.,(2014), “Elementary Engineering Drawing”, Charotan Publishing House.
2. Narayana, K.L. and Kannaaiah,P , “Engineering Graphics”, TMH.
3. Lakshminarayanan, V. and VaishWanar, R.S, “Engineering Graphics”, Jain Brothers.
4. Shah, M.B. & Rana B.C., “Engineering Drawing and Computer Graphics”, (2008), Pearson Education.
5. Agarwal B. & Agarwal C. M., “Engineering Graphics”, (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:

- HMTS1011.1 Write business letters and reports
- HMTS1011.2 Communicate in an official and formal environment
- HMTS1011.3 Effectively use the various channels of communication at work place
- HMTS1011.4 Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment
- HMTS1011.5 Learn to articulate opinions and views with clarity
- HMTS1011.6 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. Kumar,S. &Lata, P. OUP, “Communication Skills”, New Delhi2011.
2. Rizvi, Ashraf, M., “Effective Technical Communication”, Mc Graw 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</b>	L	T	P	Total	Credit points
<b>Hours per week</b>	0	0	2	2	1

### Course Outcome:

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

- HMTS1061.1 Communicate in an official and formal environment.
- HMTS1061.2 Effectively communicate in a group and engage in relevant discussion
- HMTS1061.3 Engage in research and prepare presentations on selected topics.
- HMTS1061.4 Understand the dynamics of multicultural circumstances at workplace and act accordingly.
- HMTS1061.5 Organize content in an attempt to prepare official documents.
- HMTS1061.6 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. Carter, R. And Nunan, D. (Eds), “The Cambridge guide to Teaching English to Speakers of Other Languages”, CUP, 2001.
2. Edward P. Bailey, “Writing and Speaking At Work: A Practical Guide for Business Communication”, Prentice Hall, 3<sup>rd</sup> Ed., 2004.
3. Munter, M., “Guide to Managerial Communication: Effective Business Writing and Speaking”, Prentice Hall, 5<sup>th</sup> Ed., 1999.
4. R. Anand, “Job Readiness For IT & ITES- A Placement and Career Companion”, McGraw Hill Education.2015.
5. Malhotra, A., “Campus Placements”, 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:

- MATH1201.1 Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem
- MATH1201.2 Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon
- MATH1201.3 Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate
- MATH1201.4 Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms
- MATH1201.5 Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.
- MATH1201.6 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. E.Kreyszig, “Advanced Engineering Mathematics”, Wiley Publications.
2. S.Ross, “Introduction to Probability and Statistics for Engineers and Scientists”, Elsevier.
3. S.S. Sastry, “Introductory methods of Numerical Analysis”, PHI learning.
4. D. B. West, “Introduction to Graph Theory”, Prentice-Hall of India.
5. B.S. Grewal, “Engineering Mathematics”, 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:

- PHYS1001.1 Develop basic understanding of the modern science to the technology related domain.
- PHYS1001.2 Analytical & logical skill development through solving problems.
- PHYS1001.3 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.
- PHYS1001.4 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.
- PHYS1001.5 Understand how the systems under force field work giving their trajectories which is the basic of classical field theory.
- PHYS1001.6 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. Eugene Hecht, "Optics", Pearson Education India Private Limited.
2. David J. Griffiths, "Introduction to Electrodynamics", Pearson Education India Learning Private Limited.
3. N.K. Bajaj, "Waves and Oscillations".
4. David Halliday, Robert Resnick Jearl Walker, "Principles of Physics", 10ed, Wiley.
5. Wayne M. Saslow, "Electricity, Magnetism, and Light", Academic Press.
6. Narayan Rana, Pramod Joag, "Classical mechanics", McGraw Hill Education.
7. R Takwale, P Puranik, "Introduction to Classical Mechanics", McGraw Hill Education.
8. Ghatak, "Optics", McGraw Hill Education India Private Limited.
9. C.L.Arora, "Refresher Course in B.Sc. Physics", Vol1 and Vol 2.

<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

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

**Course Outcome:**

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

- CSEN1001.1 Understand and remember functions of the different parts of a computer.
- CSEN1001.2 Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
- CSEN1001.3 Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
- CSEN1001.4 Understand how code can be optimized in high-level languages.
- CSEN1001.5 Apply high-level language to automate the solution to a problem.
- CSEN1001.6 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. Byron Gottfried, “Schaum’s outline of Programming with C”.
2. Herbert Schildt “Teach Yourself C”.
3. E Balagurusamy, “Programming in ANSI C”.

#### **Reference Books:**

1. Herbert Schildt, “C: The Complete Reference”.
2. D. M. Ritchie, B.W. Kernighan, “The C Programming Language”.

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

### Course Outcome:

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

- HMTS1202.1 Acquire competence in using English language to communicate
- HMTS1202.2 Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
- HMTS1202.3 Be adept at using various modes of written communication at work.
- HMTS1202.4 Attain the skills to face formal interview sessions.
- HMTS1202.5 Write reports according to various specifications.
- HMTS1202.6 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. Armand Matterlart and Michele Matterlart, “Theories of Communication: A Short Introduction”, Sage Publications Ltd.
2. Chan, Janis Fisher and Diane Lutovich. San Anselmo, “Professional Writing Skills”, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P., “Business English”, New York: Barron’s Educational Series.
4. Kalia, S. & Agarwal, S., “Business Communication”, Wiley India Pvt. Ltd., New Delhi, 2015.
5. Mukherjee, H.S., “Business Communication- Connecting at work”, Oxford University Press. 2<sup>nd</sup> Edition. 2015.
6. Raman, M. and Sharma, S., “Technical Communication: Principles and Practice”, 2<sup>nd</sup> Ed., 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:

- PHYS1051.1 To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- PHYS1051.2 To learn the usage of electrical and optical systems for various measurements.
- PHYS1051.3 Apply the analytical techniques and graphical analysis to the experimental data.
- PHYS1051.4 Understand measurement technology, usage of new instruments and real time applications in engineering studies.
- PHYS1051.5 To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

### Syllabus:

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

##### **Group 1: Experiments in General Properties of matter**

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

##### **Group 2: Experiments in Optics**

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

##### **Group 3: Electricity & Magnetism experiments**

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

#### **Group 4: Quantum Physics Experiments**

1. Determination of **Planck's constant**.
2. Determination of **Stefan's radiation** constant.
3. Verification of **Bohr's atomic orbital** theory through **Frank-Hertz experiment**.
4. Determination of **Rydberg constant** by studying **Hydrogen/ Helium** spectrum.
5. Determination of **Hall co-efficient of semiconductors**.
6. Determination of **band gap** of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

#### **Books:**

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



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

### **Course Outcome:**

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

- CSEN1051.1 Write simple programs relating to arithmetic and logical problems.
- CSEN1051.2 Interpret, understand and debug syntax errors reported by the compiler.
- CSEN1051.3 Implement conditional branching, iteration (loops) and recursion.
- CSEN1051.4 Decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
- CSEN1051.5 Use arrays, pointers and structures effectively in writing programs.
- CSEN1051.6 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. Byron Gottfried, "Schaum's outline of Programming with C".
2. Herbert Schildt, "Teach Yourself C".
3. E. Balagurusamy, "Programming in ANSI C".

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

### Course Outcome:

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

- MECH1051.1 The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials
- MECH1051.2 The students will be able to fabricate components with their own hands
- MECH1051.3 They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- MECH1051.4 4.By assembling different components, they will be able to produce small devices of their interest.
- MECH1051.5 The students will be able to describe different components and processes of machine tools.
- MECH1051.6 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. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. I, Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology", Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", 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>	L	T	P	Total	Credit Points
	0	0	2	2	1

### Course Outcome:

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

- HMTS1252.1 Acquire the techniques to become an effective listener.
- HMTS1252.2 Acquire the skill to become an effortless speaker.
- HMTS1252.3 Organize and present information for specific audience.
- HMTS1252.4 Communicate to make a positive impact in professional and personal environment.
- HMTS1252.5 Engage in research and prepare authentic, formal, official documents.
- HMTS1252.6 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. Carter, R. And Nunan, D. (Eds), “The Cambridge guide to Teaching English to Speakers of Other Languages”, CUP, 2001.
2. Edward P. Bailey, “Writing and Speaking At Work: A Practical Guide for Business Communication”, Prentice Hall, 3<sup>rd</sup> Ed., 2004.
3. Munter, M., “Guide to Managerial Communication: Effective Business Writing and Speaking”, Prentice Hall, 5<sup>th</sup> Ed., 1999.
4. Sen, S., Mahendra, A. & Patnaik, P., “Communication and Language Skills”, Cambridge University Press, 2015.
5. Locker, Kitty O, “Business and Administrative Communication”, McGraw-Hill/ Irwin.
6. Chaney, L. and Martin, J., “Intercultural Business Communication”, 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 Outcomes:

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

- ECEN1011.1 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.
- ECEN1011.2 Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.
- ECEN1011.3 Design different application specific circuits associated with diodes operating both in forward and reverse bias.
- ECEN1011.4 Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.
- ECEN1011.5 Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.
- ECEN1011.6 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. Boylestad & Nashelsky, "Electronic Devices & Circuit Theory".
2. R.A Gayakwad, "Op Amps and Linear IC's", PHI.
3. D. Chattopadhyay, P. C Rakshit, "Electronics Fundamentals and Applications".
4. Adel S. Sedra & Kenneth Carless Smith, "Microelectronics Engineering".
5. Millman & Halkias, "Integrated Electronics".
6. Salivahanan, "Electronics Devices & Circuits".
7. Albert Paul Malvino, "Electronic Principle".

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

### **Course Outcome:**

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

ECEN1061.1	The students will correlate theory with diode behavior.
ECEN1061.2	They will design and check rectifier operation with regulation etc.
ECEN1061.3	Students will design different modes with BJT and FET and check the operations.
ECEN1061.4	They will design and study adder, integrator etc. with OP-AMPs.

### **Detailed Syllabus:**

#### **List of Experiments**

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

### **Books:**

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



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

<b>Course Name: FUNDAMENTALS OF DATA STRUCTURES</b>					
<b>Course Code: CSBS2101</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	4	0	0	4	4

### Course Outcome:

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

- CSBS2101.1.** *Demonstrate* the standard data structures covered in this course, in relevant applications.
- CSBS2101.2.** *Identify* the application of ordered and unordered lists in relevant problems of data structures.
- CSBS2101.3.** *Apply* stack and queue data structure to solve mathematical and real-life problems.
- CSBS2101.4.** *Explore* tree and graph approaches, mentioned in this course, to solve a given problem definition.
- CSBS2101.5.** *Analyse* algorithms related to sorting, searching and hashing covered in this course, in related applications.
- CSBS2101.6.** *Compare* the performance of alternative approaches built using different data structures covered in this course, with respect to their efficiency.

### Detailed Syllabus:

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

##### **Linear Data Structure I**

###### **Introduction**

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:**

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

###### **Linked List:**

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

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

##### **Linear Data Structure II**

###### **Stack:**

Stack and its implementations (using array, using linked list), Principles of Recursion – Applications of stack, differences between recursion and iteration, tail recursion.

###### **Queue:**

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:**

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:**

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:**

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

##### **Searching:**

Sequential search, binary search, Interpolation Search

##### **Hashing:**

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

#### **Text Books:**

1. ReemaThareja, “Data Structures using C”, Oxford University Press.
2. NarasimhaKarumanchi , “Data structures and algorithms made easy”, CareerMonkPlublications

#### **Reference Books:**

1. NarasimhaKarumanchi,“Data Structures and Algorithms Made Easy-Data Structures and Algorithmic Puzzles”, CareerMonkPlublications
2. S. Lipschutz, “Data Structures”, Schaums Outlines.
3. Ellis Horowitz, SartajSahni, Susan Anderson, “Fundamentals of Data Structures of C”, Freed.
4. Aaron M. Tenenbaum, “Data Structures in C”.
5. D. Samanta, “Classic Data Structures”, PHI
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, The MIT Press.

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

### Course Outcome:

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

**MATH2103.1** Interpret the problems that can be formulated in terms of graphs and trees.

**MATH2103.2** Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.

**MATH2103.3** 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.

**MATH2103.4** Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.

**MATH2103.5** Analyze the logical fundamentals of basic computational concepts.

**MATH2103.6** 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 Coloring, 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, Congruence, 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 [12L]**

**Propositional Calculus:** Propositions, Logical Connectives, Truth Tables, Conjunction, Disjunction, Negation, Implication, Converse, Contra positive, 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.

### **Text Books:**

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill.
2. T Veerarajan, "Discrete Mathematics", Tata McGraw- Hill.

### **Reference Books:**

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

<b>Course Name: ECONOMICS FOR ENGINEERS</b>					
<b>Course Code: HMTS2101</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:

- HMTS2101.1 Evaluate a project and estimate the total cost of the project
- HMTS2101.2 Apply financial analytical methodologies to prepare a report regarding the financial performance of an organization
- HMTS2101.3 Participate actively in an organization's capital budgeting process
- HMTS2101.4 Provide vital inputs regarding the pricing of a product
- HMTS2101.5 Apply the knowledge of the interplay of various economic variables and indicators in workplace
- HMTS2101.6 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. R. Narayanswami, "Financial Accounting- A Managerial Perspective", Prentice-Hall of India Private Limited. New Delhi.
2. Horne, James C Van, "Fundamentals of Financial Management", Prentice-Hall of India Private Limited, New Delhi.
3. H. L. Ahuja., "Modern Economic Theory", S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G. and Lavelle, Jerome P., "Engineering Economic Analysis", New York: Oxford University Press. 2012.

<b>Course Name: DIGITAL LOGIC</b>					
<b>Course Code: ECEN2104</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:

- ECEN2104.1 Learn Binary Number system, and logic design using combinational gates.
- ECEN2104.2 Design applications of Sequential Circuits.
- ECEN2104.3 Design Finite State Machines.
- ECEN2104.4 Learn Memory classifications.
- ECEN2104.5 Learn basics of CMOS logic.
- ECEN2104.6 Learn various digital component design as used in VLSI applications.

### Detailed Syllabus:

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

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

#### **MODULE-2 [10L]**

**Arithmetic Circuits:** Adder circuit – Ripple Carry Adder, CLA Adder, CSA, and BCD adder, subtractor circuit.

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

#### **MODULE-3 [10L]**

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

## **MODULE-4 [6L]**

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

**Logic families:** NMOS and CMOS, their operation and specifications. Realization of basic gates using above logic families, Open collector & Tristate gates, wired-AND and bus operations.

### **Text Books:**

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

### **Reference Books:**

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



<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:

- HMTS2001.1 Be aware of the value system and the importance of following such values at workplace
- HMTS2001.2 Learn to apply ethical theories in the decision making process
- HMTS2001.3 Follow the ethical code of conduct as formulated by institutions and organizations
- HMTS2001.4 Implement the principles governing work ethics
- HMTS2001.5 Develop strategies to implement the principles of sustainable model of development
- HMTS2001.6 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. Ritzer, G., "Classical Sociological Theory", The McGraw Hill Companies, New York, 1996.
3. Doshi, S.L., "Postmodern Perspectives on Indian Society", Rawat Publications, New Delhi, 2008.
4. Bhatnagar, D.K., "Sustainable Development", Cyber Tech Publications, New Delhi, 2008.
5. Kurzweil, R., "The age of Spiritual Machines", Penguin Books, New Delhi, 1999.
6. Weinberg, S.K., "Social Problems in Modern Urban Society", Prentice Hall Inc., USA, 1970.
7. Giddens, "Anthony 2009. Sociology", London, Polity Press (reprint 13<sup>th</sup> Edition).

<b>Course Name: FUNDAMENTALS OF DATA STRUCTURESLAB</b>					
<b>Course Code: CSBS2151</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:

- CSBS2151.1. Demonstrate the concept of memory mapping for different data structures.
- CSBS2151.2. Analyze the linear data structures for solving the real life problems.
- CSBS2151.3. Solve the different problems applying appropriate non-linear data structures.
- CSBS2151.4. Compute the data structure in a sorted order using appropriate sorting algorithms.
- CSBS2151.5. Examine the data structure to search a data pattern by applying suitable searching algorithms.
- CSBS2151.6. Identify the appropriate data structure for a given problem.

### Detailed Syllabus:

1. Matrix manipulations and Sparse matrix
2. Polynomial representation and operations
3. Implement List data structure using i) array ii) singly linked list.
4. Implementation of basic operations on doubly linked list.
5. 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*
6. Conversion and evaluation of expressions (Infix, Prefix, Postfix operations).
7. Implementation of Sorting Techniques.
8. Implementation of Searching Techniques.
9. Implement Binary Search Tree (BST) with its operations
10. Implement Graph Algorithms (BFS, DFS)

**Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India.
2. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill.
3. ReemaThareja, "Data Structures using C", Oxford University Press.
4. NarasimhaKarumanchi,"Data Structures and Algorithms Made Easy-Data Structures and Algorithmic Puzzles", CareerMonkPlublications
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", W.H.Freemanand Company.

<b>Course Name: DIGITAL LOGIC LAB</b>					
<b>Course Code: ECEN2154</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:

- ECEN2154.1 Use the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method etc.
- ECEN2154.2 Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
- ECEN2154.3 Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
- ECEN2154.4 Realize different logic circuits using ICs built with various logic families.

### Detailed Syllabus:

#### **Choose any ten experiments out of the twelve suggested next:**

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

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

<b>Course Name: PROBABILITY AND STATISTICAL METHODS</b>					
<b>Course Code: MATH2111</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:

MATH2111.1 Articulate the axioms (laws) of probability

MATH2111.2 Compare and contrast different interpretations of probability theory and take a stance on which might be preferred

MATH2111.3 Formulate predictive models to tackle situations where deterministic algorithms are intractable

MATH2111.4 Summarize data visually and numerically

MATH2111.5 Assess data-based models.

MATH2111.6 Apply tools of formal inference.

### Detailed Syllabus:

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

**Probability-I (Single variable 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, Normal approximation to Binomial and Poisson Distribution, Exponential and Multinomial distribution, Moment generating and characteristic functions, Limit theorems: Markov's inequality and Chebyshev's inequality with examples.

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

**Probability-II (Joint Distribution and Markov Chains):** 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, Markov Chains: Introduction, Chapman-Kolmogorov equations, Classification of states, Some applications: Gambler's Ruin Problem.

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

**Statistics-I:** Moments, Skewness and Kurtosis, Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Covariance, Correlation and Regression, Spearman's Rank Correlation coefficient, Curve fitting: Straight line and parabolas.

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

**Statistics-II:** Population and Samples, The sampling distribution of mean (standard deviation known), The sampling distribution of mean (standard deviation unknown), Point and Interval estimation, Tests of Hypotheses, Null Hypotheses and Tests of Hypotheses with examples.

**Text Books:**

1. Richard A Johnson, "Probability and Statistics for Engineers", Pearson Education.
2. Amritava Gupta, "Groundwork of Mathematical Probability and Statistics", Academic Publishers.

**Reference Books:**

1. S.M. Ross, "Introduction to Probability Models", Elsevier.
2. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons.
3. W. Feller, "An Introduction to Probability theory and its applications", Vol-I, John Wiley and Sons.



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

<b>Course Name: OPERATING SYSTEM CONCEPT</b>					
<b>Course Code: CSBS2201</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:

- CSBS2201.1.** Differentiate different types of operating systems (namely, batch, multi programmed, time-sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.
- CSBS2201.2.** Describe system operations, internal structure of computer system and operating system.
- CSBS2201.3.** Illustrate multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.
- CSBS2201.4.** Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.
- CSBS2201.5.** Describe the operations of IO devices and how they are governed by the operating system
- CSBS2201.6.** Define the activity and impact of threat, virus, worm and how the system could be protected from them.

### Detailed Syllabus:

#### **MODULE – I [9L]**

**Introduction [2L]:** 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 [2L]:** 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 [5L]**

**Processes [3L]:** Concept of processes, operations on processes (creation, maintenance, termination scheduling, communication).

**Threads [2L]:** Overview, benefits of threads, user and kernel threads, multithreading models and their use.

#### **MODULE – II [14L]**

**Process Scheduling [2L]:** Process scheduling, co-operating processes, inter process communication.

**CPU Scheduling [4L]:** Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), multilevel queue and feedback queue algorithms, algorithm evaluation, multi-processor scheduling.

**Process Synchronization [5L]:** Background, critical section problem, algorithms to address critical section problem (two process and multi-process solutions), synchronization hardware, semaphores, classical problems of synchronization and their solutions, deadlock during synchronization, monitor.

**Deadlocks [3L]:** 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, Optimal, MRU, MFU, LFU), allocation of frames, thrashing.

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

### **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, counting), 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. Silberschatz A. and Peterson J. L., “Operating System Concepts”, Wiley.
2. Tanenbaum A.S., “Operating System Design & Implementation”, Practice Hall NJ.
3. Milenkovic M., “Operating System: Concept & Design”, McGraw Hill.

### **Reference Books:**

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

<b>Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE</b>					
<b>Course Code: CSBS2202</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:

- CSBS2202.1. Categorize the types of instructions and addressing modes and their impact on processor design.
- CSBS2202.2. Demonstrate the design of the arithmetic and logical units of a digital computer system.
- CSBS2202.3. Analyze performance and techniques to improve the performance of cache memory organization to reduce the access time.
- CSBS2202.4. Illustrate the concepts of paging, segmentation, segmentation with paging, and page replacement strategies in the paradigm of virtual memory to create the illusion of a large memory of a computer system.
- CSBS2202.5. Explain the pipeline techniques for consistent execution of instructions with minimum hazards.
- CSBS2202.6. Understand the concepts of parallel processing, multiprocessor architectures and control unit design.

### Detailed Syllabus:

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

##### **Introduction to Computer and Computer Arithmetic:**

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

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

##### **Memory Organization and I/O techniques:**

Inclusion, coherence and locality properties, Memory Hierarchy, Cache memory organization, Memory replacement policies, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Modes of transfer, Handshaking and DMA.

## **MODULE–III [10L]**

### **Pipeline and ILP:**

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

## **MODULE–IV [11L]**

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

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

### **Books:**

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

<b>Course Name: DESIGN AND ANALYSIS OF ALGORITHMS</b>					
<b>Course Code: CSBS2203</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:

- CSBS2203.1.** Analyze the time and space complexity of an algorithm using asymptotic notations.
- CSBS2203.2.** Distinguish the algorithms to solve optimization problems.
- CSBS2203.3.** Illustrate the suitable algorithmic technique to find out a solution of decision making problems.
- CSBS2203.4.** Apply the appropriate algorithmic techniques to solve the mathematical puzzles.
- CSBS2203.5.** Describe different NP-hard and NP-complete problems and necessity of approximation algorithms.
- CSBS2203.6.** Develop algorithms to solve common engineering problems.

### Detailed Syllabus:

#### **MODULE – I [9L]**

##### **Introduction [3L]:**

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

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

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

##### **Matrix Multiplication Algorithm [1L]:**

Strassen's matrix multiplication algorithm.

##### **Heapsort [2L]:**

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

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

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

## **MODULE – II [9L]**

### **Graph Traversal Algorithm [5L]:**

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

### **Greedy Method [4L]:**

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

## **MODULE – III [11L]**

### **Dynamic Programming [8L]:**

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

### **Network Flow [3L]:**

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

## **MODULE – IV [12L]**

### **Backtracking [4L]:**

Basic method, 8 queens problem, Graph coloring problem.

### **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.

### **Text Books:**

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms".
2. E.Horowitz and Shani, "Fundamentals of Computer Algorithms".

### **Reference Books:**

1. Aho, J.Hopcroft and J.Ullman, "The Design and Analysis of Algorithms".
2. D.E.Knuth, "The Art of Computer Programming".
3. Jon Kleiberg and Eva Tardos, "Algorithm Design".
4. K.Mehlhorn, "Data Structures and Algorithms" - Vol. I & Vol. 2.
5. S.Baase, "Computer Algorithms".
6. E.M.Reingold, J.Nievergelt and N.Deo, "Combinatorial Algorithms- Theory and Practice", Prentice Hall, 1997

<b>Course Name: INTRODUCTION TO INNOVATION AND ENTREPRENEURSHIP</b>					
<b>Course Code: CSBS2204</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:

- CSBS2202.1. Learn the various aspects of innovation.
- CSBS2202.2. Identify methods of fostering innovation.
- CSBS2202.3. Understand the concept and theories of entrepreneurship.
- CSBS2202.4. Recognize the qualities of entrepreneurs that contribute to their success.
- CSBS2202.5. Identify social entrepreneurship opportunities.
- CSBS2202.6. Generate several ideas for potential businesses based on important trends and each student's interests.

### Detailed Syllabus:

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

##### Introduction to innovation

- Creativity, Invention and Innovation
- Necessity of innovation in current business world
- Different types of Innovation
- Relevance of Technology and Innovation
- Adaptability of an innovation
- The Indian Innovations and opportunities

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

##### Promoting and managing innovation

- Innovators and Imitators
- Patents, Trademarks, Intellectual Property
- Exploring, Executing, Leveraging and renewing innovation
- Strategy for Commercializing Innovation
- Risks and barriers for introducing products and services
- Selecting a Strategy, setting up the Investment and establishing organisation
- Evaluating the Costs and impact of the Project



## **MODULE–III [10L]**

### **Introduction to Entrepreneurship**

- Entrepreneurship in global context–social and economic development
- Opportunity discovery
- IP innovation and Entrepreneurship
- Entrepreneurial attributes/ indicators
- Theories of entrepreneurship
- Characteristics of an entrepreneurial venture, factors affecting entrepreneurial

## **MODULE–IV [10L]**

### **Social Entrepreneurship**

- Social Entrepreneurship opportunities
- Understanding sectoral opportunities for social enterprises
- Science and Technology for Social Change
- Tools and Approaches
- Social entrepreneurship models

### **Text Books:**

1. Robin Lowe and Sue Marriott, “Enterprise: Entrepreneurship and Innovation Concepts, Contexts and Commercialization”.
2. John Bessant and Joe Tidd, “Innovation and Entrepreneurship”, ISBN: 978-1-118-99309-5, Wiley.

### **Reference Books:**

1. Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
2. Peter F. Drucker, “Innovation and Entrepreneurship”, Harper Business Publication. (www.PETER-DRUCKER.com)
3. EDII, “Faculty and External Experts –A Hand Book for New Entrepreneurs”, Entrepreneurship Development Institute of India, Ahmadabad, 1986.
4. Philips, Bonefiel and Sharma, “Social Entrepreneurship”, Global vision publishing house, New Delhi (2011).

<b>Course Name: MANAGERIAL ECONOMICS</b>					
<b>Course Code: CSBS2205</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:

- CSBS2205.1. Appreciate the foundational concepts of managerial economics.
- CSBS2205.2. Develop a microeconomic approach to business decisions.
- CSBS2205.3. Arrive at decisions by applying concepts of microeconomics.
- CSBS2205.4. Apply the tools of managerial economics and find solutions to the complex problems of production processes.
- CSBS2205.5. Co-relate concepts and theories of microeconomics and macroeconomics.
- CSBS2205.6. Decide and choose options aimed at furthering the goals of the organization.

### Detailed Syllabus:

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

- Managerial Economics: Fundamental Concepts
- Objectives of the Firm; Environment of Business; Economic and Non-Economic Elements and their Interactions
- Decision Making Consumer Behaviour: Utility Analysis; Equi-marginal Utility; Indifference Curve; Consumer Equilibrium
- Demand Decision: Meaning & Types of Demand; Determinants of Demand; Demand Function
- Demand Elasticity Demand Estimation: Methods of Demand Estimation; Demand Forecasting; Types of Demand Forecasting

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

- Production Decisions: Firm's behaviour in short & long run
- Cost Concepts; Cost-Output Relations
- Production Function; Elementary Description, Pricing Decisions: Determinants of Price; Pricing under different market conditions
- Objectives of Pricing under different market structures
- Perfect Competition; Monopoly; Oligopoly; Monopolistic Competition

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

- Monetary Policy: Different Components of Money Supply
- Monetary Theory and Policy in Practice; Interest Rate Policy
- Role of RBI in Monetary Management; Credit Policy
- Financial Institutions Fiscal Policy: Fiscal Imbalance
- Government Expenditure; Plan and Non-Plan Expenditure; Tax Policy and Reforms; Government Borrowings: Domestic and External Commercial Policy
- Foreign Trade Policy; Foreign Exchange Management Act (FEMA)
- External Sector: Balance of Payment and Balance of Trade; Current Account and Capital Account; Trends in Exports and Imports

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

- Business and Government: Role of Government; Development Strategy
- Industrial Policy; Industries (Development and Regulations) Act, 1951; Industrial Policy Resolution (IPR) 1956
- Monopolies and Restrictive Trade Practices (MRTP) Act 1969
- Five Year Plans; Review of Preceding Five Year Plan; Overview of Latest Five Year Plan Public Sector in India: Role of Public Sector; Organisation of Public Sector; Problems and Prospects of Public Sector
- Economic Reforms: Liberalisation; Privatisation and Globalisation; Assessment of New Economic Reforms

### **Books:**

1. Ahluwalia, I J, "India's economic reforms and development, essays for Manmohan Singh", New Delhi: OUP, 1998.
2. Ahluwalia, Montek S. , "Macroeconomics and Monetary Policy", New Delhi: Oxford University Press, 2002.
3. Ahluwalia, Montek S., "Macroeconomics and Monetary Policy: Issues for a reforming economy", New Delhi: Oxford University Press, 2003.
4. Ahuja, H. L., "Advanced Economic Theory: Microeconomic Theory", Ed 13, New Delhi: S Chand & Co, 2003
5. Bhatia, H. L., "Public Finance", Ed 25th, New Delhi: Vikas Publishing House, 2006.

<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	-	-	2	-

**Course Outcome:**

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

- CSBS2016.1.** Understand the natural environment and its relationships with human activities.  
**CSBS2016.2.** Characterize and analyze human impacts on the environment.  
**CSBS2016.3.** Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.  
**CSBS2016.4.** Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.  
**CSBS2016.5.** Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.  
**CSBS2016.6.** 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. Gour Krishna Das Mahapatra, "Basic Environmental Engineering and Elementary Biology", Vikas Publishing House P. Ltd.
2. A. K. De, "Environmental Chemistry", New Age International.
3. A. K. Das, "Environmental Chemistry with Green Chemistry", Books and Allied P. Ltd.

### **Reference Books:**

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

<b>Course Name: OPERATING SYSTEM CONCEPT LAB</b>					
<b>Course Code: CSBS2251</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	0	0	3	3	1.5

### Course Outcome:

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

- CSBS2251.1** Develop and debug programs in UNIX environment.
- CSBS2251.2** Develop shell scripts to manage the system memory, user, files, and devices.
- CSBS2251.3** Develop multi-processing and multi-threading environment capable of performing multiple tasks or sub-tasks simultaneously.
- CSBS2251.4** Apply system calls and signals for user defined purposes
- CSBS2251.5** Design a synchronized multi-threaded system capable of resource sharing
- CSBS2251.6** Develop C programs to share information between two process using concepts of IPC.

### Detailed Syllabus:

1. **Managing Unix/Linux Operating System [9P]:** Familiarization with LINUX OS and shell commands (commands and filters), Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process [6P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal [3P]:** signal handling, sending signals, signal interface, signal sets, user defined signals.
4. **Semaphore [6P]:** Programming with semaphores to solve critical section problems (e.g. producer consumer problem)
5. **POSIX Threads [6P]:** Programming with pthread functions (viz. pthread\_create, pthread\_join, pthread\_exit, pthread\_attr\_init, pthread\_cancel)
6. **Inter-process communication [6P]:** Pipes (use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

### Text Books:

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

### Reference Books:

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

<b>Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE LAB</b>					
<b>Course Code: CSBS2252</b>					
<b>Contact</b>	L	T	P	Total	Credit Points
<b>Hours per week</b>	0	0	3	3	1.5

### **Course Outcome:**

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

- CSBS2252.1** Analyze different types of logic gates and verify K-Maps and truth tables of logic gates.
- CSBS2252.2** Construct adder and subtractor circuits and defend the obtained truth tables and K-maps via TBW.
- CSBS2252.3** Design and construct Multiplexer circuits and defend the obtained truth tables and K-maps.
- CSBS2252.4** Design and construct different converters and ALU circuits and defend the obtained truth tables and K-maps via TBW.
- CSBS2252.5** Design horizontal and vertical expansion of RAM and compare their results from obtained truth tables.
- CSBS2252.6** Design seven segment displays and defend the obtained truth tables.

### **Detailed Syllabus:**

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
    - a. Multiplexers: 4:1 and 8:1, 8:1 using 4:1 and 2:1
    - b. Code Converters: 4-bit binary to gray, 4-bit gray to binary
    - c. 7-segment display
    - d. ALU

### **Books:**

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

<b>Course Name: DESIGN AND ANALYSIS OF ALGORITHMS LAB</b>					
<b>Course Code: CSBS2253</b>					
<b>Contact Hours per week</b>	L	T	P	Total	Credit Points
	0	0	3	3	1.5

**Course Outcome:**

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

- CSBS2253.1. Analyze the technique of divide-and-conquer to find out a solution
- CSBS2253.2. Apply greedy methods to obtain the optimal solution.
- CSBS2253.3. Examine different Graph traversal algorithms (BFS and DFS).
- CSBS2253.4. Solve different problem using the technique of backtracking, branch and bound algorithms.
- CSBS2253.5. Demonstrate the technique of dynamic programming to solve different problems.
- CSBS2253.6. Develop appropriate algorithm to solve common engineering problems.

**Detailed Syllabus:**

**Programming Language used: C**

**Lab:1 : Divide and Conquer:**

Implement Binary Search using Divide and Conquer approach  
 Implement Merge Sort using Divide and Conquer approach

**Lab:2 : Divide and Conquer:**

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

**Lab:3 : Graph Traversal Algorithm:**

Implement Breadth First Search (BFS)  
 Implement Depth First Search (DFS)

**Lab:4 : Greedy method:**

Knapsack Problem  
 Job sequencing with deadlines

**Lab:5 : Greedy method:**

Minimum Cost Spanning Tree by Prim's Algorithm  
 Minimum Cost Spanning Tree by Kruskal's Algorithm



Single Source shortest Path for a graph (Dijkstra)

**Lab:6 : Dynamic Programming:**

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

**Lab:7 : Dynamic Programming:**

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

**Lab:8: Dynamic Programming:**

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

**Lab:9 : Backtracking:**

Implement 8 Queen Problem

**Lab:10 : Backtracking:**

Graph Coloring Problem

**Lab:11 : Brunch and Bound:**

Implement 15 Puzzle Problem

**Books:**

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

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

<b>Course Name: COMPUTER NETWORKS</b>					
<b>Course Code: CSBS3101</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

### Course Outcomes:

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

- CSBS3101.1.** Describe the fundamental concepts of data communication and networking, layered models, protocols, networking devices.
- CSBS3101.2.** Describe theoretical basis for data communication, digital and analog transmission, multiplexing, switching, transmission media.
- CSBS3101.3.** Illustrate data link layer services, framing, error control, flow control, data link layer protocols and various channel access protocols.
- CSBS3101.4.** Examine various routing algorithms, addressing schemes and different network layer protocols.
- CSBS3101.5.** Analyze different transport layer protocols, techniques for congestion control and QoS provisioning.
- CSBS3101.6.** Define 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. Data Communications and Networking – B. A. Forouzan –TMH

### **Reference Books**

1. Computer Networks – A. S. Tanenbaum –Pearson Education/PHI
2. Data and Computer Communications – 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 – Comer –Pearson Education/PHI

<b>Course Name: DATABASE MANAGEMENT SYSTEMS</b>					
<b>Paper Code: CSBS3102</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

### Course Outcomes:

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

- CSBS3102.1.** Demonstrate the concepts of various data model and schemas used in database design.
- CSBS3102.2.** Design relational database schemas using the conceptual modeling tools like ER diagrams.
- CSBS3102.3.** Analyze the functional dependencies and normalize the relational database design.
- CSBS3102.4.** Apply the query language to manipulate the relational databases.
- CSBS3102.5.** Describe the concept of transaction, basic database storage structures, and indexing.
- CSBS3102.6.** Construct database schema for various real life problems.

### Detailed Syllabus

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

**Introduction to DBMS:** Introduction to Database and DBMS, Importance of Database Design, Problems with File System Data Management, Database Systems, Three-Level Architecture, Instances and Schemas, Database Administrator, Database Users, Advantages and Disadvantages of DBMS.

**Data Model:** Data Modeling and Data Models, Importance of Data Models, Data Model Basic Building Blocks.

**Entity-Relationship Modeling:-** Entity and Entity Instances, Attributes, Entity Relationships, Cardinality of Relationships, Strong and Weak Entity, Generalization, Specialization, Aggregation, Developing an ER Diagram, Entity Integrity and Primary Key, Translating ER Model into Relational Model.

**Relational Algebra:** Operators- Selection, Projection, Union, Intersection, Set difference, Cross product, Rename, Assignment, Various types of joins, Division.

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

**Relational Data Model:** A Logical View of Data, Keys, Integrity Rules, Relational Set Operators, Data Dictionary and the System Catalog, Relationships within the Relational Database, Data Redundancy Revisited, Indexes, Codd's Relational Database Rules.

**Relational Database Design:** Functional Dependency (FD) – Definition, Trivial and Non- Trivial FD, Closure of Set of FD, Closure Of Attribute Sets, Irreducible Set of FD, Canonical Cover, Normalization – 1NF, 2NF, 3NF, BCNF, Decomposition using FD, Lossless Decomposition, Dependency Preservation. Normalization using multi-valued dependencies and 4NF, Join dependency and 5NF, Domain key normal form (DKNF).

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

**Structured Query Language (SQL):** Introduction to SQL, DDL, DML, DCL, Basic Structure, Basic Queries, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, Assertions, Views, Joining Database Tables, Commit and Rollback.

Sub queries and Correlated Queries, SQL Built in Functions - Numeric, Date, String Functions, Updatable Views.

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

### ***Introduction to Procedural Language/Structured Query Language (PL/SQL):***

PL/SQL block structure, Variables, Control Structure and iteration, Implicit and Explicit Cursors, Stored procedures and functions, PL/SQL packages, Triggers, Locks.

### ***Concepts of Transaction and Concurrency Control:***

Transaction Concept and State. Executions, Serializability, Recoverability. Concurrency Control Techniques: Lock based Protocols.

***Storage structure & Indexing:*** Sequential and indexed file organization, Primary, Secondary & Multi Level indexing

### **Textbooks**

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH.
2. Fundamentals of Database Systems - Elmsari and Navathe, Addison-Wesley.

### **Reference Books**

1. An Introduction to Database Systems - Date C. J, Addison-Wesley.
2. SQL-PL/SQL - Ivan Bayross, BPB.

<b>Subject Name: FORMAL LANGUAGE &amp; AUTOMATA THEORY</b>					
<b>Paper Code: CSBS 3103</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

### Course Outcomes:

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

- CSBS3103.1.** Demonstrate basic concepts of formal languages of finite automata techniques
- CSBS3103.2.** Identify different formal language classes and their relationships
- CSBS3103.3.** Design finite automata for different regular expressions and languages
- CSBS3103.4.** Construct context free grammar for various languages
- CSBS3103.5.** Design push down automata as a recognizer of languages
- CSBS3103.6.** Interpret Turing machines as a language acceptor

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

**Basic concepts:** Propositions, Connectives, Well-formed Formulas, Disjunctive Normal Form.

**Finite Automata:** Definition, Transition Functions, Deterministic finite automaton (DFA) and non-deterministic finite automaton (NFA). Transition diagrams, Application of finite automata, NFA with  $\epsilon$  transitions - Significance, acceptance of languages. Design of DFA/ NFA for given languages. Equivalence between NFA with and without  $\epsilon$  transitions. NFA to DFA conversion.

**Finite state machine:** Definitions, Moore & Mealy machine and their conversion, Minimization of FSM, Equivalence between two FSM's, Limitations of FSM.

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

**Formal Language and Grammars:** Chomsky Classification of grammar, Right and Left Linear Grammar, Regular Grammar, Regular Expression, Regular Language, Closure property of Regular Languages, Regular string accepted by NFA/DFA, Pumping Lemma, Properties of Regular expressions. Identifying non regular languages, reduction of number of states, equivalence between regular language and regular grammars.

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

**Context free Language and Grammar:** Context free Language, Context free Grammar, and derivation tree, left most and right most derivation, Parsing and ambiguity, Chomsky and Greibach Normal Form, Pumping Lemma, Properties of CFL including closure property

**Pushdown Automata (PDA):** PDA, Acceptance by PDA, PDA and CFL, Parsing and PDA, NPDA as recognizer of CFL.

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

**Turing machine:** Introduction to Turing Machine, Definition, Model. Design of TM for different languages, TM as language acceptor. TM as transducers. Computable functions. Languages accepted by a TM, Non Deterministic Turing Machine, Universal Turing Machine, Undecidable Problems: Halting Problem of TM, Post correspondence problem, undecidable problems of CFL, Post Systems.

**Text Books:**

1. P. Linz, "An Introduction to formal Languages and Automata", Norasa
2. Mishra, Chandrashekharan, "Theory of Computer Science", PHI

**Reference Books:**

3. J. E. Hopcroft, J. D. Ullman, "Introduction of automata Theory, Languages and Computation", Student Edition, Norasa,
4. ZVI Kohavi, Switching & Finite Automata, Tata McGraw Hill.
5. John C Martin, "Introduction to Theory of formal Languages and Automata", McGraw Hill
6. S. P. Eiger Xavier, "Theory of Automata, Formal Languages and Computation, New Age Publishers

<b>Paper Name: PRINCIPLES OF MANAGEMENT</b>					
<b>Paper Code: HMTS 3101</b>					
<b>Contact hrs. 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:**

- HMTS3101.1.** Study the evolution of Management.
- HMTS3101.2.** Understand various management functions and have some basic knowledge on different aspects of management.
- HMTS3101.3.** Understand the planning process in an organization.
- HMTS3101.4.** Understand the concept of organizational structure.
- HMTS3101.5.** Demonstrate the ability to direct, lead and communicate effectively.
- HMTS3101.6.** Analyze and isolate issues and formulate best control methods.

**Detailed Syllabus:**

**MODULE -I [8L]**

**Management:** Definition, nature, purpose and scope of management. Skills and roles of a Manager, functions, principles;

**Evolution of Management Thought:** Taylor Scientific Management, Behavioural 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 behaviour –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.

### **Text Books**

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

<b>Course Name: COMPUTER GRAPHICS</b>					
<b>Course Code: CSBS 3131</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS3131.1.** 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.
- CSBS3131.2.** Apply DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; to create composite geometric figures.
- CSBS3131.3.** 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.
- CSBS3131.4.** Employ 2D and 3D transformation techniques (translation, rotation, scaling, shearing, reflection)
- CSBS3131.5.** 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.
- CSBS3131.6.** 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 [8L]**

Introduction to computer graphics & graphics systems, Relationship and difference between computer Graphics, Image, Image Processing; Representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing; Color Models, lookup table, Histogram; Image representing hardware: Cathode 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 [8L]**

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 [8L]**

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 [8L]**

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>Paper Name: E-COMMERCE</b>					
<b>Paper Code: CSBS 3132</b>					
<b>Contact hrs. 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:**

- CSBS3132.1.** Describe the basics of E-commerce system
- CSBS3132.2.** Choose right kind of hardware and software platforms for the E-commerce system they are building
- CSBS3132.3.** Classify EDI, B2B, B2C, C2C, m-commerce, E-Governance – the varied aspects of E-commerce
- CSBS3132.4.** Interpret the importance of security in E-commerce
- CSBS3132.5.** Indicate E-commerce marketing concepts, dimensions and technologies
- CSBS3132.6.** Demonstrate 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: Digital Commerce Marketing and Advertising Concepts (Strategies and Tools), Internet Marketing Technologies, Understanding the Costs and Benefits of Online Marketing Communications, Social Marketing, Mobile Marketing, Local and Location-Based Mobile Marketing,

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

**MODULE – IV [8L]**

***Emerging technologies*** like Virtual/Augmented Reality, Blockchain, Internet of Things, AI and Machine Intelligence – how these technologies are influencing E-commerce.

**Text Books**

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

**Reference Book**

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

<b>Paper Name: SOFT COMPUTING</b>					
<b>Paper Code: CSBS 3133</b>					
<b>Contact hrs. 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:

- CSBS3133.1.** Describe about soft computing concepts, technologies and their role in problem solving.
- CSBS3133.2.** Analyze the genetic algorithms and their applications to solve optimization problems.
- CSBS3133.3.** Demonstrate different neural network architectures, algorithms, applications and their limitations.
- CSBS3133.4.** Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
- CSBS3133.5.** Identify the need for approximation analysis and rough set theory in developing applications.
- CSBS3133.6.** Inspect various soft computing techniques in order to solve Multi-Objective Optimization Problem (MOOP).

### **Detailed Syllabus:**

#### **MODULE - I [7L]**

##### *Introduction*

Introduction to soft computing, Different tools and techniques, Usefulness and applications.

##### *Genetic algorithm (GA)*

Basic concepts, Working principle, Encoding, Fitness function, Genetic modeling: Inheritance, Selection, Cross over, Mutation, Bitwise operator, Convergence of GA,

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

##### *Neural Network*

Structure and function of biological neuron, Artificial neuron, Definition of Artificial Neural Network (ANN), Taxonomy of neural net, 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, Applications of neural networks.

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

##### *Fuzzy sets and Fuzzy logic systems*

Overview of classical set theory, Fuzzy sets and Fuzzy relations, Fuzzy set operations, Properties of Fuzzy sets, Cardinality, Properties of Fuzzy relations.

##### *Membership functions*

Features of membership functions, Standard forms and boundaries, Standard Fuzzification methods.

### ***Fuzzy to Crisp conversions***

Lambda cuts for Fuzzy sets, Fuzzy relations, Defuzzification methods, Overview of classical predicate logic, Fuzzy logic, Approximate reasoning and Fuzzy implication.

Overview of fuzzy rule based systems.

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

### ***Rough Set***

Introduction to Rough sets, Decision table, Indiscernibility relations and set approximation, Reducts & Core, Rough approximation, Decision matrix, and Application of Rough set.

***Multi-Objective Optimization Problem (MOOP):*** Introduction to MOOP, Mathematical formulation, Examples, Decision space and Objective space, Single Objective vs Multi-Objective, Ideal solution vs Real solution, Concept of Domination – Non-dominated set, Pareto optimal set, Pareto optimal front.  
Introduction to Vector Evaluated Genetic Algorithm (VEGA), Multi-Objective Genetic Algorithm (MOGA).  
Overview of Niche Pareto Genetic Algorithm (NPGA), Non-dominated Sorting Genetic Algorithm (NSGA), NSGA II

***Overview of Evolutionary Algorithm*** - Ant colony optimization (ACO), Particle swarm optimization (PSO)

### **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.

### **Reference Books:**

1. Soft Computing and Its Applications, Volume One: A Unified Engineering Concept, Volume 1 –Kumar S. Ray, CRC Press.
2. Genetic Algorithms in search, Optimization & Machine Learning - David E. Goldberg, Pearson India.
3. Artificial Neural Networks - B. Yegnanarayana, PHI.
4. Soft computing - Dilip K. Pratihar, Alpha Science International.

<b>Paper Name: IMAGE PROCESSING</b>					
<b>Paper Code: CSBS 3134</b>					
<b>Contact hrs. 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:**

- CSBS3134.1.** Review the fundamental concepts of a digital image processing system.
- CSBS3134.2.** Apply different techniques employ for the enhancement of images in spatial domain.
- CSBS3134.3.** Explain different causes for image degradation and image restoration techniques.
- CSBS3134.4.** Illustrate different techniques employ for the enhancement of images in frequency domain.
- CSBS3134.5.** Demonstrate different compression techniques applied to compress an image.
- CSBS3134.6.** Compute 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: COMPUTER NETWORKS LAB</b>					
<b>Course Code: CSBS 3151</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>1.5</b>

**Course Outcomes:**

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

- CSBS3151.1.** Describe the concepts of socket programming.
- CSBS3151.2.** Demonstrate Socket programming to design client server environment.
- CSBS3151.3.** Develop an application to execute command remotely using socket programming.
- CSBS3151.4.** Develop a file transfer application using socket programming.
- CSBS3151.5.** Learn to gather network information using socket programming.
- CSBS3151.6.** Develop different ARQ techniques using socket programming.

**Syllabus:**

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

**Books**

1. Unix Network Programming, Richard Stevens, Bill Fenner, and Andrew M. Rudoff, Volume1 & 2, Addison-Wesley, 2004.

<b>Course Name: DATABASE MANAGEMENT SYSTEMS LAB</b>					
<b>Paper Code: CSBS3152</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>1.5</b>

**Course Outcomes:**

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

- CSBS3152.1.** Construct database and tables using RDBMS
- CSBS3152.2.** Manage data within the RDBMS by performing various operations.
- CSBS3152.3.** Determine the output fetched from table/s through various complex query processing.
- CSBS3152.4.** Modify the database access control using various query processing.
- CSBS3152.5.** Investigate the data using PL/SQL
- CSBS3152.6.** Construct various data control to handle the data transactions.

**Problems related to the following topics:**

Topic 1: Database Creation

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

Topic 2: Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

Topic 3: 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

Topic 4: Clause

- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

Topic 5: Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOK

Topic 6: PL/SQL overview

- Structure of PL/SQL block.
- Using PL/SQL variables, taking user input and displaying the output.
- PL/SQL Control structures(Conditional control, Iterative control, Sequential control)
- Built-in PL/SQL functions
- PL/SQL composite datatype (Tables, ROWTYPE)
- Subprograms
  - Procedures
  - Functions
- Cursor Management
  - Implicit Cursor
  - Explicit Cursor
  - Cursor for-loop
- Database Triggers
- Error Handling
- Packages

#### Topic 7: Transaction management

- Transaction with COMMIT, ROLLBACK, SAVEPOINT
- Locking with pair of user
- Locking with multiuser

#### **Books**

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH..
2. SQL-PL/SQL - Ivan Bayross, BPB

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

<b>Course Name: SOFTWARE ENGINEERING</b>					
<b>Course Code: CSBS3201</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

### Course Outcomes:

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

- CSBS3201.1. Understand the basic concept of SDLC stages and different SDLC models.
- CSBS3201.2. Model function-oriented software design.
- CSBS3201.3. Develop object-oriented software design.
- CSBS3201.4. Analyze different approaches of testing methodology in a software system.
- CSBS3201.5. Estimate size, effort, cost and time related to a software project.
- CSBS3201.6. Prepare software project schedule and staffing plan.

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

#### **Introduction to Software Engineering**

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

#### **Requirements Phase**

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

#### **Structured Analysis Modeling Techniques**

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**

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**

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**

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

### **Review and Testing**

Self-Review / Peer Review , Testing Overview -- Objective, Definition, Static and Dynamic Testing, Functional vs. Non-functional Testing, Testing Artifacts – Test Cases and Test Suites, Stub and Driver, Testing Methods -White Box Testing with Test Coverage using Control Flow Graph (CFG) and Cyclomatic Complexity, Black Box Testing with Equivalence Class Partitioning and Boundary Value Analysis, Testing Level – Unit Testing, Integration Testing, System Testing, (User) Acceptance Testing, Regression Testing, Performance Testing, Usability Testing, Non-functional Testing

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

### **Software Maintenance**

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

### **Software Estimation**

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**

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

### **Configuration Management**

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

### **Text 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.

### **Reference Books**

1. Software engineering-Ian sommerville, addison-wesley publishing company, England.
2. An integrated approach to software engineering-Pankaj Jalote, Narosa publishing House, New Delhi.
3. The unified modeling language User guide-Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson education, New York.

<b>Course Name: Object Oriented Programming</b>					
<b>Paper Code: CSBS3202</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

### Course Outcomes:

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

- CSBS3102.1.** Recall the knowledge of procedural language and map it to paradigm of object oriented concept.
- CSBS3102.2.** Relate the real world problem with object oriented approach.
- CSBS3102.3.** Describe and illustrate the features of object-oriented programming.
- CSBS3102.4.** Analyze any real world problem with object oriented approach and formulate a solution for the same.
- CSBS3102.5.** Manage the complexity of procedural language by using the concept polymorphism, inheritance, abstraction, encapsulation.
- CSBS3102.6.** Create and explain some GUI and thread-based applications.

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

#### **Basics of OOP and Introduction to JAVA:**

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

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

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

#### **Class & Object proprieties:**

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

#### **Reusability properties:**

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

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

#### **Exception handling and I/O:**

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

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

## **Multithreading and Applet & Swing Programming:**

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

## **Text Books**

1. The complete reference-Java2, Patrick Naughton, Herbert Schildt, TMH
2. Object Oriented Modelling and Design, Rumbaugh, James Michael, Blaha, Prentice Hall, India.

## **Reference Books:**

1. Object-Oriented System Development Ali Bahrami, McGraw Hill.
2. Core Java for Beginners, R. K Das, VIKAS PUBLISHING.
3. Java How to Program, Deitel and Deitel, 6th Ed. – Pearson.
4. Beginning Java 2 SDK, Ivor Horton's, Wrox.
5. Programming with Java: A Primer, E. Balagurusamy, 3rd Ed., TMH.



<b>Course Name: ENTERPRISE SYSTEM AND IT SOLUTIONS</b>					
<b>Course Code: CSBS3203</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CSBS3203.1. Classify various functional areas of management and information systems therein and information technologies involved.
- CSBS3203.2. Evaluate the current role of IT in an organization for fulfilment of organizational goals and objectives and implementation of strategies.
- CSBS3203.3. Analyse the role of business processes in support of implementation of enterprise systems
- CSBS3203.4. Evaluate the implementation process of Enterprise Systems.
- CSBS3203.5. Describe how Enterprise systems use relational database management systems to manage organisational data and retrieve information for decision making.
- CSBS3203.6. Analyse cases relevant to enterprise systems vis-a-vis decision making.

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

**Introduction:** Enterprise and System concepts, system types and examples, Data and information; sources of data for business; Strategy & Technology; Information as a strategic asset.

**Digitalisation in Business:** Digitalization & Digital Transformation; Importance of Digital Media; Disruptive technologies;

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

**Management Information System:** Information Systems and Organization Strategy; Basic Concepts of Information System; Computer based IS for Decision Making Process.

**IT for Business:** Data Management & Analytics, Concepts and practices of Business Intelligence; Concepts of Data warehousing, data mart, meta data, multidimensional modeling, Online Analytical Processing (OLAP), Online Transaction Processing (OLTP).

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

**Introduction to Enterprise System:** Business Processes: Sales & Distribution (SD), Procurement, Production Planning & Control (PP), Materials Management (MM), Finance and Control (FICO), Human Resource Management (HM), Warehouse Management (WM), Quality Management (QM), Enterprise Asset Management etc.

**Enterprise-wide Resource Planning (ERP):** Concept, evolution, functions, architecture; ERP & Business Process Redesign; ERP software overview.

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

**SCM (Supply Chain Management):** Concepts of SCM, drivers of SCM, inbound & outbound definition, brief description and applicability - eProcurement, eTailing, eLogistics, eCollaboration, eIntegration,, SCM tools

**CRM (Customer Relationship Management):** Concepts of CRM, Features, types, application of CRM, Sales force automation, CRM tools. Concept of XRP (extended ERP). Case study

#### **Text Books**

1. Management Information Systems by James A. O'Brien (Author), George M. Marakas (Author), Ramesh Behl - MGH

2. Integrated Business Processes with ERP Systems, by Simha R. Magal and Jeffrey Word, Wiley
3. Business Intelligence, Analytics, and Data Science: A Managerial by Ramesh Sharda, Dursun Delen , Efraim Turban, Pearson

**Reference Books:**

1. MIS: Managing Information Systems in Business, Government and Society-by RAHUL DE- Wiley
2. Management Information Systems: Managing the Digital Firm-Kenneth C. Laudon, Jane P. Laudon- Pearson
3. Enterprise Resource Planning, Mary Sumner, Pearson
4. Enterprise Resource Planning, Alexis Leon, Tata McGraw-Hill

<b>Course Name: MOBILE COMPUTING</b>					
<b>Course Code: CSBS3231</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS3231.1.** Understand various multiple access techniques and compare among them.
- CSBS3231.2.** Learn the evolution of different generations of mobile networks.
- CSBS3231.3.** Understand the concept of cellular mobile communication.
- CSBS3231.4.** Explain different inter-networking challenges and solutions in wireless mobile networks.
- CSBS3231.5.** Analyze the modifications necessary in normal TCP and IP protocols to be made suitable for wireless network.
- CSBS3231.6.** Compare among different mobile routing algorithms.

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

Introduction to Mobile Communication: Introduction to mobile wireless communication and systems, Channel Assignment Schemes, Channel interferences. Multiple Access Technologies in cellular communication: Time division multiple access (TDMA), Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA). Second generation (2G) Network: Global system for mobile communication (GSM). Third Generation 3G Wireless Networks-UMTS, Fourth Generation 4G Wireless Networks-LTE Advanced, Brief introduction of 5G network.

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

Cellular Mobile Communication: Generations of Cellular Communication Technologies, Services and architecture of GSM, GSM Frequency Bands and allocation strategy, GPRS, 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[10 L]**

Mobile Network and Transport Layer: Wireless LAN – IEEE 802.11. PAN-Bluetooth- Piconet, Scatternet, Connection Establishment, Protocol Stack. Mobile IP (Goals, Assumptions, Entities and terminology), IP packet delivery, Agent advertisement and discovery, Registration, Route optimizations. Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, ATCP, Transmission / Timeout Freezing Selective Retransmission, Transaction oriented TCP.

#### **Module-IV [7L]**

Mobile Routing and Application Protocols: Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, Routing and various routing algorithms- DSR, WRP, DSDV, AODV, ZRP. Multicast Routing Algorithms: MAODV, ODMRP. Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML).

### **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. Nicklous and T. Stober, Springer.
2. Introduction to Wireless and Mobile systems, D. P. Agrawal, Qing-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: MACHINE LEARNING</b>					
<b>Course Code: CSBS3232</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS3232.1.** Interpret the basics of the machine learning paradigm.
- CSBS3232.2.** Inspect the patterns in the data using Regression techniques.
- CSBS3232.3.** Contrast the complexity of Machine Learning algorithms and their limitations
- CSBS3232.4.** Break down the various neural network and deep learning models.
- CSBS3232.5.** Compute linear and non-linear functions using SVM
- CSBS3232.6.** Apply Machine Learning algorithms in practice using real-world data.

**Module I [10L]**

**Introduction:** Basic Concept of Learning, Example of Learning, Components of Learning, Simple Model of Learning, Different Types of Learning;

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

**Module II [10L]**

**Components of learning;** Error and Noise, From Training to Testing, Dichotomies, Growth Function, Break Points.

**Evaluation Metrics:** Learn about metrics such as accuracy, precision, and recall used to measure the performance of your models.

**The VC Dimension:** The definition, VC Dimension of Perceptron's, Interpreting the VC Dimension, Utility of VC Dimension.

**Bias-Variance Tradeoff:** Bias and Variance, Learning Curves.

**Module III [10L]**

**Neural Model:** Recapitulation of Neural Network Model and Backpropagation algorithm; 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.

**Module IV [10L]**

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

**Overfitting:** Introduction to Overfitting, Dealing with Overfitting, Concept of Regularization.

**Text Books:**

1. Learning from Data - A short Course, Y. S. Abu-Mostafa, M. Magdon-Ismail, H. T. Lin, AMLbook.com.
2. Computational Intelligence Principles, Techniques and Applications, Konar, Springer, 2012.
3. Machine Learning, First Edition, T. Mitchell, McGraw-Hill, 1997.

**Reference Books:**

1. Neural Networks and Learning Machines, Third Edition, S. Haykin, 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: COMPILER DESIGN</b>					
<b>Course Code: CSBS3233</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CSBS3233.1.** Acquire knowledge of different phases and passes of compilation and design lexical analyzer for a language.
- CSBS3233.2.** Understand the parser and its types i.e., Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
- CSBS3233.3.** Understand the concept of Type Checking and Run Time Environments.
- CSBS3233.4.** Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
- CSBS3233.5.** Generate intermediate code for statements in high level language.
- CSBS3233.6.** Apply optimization techniques to intermediate code and generate machine code for high level language program.

#### **MODULE – I [8L]**

##### **Introduction to Compiler**

Analysis of a source program, Different phases of compilation, Cousins of a compiler.

##### **Lexical Analysis**

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token,

Recognition of a tokens, A language for specifying lexical analyzer: Design of a lexical analyzer generator (Lex).

#### **MODULE – II [12L]**

##### **Syntax Analysis**

Role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL(1)), Bottom up parsing, Handles, Viable prefixes, Various forms of LR parsers (SLR(1), LR(0), LR(1)), Construction of LALR(1), Parser generators (YACC).

##### **Type checking**

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

##### **Run time environments**

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.

#### **MODULE – III [7L]**

##### **Syntax directed translation**

Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L -attributed definitions, Translation schemes. Top-down Translation: Elimination of left recursion. Bottom-up evaluation of inherited attributes.

##### **Intermediate code generation**

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

#### **MODULE – IV [8L]**

### **Code generations**

Issues in the design of code generator, Basic blocks and flow graphs: Transformations of basic blocks; Loops; A simple code generator, Register allocation and assignment. The DAG representation of basic blocks.

**Code optimization** Introduction, principle sources of optimization, Loop optimization, Code motion, Induction variables, Peephole optimization.

### **Text Books**

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

### **Reference Book**

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



<b>Course Name: BLOCKCHAIN TECHNOLOGY AND APPLICATIONS</b>					
<b>Course Code: CSBS3234</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS3232.1.** Understand core Blockchain concepts, the benefits, and the limitations of blockchain technologies along with key differentiators for blockchain from other technology systems.
- CSBS3232.2.** Explain how the cryptographic technologies are used to frame architecture of the Blockchain Framework.
- CSBS3232.3.** Identify the working principles of Bitcoin and Ethereum Blockchain..
- CSBS3232.4.** Understand general blockchain design concepts and consensus mechanisms that work on permissionless blockchain. CSEN1051.1
- CSBS3232.5.** Make decisions about the use (or not) of blockchain technology in systems, and support decisions with relevant arguments and determine real world challenges that blockchain technologies may assist (or explain why not) in solving.
- CSBS3232.6.** Understand Enterprise Blockchain (Hyperledger), BitCoin NG, BizCoin, Algorand, Interoperability and Security on blockchain.

#### **Module – I [8L]**

Centralized vs Decentralized system - Advantages and Disadvantages, Distributed Database, Brief idea of blockchain, Cryptocurrency, Evolution of Cryptocurrency.

Cryptography: Public Key & Private Key, Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, Information hiding, RSA, SHA 256, Hash Pointer, Markel Tree,

#### **Module – II [8L]**

Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Consensus mechanism: Introduction, Nakamoto consensus, Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET), Proof of Burn (PoB).

#### **Module – III [10L]**

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.

Ethereum basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, DAAPs

#### **Module – IV [10L]**

Permission Oriented Blockchain, Smart Contract over Closed Network, Paxos, Byzantine General Problem, BFT Consensus, PBFT, PoW vs PBFT,

Enterprise Blockchain: Hyperledger, Hyperledger Fabric, Hyperledger Indy, Hyperledger Aries

Concepts of Bitcoin NG, CoSi, ByzCoin, Algorand, Decentralization of Digital Identity, DIDs, Verifiable Credentials.

Blockchain Interoperability: Asset Transfer, Escrow, HTLC

Blockchain Security.

#### **Text Books:**

1. Lorne Lantz and Daniel Cawrey, “Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications”, Shroff/O'Reilly

**Reference Books:**

1. William Stallings, “Cryptography and Network security Principles and Practices”, Pearson/PHI
2. Wayne Walker, “Blockchain: Real-World Applications And Understanding: How Blockchain Can Be Applied In Your World”, Audiobook
3. Antony Lewis, “The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them(Cryptography, Crypto Trading, Digital Assets, NFT)”, Mango Media.

<b>Course Name: FUNDAMENTALS OF SENSORS AND TRANSDUCERS</b>					
<b>Course Code: AEIE3221</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- AEIE3221.1.** Use different methods for converting a physical parameter into an electrical quantity.
- AEIE3221.2.** Select the best fit transducers, including those for measurement of temperature, strain, motion, position and light intensity.
- AEIE3221.3.** Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like displacement, stress, force, acceleration, flow, etc.
- AEIE3221.4.** Acquire knowledge on high temperature sensing systems used in steel, aluminium, and copper plants.
- AEIE3221.5.** Learn basic principle of smart sensors.
- AEIE3221.6.** Identify different type of sensors used in real life applications and know their importance.

**Module I [10 L]**

Definition, principle of sensing & transduction, classification of transducers. Resistive Transducers: Potentiometric transducer- Construction, symbol, materials, loading effect, error calculations, sensitivity. Strain gauge- Theory, type, materials, gauge factor, temperature compensation and dummy gauge, Strain measurement circuit- quarter, half and full bridge configuration. Inductive sensor- Principle, common types, Reluctance change type, Mutual inductance change type, transformer action type. LVDT- Construction, working principle.

**Module II [6 L]**

**Capacitive sensors:** Variable distance-parallel plate type, variable area- parallel plate, variable dielectric constant type, calculation of sensitivity, Microphone, response characteristics. Piezoelectric transducers: piezoelectric effect, charge and voltage co-efficient and relationships, crystal model, materials, natural & synthetic type, charge amplifier. Ultrasonic sensors- Liquid velocity and level measurements. Magnetoresistive effect and Magnetostrictive sensors.

**Module III [12 L]**

**Thermal sensors:** Resistance Temperature Detector (RTD) - materials, temperature range, R-T characteristics, configurations, applications. Thermistors- materials, shape, R-T characteristics, ranges and accuracy specification. Thermocouple- Thermo electric laws, types, temperature ranges, series and parallel configurations, cold junction compensation, compensating cables. Thermal Radiation sensors- types, constructions and comparison. Introduction to semiconductor type temperature sensors.

**Module IV [8 L]**

**Radiation sensors:** LED, LDR, photodiodes, Photovoltaic cells, photo emissive cell types, materials, construction, response, applications. Geiger counters, Scintillation detectors. Introduction to smart sensors

**Text Books**

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI

**Reference Books:**

1. Instrument transducers, H.K.P. Neubert, Oxford University press.
2. Measurement systems: application & design, E.A.Doebelin, Mc Graw 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>
	<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:

- ECEN3222.1.** Understand microprocessors and microcontrollers – their operation and programming.
- ECEN3222.2.** Identify RISC processors from CISC processors and apply them in circuits.
- ECEN3222.3.** Analyze operations of different serial and parallel buses and interrupts.
- ECEN3222.4.** Evaluate different hardware designs and memory configurations.
- ECEN3222.5.** Write RTOS for complex processor-based designs.
- ECEN3222.6.** Design processor and controller based intelligent systems for real life problems.

### **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.

### **Text Books**

1. "The Art of Designing Embedded Systems", Jack Ganssle, (Newnes), 1999.
2. "An Embedded Software Primer", (Addison Wesley), David Simon, 2000.

**Reference Books:**

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

<b>Course Name: COMPUTATIONAL MATHEMATICS</b>					
<b>Course Code: MATH3221</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- MATH3221.1.** Identify patterns in data in the form of recurrences and using the latter to evaluate finite and infinite sums.
- MATH3221.2.** Explain combinatorial phenomena by using binomial coefficients, generating functions and special numbers.
- MATH3221.3.** Solve computational problems by applying number theoretic concepts such as primality, congruences, residues etc.
- MATH3221.4.** Analyze the properties of networks by invoking graph theoretic concepts such as connectivity, matchings, coloring etc.
- MATH3221.5.** Combine the concepts of recurrences, sums, combinatorics, arithmetic and graph theory in order to comprehend computational methods.
- MATH3221.6.** Interpret mathematically the algorithmic features of computational situations

#### **Module 1 [9L]**

**Sums:** Sums and recurrences, manipulation of sums, multiple sums, general methods, finite and infinite calculus, infinite sums.

#### **Module 2 [9L]**

**Binomial coefficients and special numbers:** Basic identities involving binomial coefficients. Bernoulli numbers, Euler numbers, harmonic numbers, Fibonacci numbers, recurrence relations for these numbers.

#### **Module 3 [9L]**

**Integer functions and arithmetic:** Floors and ceilings, the binary operation ‘mod’, divisibility, primes, relative primality, the congruence relation ‘mod’, residues, Euler phi function, Fermat’s Little Theorem, Wilson Theorem, primitive roots, the law of quadratic reciprocity, (Statement only).

#### **Module 4 [9L]**

**Generating functions:** Basic maneuvers, well-known sequences and their generating functions, using generating functions to solve recurrences, generating functions for special numbers.

#### **Textbooks**

- Concrete Mathematics, Ronald Graham, Donald Knuth, Oren Patashnik, Addison-Wesley.

#### **Reference Books**

- Elementary Number Theory, David Burton, McGraw Hill.

<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>
	<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:

- MATH3222.1.** Articulate the axioms (laws) of probability.
- MATH3222.2.** Compare and contrast different interpretations of probability theory selecting the preferred one in a specific context.
- MATH3222.3.** Formulate predictive models to tackle situations where deterministic algorithms are intractable.
- MATH3222.4.** Quantifies the amount of uncertainty involved in the value of a random variable or the outcome of a random process.
- MATH3222.5.** Apply the data processing inequality to data science, machine learning and social science.
- MATH3222.6.** Develop the concept of data compression in the process of encoding information in signal processing.

### **MODULE – I**

#### *Single and Bivariate Probability Distributions*

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

### **MODULE-II**

#### *Markov Chains and Statistical Methods*

- Markov Chains: Introduction
- Chapman-Kolmogorov equations
- Classification of states
- Some applications: Gambler's Ruin Problem
- Measures of Central tendency: Moments, skewness and Kurtosis
- Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions
- Spearman's Rank Correlation coefficient
- Curve fitting: Straight line and parabolas

### **MODULE-III**

#### *Classical Information Theory-I*

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



- Log Sum Inequality and Its Applications

## **MODULE-IV**

### ***Classical Information Theory-II***

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

### **Text 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. “Elements of Information Theory”, Thomas M. Cover and Joy A. Thomas, Wiley.

### **Reference Books:**

1. “An Introduction to Probability theory and its applications”, Vol-I, W. Feller, John Wiley and Sons.
2. “Information Theory and Reliable Communication”, Robert G. Gallager, John Wiley and Sons.

<b>Course Name: HUMAN RESOURCE MANAGEMENT</b>					
<b>Course Code: HMTS3221</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- HMTS3221.1.** Comprehend the importance of human resources and their effective management in organizations
- HMTS3221.2.** Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs
- HMTS3221.3.** Explain the organizational, societal and individual costs and benefits of training and development
- HMTS3221.4.** Understand the role of resistance and commitment in relation to change, propose change strategies for enhancing organizational development, and facilitate change implementation
- HMTS3221.5.** Understand the appropriate policies and practices involved in the performance management process
- HMTS3221.6.** Analyze core issues, policies and practices surrounding employee relations and labour laws, trade unionism, grievance handling and disciplinary measure.

**MODULE-I [6L]**

**Human Resource Management:** Meaning, Scope, objectives, and functions of HRM, HR as a Factor of Competitive Advantage, Structure of HR Department, Line and staff responsibility of HR Managers, Environmental factors influencing HRM

**Human Resource Planning:** definition, objective, process of HRP. Supply and Demand Forecasting techniques, Manpower Inventory, Career Planning & Development, Succession Planning, Human Resource Information System (HRIS)

**MODULE-II [7L]**

**Recruitment and Selection:** Process, Sources, Methods of selection, Interviewing Methods, Skills and Errors.

**Human Resource Development:** Definition, objective, process of HRD, Assessment of HRD Needs, HRD Methods, Training Process; Designing, Implementation and Evaluation of Training Programmes, Induction Training. Developing Managerial Skills for: team management, collaboration, interaction across business functions, presentation, Negotiation, and Networking.

**MODULE-III [8L]**

**Performance Appraisal Systems:** Purpose, Methods, Appraisal instruments, 360 degree Appraisal, HR Score Card, Errors in appraisal, Potential Appraisal, Appraisal Interview.

**Compensation Management:** Concepts, Components; System of Wage Payment, job evaluation, wage/ salary fixation, incentives, bonus, ESOPs, Fringe Benefits, Retirement Benefits. Compensation Plans

**MODULE-IV [9L]**

Industrial Relations in India: Parties; Management and Trade Unions, Industrial Disputes: Trends, Collective Bargaining, Settlement Mechanisms, Role of Government, Labour Policy in India.

Workers' Participation in Management: Concept, Practices and Prospects in India, Quality Circles and other Small Group Activities.

Discipline Management: Misconduct, Disciplinary action, Domestic Enquiry, Grievance Handling

**Text books**

1. Agarwala T. - Strategic Human Resource Management, OUP

**Reference Books**

1. Aswathappa, K. - Human Resource Management, Tata McGraw Hill
2. Jyothi P. & Venkatesh, D.N. - Human Resource Management, OUP
3. Ramaswamy, E.A. - Managing Human Resources, OUP
4. Saiyadain, M.S - Human Resource Management, Tata McGraw Hill
5. Mondal Sabari & Goswami Amal - Human Resource Management: Vrinda Publications

<b>Course Name: INDIAN CONSTITUTION AND CIVIL SOCIETY</b>					
<b>Paper 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>
	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Course Outcomes:**

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

- INCO3016.1.** Analyze the historical, political and philosophical context behind the Indian Constitution-making process
- INCO3016.2.** Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions.
- INCO3016.3.** Understand the contemporaneity and application of the Indian Constitution in present times
- INCO3016.4.** Critique the contexts for constitutional amendments in consonance with changing times and society.
- INCO3016.5.** Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels.
- INCO3016.6.** Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work.

**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

**Text Books**

1. Civil Society and Democracy, C.M.Elliot, (ed.), OUP, Oxford, 20012.

**Reference Books:**

1. The Idea of the Modern State, David Held et.al (ed), Open Univ. Press, Bristol, 1993
2. Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

<b>Course Name: SOFTWARE ENGINEERING LAB</b>					
<b>Paper Code: CSBS3251</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>1.5</b>

**Course Outcomes:**

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

- CSBS31511.** Prepare SRS document for sample software project as per IEEE guidelines.
- CSBS31512.** Design sample software project using Entity Relationship Diagram.
- CSBS31513.** Design sample software project using Data Flow Diagram.
- CSBS31514.** Design sample software project using various UML diagrams.
- CSBS31515.** Prepare software project schedule.
- CSBS31516.** Prepare test cases for sample software project.

**Syllabus:**

1. Preparation of SRS document for sample software project in standard format.
2. 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 project Schedule using Gantt and PERT Chart.
6. Preparation of Test Cases for sample software project (small module).

Following projects can be used as sample software projects:

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

**Text 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.

**Reference Books**

1. Software engineering-Ian sommerville, addison-wesley publishing company, England.
2. An integrated approach to software engineering-Pankaj Jalote, Narosa publishing House, New Delhi.
3. The unified modeling language User guide-Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson education, New York.

<b>Course Name: OBJECT ORIENTED PROGRAMMING LAB</b>					
<b>Paper Code: CSBS3252</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>1.5</b>

**Course Outcomes:**

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

- CSBS3152.1.** Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.
- CSBS3152.2.** Implement Object Oriented Programming Features to improve the solution designs.
- CSBS3152.3.** Apply Multithreading solutions of real life problems.
- CSBS3152.4.** Reconstruct the solution to a problem in GUI mode.
- CSBS3152.5.** Design programs in platform independent environment.

**Syllabus:**

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

**Lab1:**

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

**Lab 2:**

Use of constructor, static, final, array, date, access specifiers.

**Lab 3:**

Familiarization with String, StringBuffer, ArrayList and LinkedList classes

**Lab 4:**

Inheritance and Dynamic Method Dispatch

**Lab 5 & 6:**

Abstract Class, Interface and Package Java Exception Handling.

**Lab 7:**

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

**Lab 8:**

Exploring Java multithreading concept.

**Lab 9:**

Java Applet, AWT Event Handling

**Lab 10:**

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

**Lab 11:**

Basic JDBC connection and data handling.

**Text Books**

1. The complete reference-Java2, Patrick Naughton, Herbert Schildt, TMH
2. Object Oriented Modelling and Design, Rumbaugh, James Michael, Blaha, Prentice Hall, India.

**Reference Books:**

1. Object-Oriented System Development Ali Bahrami, McGraw Hill.
2. Core Java for Beginners, R. K Das, VIKAS PUBLISHING.
3. Java How to Program, Deitel and Deitel, 6th Ed. – Pearson.
4. Beginning Java 2 SDK, Ivor Horton's, Wrox.
5. Programming with Java: A Primer, E. Balagurusamy, 3rd Ed., TMH.

## Open Elective-I offered by CSBS Department

<b>Course Name: INTRODUCTION TO E-COMMERCE</b>					
<b>Paper Code: CSBS3221</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:

**CSBS3221.1.** Understand the basics of E-commerce system.

**CSBS3221.2.** Choose right kind of hardware and software platforms for the e-commerce system they are building.

**CSBS3221.3.** Understand EDI, B2B, B2C, C2C, m-commerce, E-Governance – the varied aspects of E-commerce.

**CSBS3221.4.** Understand the importance of security in E-commerce.

**CSBS3221.5.** Understand E-commerce marketing concepts, dimensions and technologies.

**CSBS3221.6.** Understand how different emerging technologies are reshaping E-commerce.

### **Module – I [8]**

**Electronic Commerce:** Overview, Definitions, Advantages & Disadvantages of E-Commerce, Drivers of E-Commerce, Myths, Dot Com Era, E-business.

**Technologies:** Relationship between E-Commerce e & Networking, Different Types of Networking For E-Commerce, Internet, Intranet & Extranet.

**Wireless Application Protocol:** Definition Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement for E-Commerce.

**Electronic Data Interchange (EDI):** Meaning, Benefits, Concepts, Application, EDIFACT standard, VAN, Internet EDI.

### **Module – II [10]**

**Business Models of E-Commerce:** Models based on transaction party - B2B, B2C, C2B, C2C, E-Governance. 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 [10]**

**Risk of E-Commerce:** Overview, Security for E-Commerce, Security Standards, Firewall, Cryptography, Key Management, Digital Signatures, Digital Envelope, Digital Certificates, VPN.

**E-Payment Mechanism:** Payment through card system, E-Cheque, E-Cash, E-Payment, Threats & Protections.

**E-Marketing:** Traditional Online Marketing, SEO and its role. Internet Marketing Technologies, Social Marketing, Location based marketing.

### **Module – IV [8]**

Emerging technologies-RFID, Augmented Reality, Blockchain, Internet of Things, AI and Machine Intelligence, Technologies influencing E-commerce.

### **Text Books:**



1. E-commerce Business. Technology. Society by Kenneth C. Laudon, Carol G. Traver, Pearson Education
2. Electronic Commerce 2010 A Managerial Perspective by Efraim Turban, David King, Jae Lee, Ting-Peng Liang, Deborrah Turban

**Reference Books:**

1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH

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

### Course Outcomes:

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

- CSBS4101.1. Impart different facets of controllable and uncontrollable forces to the business
- CSBS4101.2. make aware how to allocate resources to multi-unit and single unit business organisation
- CSBS4101.3. Offer different analytical techniques for analysing and forecasting business environment
- CSBS4101.4. Explain students how to implement strategy considered for any business organisation

### **Module I [8L]**

Introduction to Strategic Management: Concept of strategy using a case of failure and a case of initially failure but got success finally, The Strategic management process, Strategic Intent, Vision, Mission, Values, Goals, Objectives, Policy.

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

Analysis of External Environment: Purpose, Macro and Micro business environments, Environmental analysis and Diagnosis, Porter's model of Industry analysis. Competitive Rivalry and Dynamics: Concept and types of competition. Drivers of competitive behavior.

Analysis of Internal Environment: Challenges of analyzing the internal environment, Resources and capabilities, Value chain analysis, strategic advantage factors, Core competencies and competitive advantage, Criteria for sustainable competitive advantage. Search of a Strategic alternative: SWOT and TWOS, Space and IE matrix method and QSPM.

### **Module III [8L]**

Portfolio Strategies and Methods, Strategic alternative: Stable growth, growth, turnaround and Retrenchment. Various Business level strategy, Importance and classification of business level strategy, corporate level strategy. Global Strategy: Identifying international opportunity, Strategies for entry in abroad market, Risk in internationals environment.

### **Module IV [6L]**

Strategy implementation: Functional and Structural Implementation, Obstacles to Change. Stability vs Change. Strategy Evaluation and Control: Strategy Evaluation framework and Problem during implementation, Criteria for Strategy Evaluation, The Balanced Scorecard.

### **Text Book:**

1. Discourses on Strategic Management. D.Roy, Asian Books Pvt Ltd

### **Reference Books:**

1. Strategic Management: Concepts and Cases A. A.T hompson, A. J. Strickland, McGraw Hill

<b>Course Name: OPERATIONS MANAGEMENT</b>					
<b>Course Code: CSBS4131</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS4131.1.** Enhance the analytical skills of the students and take them better decisions.
- CSBS4131.2.** Understand the strategic importance of operations management in terms of providing competitive advantage in the workplace.
- CSBS4131.3.** Understand the relationship between operations and other business functions.
- CSBS4131.4.** Understand techniques of location and facility planning; line balancing; job scheduling in operations management.
- CSBS4131.5.** Understand the Materials Management function starting from Demand Management through Inventory Management and classification of materials in stock.

**Module I [6L]**

**Introduction to Production and Operations Management:** Difference between Manufacturing and Service Operations; Product Process Matrix capacity planning-Responsibilities of Production Manager; Production as a Coordination Function; Production Cycle, Production Planning & Control Concept.

**Characteristics of Manufacturing Systems:** Classification of Manufacturing Systems with Examples; Differences between Intermittent and Continuous Production

**Module II [8L]**

**Plant Location:** Need for a Good Plant Location; Factors influencing Plant Location–Tangible and Intangible Factors; Economic Survey of Site Selection

**Plant Layout:** Need for a Good Plant Layout; Characteristics of a Good Layout; Costs associated with Plant Layout; Process Layout vs. Product Layout; Optimization in a Process Layout and Product Layout; Designing Product and Process Layout; Assembly Line Balancing – Concept and Problems; Cellular Manufacturing Concept

**Module III [8L]**

**Purchase Management:** Purchasing Procedure; Value Analysis; Vendor Selection; Negotiation; Make or Buy decision

**Inventory Management:** Classification of inventory items – ABC, FSN, VED classification; Introduction to EOQ and EBQ; MRP – Concept, inputs and outputs, benefits, examples; Deterministic demand model–EOQ-Continuous and Periodic review Inventory models; Master Production Schedule and MRP; Concepts of MRP II, JIT and ERP

**Module IV [8L]**

**Maintenance Management:** Types of Maintenance – Breakdown and Preventive Maintenance; Total Productive Maintenance (TPM)

**Work Study:** Definition and its Importance; Basic Procedure in Performing a Work Study; Method Study – Objectives and Procedure; Work Measurement–Objectives and Procedure; Concepts of Performance Rating, Basic Time, Allowances and Standard Time

**Text Books:**

1. Chary, S.N. – Production and Operations Management; TMH

**Reference Books:**

1. Panneerselvam, R. – Production and Operations Management, PHI
2. Bedi, K. – Production and Operations Management; Oxford University PressChase,
3. Jacobs, Aquilano and Agarwal – Operations Management for Competitive Advantage; TMH
4. Buffa, E. S. and Sarin, R.K. – Modern Production / Operations Management;John Wiley
5. Collier, Evans and Ganguly – Operations Management; Cengage Learning

<b>Course Name: MARKETING MANAGEMENT</b>					
<b>Course Code: CSBS4132</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

**CSBS4131.1** Identify the scope and significance of Marketing in the actual business environment.

**CSBS4131.2** Practice marketing communication skills relevant to the corporate world.

**CSBS4131.3** Coordinate the various marketing environment variables and interpret them for designing marketing strategy for business firms

**CSBS4131.4** Illustrate market research skills for designing innovative marketing strategies for business firms.

### **Module I [6L]**

**Introduction:** Definitions of marketing; Core Concept of Marketing – need, want, demand, offering and branding, value and satisfaction, Evolution of marketing concepts (orientations); Marketing Mix – 4Ps and 4Cs

**Market Segmentation, Targeting and Positioning (STP):** Concepts of market segmentation: Various bases for segmentation: Geographic, Demographic, Psychographic (VALS-II) and Behavioural; Targeting: Mass marketing, Segment, Marketing, Niche Marketing, Micro Marketing and Customization; Concept of Differentiation and Positioning

### **Module II [4L]**

**Consumer Behaviour and Marketing Research:** A framework of consumer decision making process, overview of major factors influencing consumer behavior; marketing research: Role in decision making, Steps and process of Marketing Research, B2B Marketing.

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

**Product:** Product Classification, Service – characteristics and expanded service mix elements; Product Levels, Product Mix, Product Line Management, Product Life Cycle: concept and types and strategies across the phases, New Product Development.

**Branding and Packaging:** Purpose of branding; Brand equity; Branding strategies; Purpose of Packaging; Types of Packaging – primary, secondary, shipping packages.

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

**Pricing:** Procedure for price setting; Pricing objectives; Cost and Demand consideration; Pricing Methods, Pricing Strategies

**Promotion:** Elements of Promotion Mix (Advertising, Sales Promotion, Personal Selling, Direct Marketing, Publicity & PR), 5M model of Advertising, Concept of Digital Marketing; Overview of Selling Process

**Text Books:**

1. Ramaswamy & Namakumari - Marketing Management; McMillan
2. Kotler, P., Keller, K., Koshy, A. & Jha, M. - Marketing Management; Pearson

**Reference Books:**

1. Saxena, R. - Marketing Management; TMH
2. Kotler, P., Keller, K., Koshy, A. & Jha, M. - Marketing Management; Pearson
3. Kurtz, David L, Boone , Louis E - Principles of Marketing; Thomson
4. Keith Blois – Text Book of Marketing; Oxford University Press
5. Etzel, M.J., Walker, B.W. & W.J. Stanton - Marketing; TMH

<b>Course Name: FINANCIAL MANAGEMENT</b>					
<b>Course Code: CSBS4133</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CSBS4133.1. Understand the basic concept of financial management.
- CSBS4133.2. Apply the tools from financial management this would facilitate the decision making i.e. Capital Budgeting.
- CSBS4133.3. Develop analytical skills this would facilitate the decision making in business situations.
- CSBS4133.4. Explain and use of financial analysis techniques i.e. Fund Flow, Cash Flow.
- CSBS4133.5. Estimate working capital requirement of Business concern
- CSBS4133.6. Explain the Factors affecting the capital structure and significance of capital structure.

### **Module I [5L]**

**Introduction:** Introduction to Financial Management - Goals of the firm – Financial Environments.

**Time Value of Money:** Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

**Valuation of Securities:** Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM.

### **Module II [7L]**

**Risk & Return:** Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

**Cost of Capital:** Concept, Computation of Specific Cost of Capital for Equity, Preference-Debt, Weighted Average Cost of Capital-Factors affecting Cost of Capital

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

**Working Capital Management:** Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital

**Cash Management:** Motives for holding cash, Speeding up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring

### **Module IV [8L]**

**Capital Budgeting:** The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection- Alternative Methods

**Text Books:**

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill.

**Reference Books:**

1. Brigham - Financial Mgmt, 10th Ed, Thomson Learning
2. Srivastava, Misra: Financial Management, OUP
3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.



<b>Course Name: WEB TECHNOLOGY</b>					
<b>Course Code: CSBS4134</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CSBS4134.1** Understand the concepts of semantic web technology.
- CSBS4134.2** Apply the concept of HTML to develop a webpage.
- CSBS4134.3** Apply the concept of java script to develop a webpage.
- CSBS4134.4** Explore Node.js create component based web pages.
- CSBS4134.5** Explore Angular features and create component based web pages.
- CSBS4134.6** Design Front-end web pages and connect to the MONGODB Databases.

### **Detailed Syllabus:**

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

**Introduction:** The basics of semantic web: Traditional web to semantic web – WWW and its usage- Meta data and its creation, addition in the web page; Meta data tools - search engines for semantic web –search engine for web page markup problem and query building problem.

**HTML5:** Detecting HTML 5 features – Canvas, video, local storage, web workers, offline applications, geo-location, placeholders, and input types. What does it all mean – doc type, root, headers, articles, dates and times, navigation and footers. Let’s call it a drawing surface – Simple shapes, canvas, Paths, texts, gradients and images. The past, present and future of local storage for web applications, A Form of madness – place holders, autofocus fields, email, web addresses, numbers as spin boxes and sliders, date and color pickers, search boxes.

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

**Java script Basics:** Introduction, JavaScript syntax, Types of Data and Variables, Operations and calculations, Arrays, Decisions, Loops, Using Functions, Using Objects, The String Objects, The Math class, The Array objects, The Document Object, Using Events.

**JavaScript Advanced:** Scopes and Closures, Understand "this" and prototypes, OO concepts as applied to JS and prototypal inheritance, Understanding the meaning of asynchronous.

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

**Introduction to Server-side JS Framework. Node.js:** Introduction - What is Node.js, Architecture, Feature of Node JS, Installation and setup - Creating web servers with HTTP (Request & Response), Understand npm and package.json structure File system APIs.

## **Node.js with MONGODB**

**CRUD Operations using Node.js:** Event Handling - GET & POST implementation, Use Express.js to create a REST API. Use GET, POST. Connect to NoSQL Database using Node.js, Implementation of CRUD operations.

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

### **Introduction to Client-side JS Framework – Basics of Angular 4.0:**

Introduction to Angular 4.0, Needs & Evolution, Features-Setup and Configuration, Components and Modules– Templates, Change Detection, Directives, Data Binding, Pipes, Nested Components, Model Driven Forms or Reactive Forms.

### **Text Books:**

1. LiyangYu , “Introduction to the Semantic Web and Semantic web services” Chapman & Hall/CRC, Taylor & Francis group, 2007.
2. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, “ng-book, The Complete Book on Angular 4” September 2016
3. KrasimirTsonev, “Node.js by Example Paperback”, May 2015

### **Reference Books:**

1. Johan Hjelm, “Creating the Semantic Web with RDF “, Wiley, 2001
2. HTML 5 Up and Running, Mark Pilgrim, O“REILLY| GOOGLE Press, 2010.

<b>Course Name: DATA ANALYTICS</b>					
<b>Course Code: CSBS4135</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

**CSBS4135.1.** Illustrate the data collection, management, and storage procedures

**CSBS4135.2.** Demonstrate proficiency with exploratory data analysis of data

**CSBS4135.3.** Apply appropriate classification algorithms to classify real-world datasets.

**CSBS4135.4.** Explain various Clustering techniques to find out the different clusters of data.

**CSBS4135.5.** Experiment with the data set by reducing the dimension using PCA techniques.

**CSBS4135.6.** Produce visual representation of real-world data.

**Module I [9L]**

**Introduction:** About Data Analytics, Components of a modern Data Ecosystem, Applications of Data Analytics.

**Data Acquisition:** Gather information from different sources, Internal systems and External systems, Web APIs, Open Data Sources, Data APIs, Web Scraping, Relational Database access (queries) to process/access data,.

**Data Pre-processing and Preparation:** Data cleansing, Data editing, Data reduction, Data wrangling.

**Exploratory Data Analysis (EDA):** Structured Data, Rectangular Data, Location, Variability, Data Distribution, Binary and Categorical Data, Correlation, Multiple Variables.

**Introduction to Regression:** Input Representation, Linear Classification, Linear Regression.

**Module II [9L]**

**Classification Techniques:** Introduction, Concept of Training and Test Datasets. Decision tree, pre-pruning, post-pruning, Rule-based classification. K-nearest Neighbor, Bayes' classifier, Neural Network

**Module III [10L]**

**Clustering Techniques:** Clustering paradigm, K-means, Fuzzy C-means, Hierarchical clustering, DBSCAN.

**PCA:** Introduction to PCA, Reduce the dimensionality of the data using Principal Component Analysis

**Module IV [9L]**

**Data Visualization:** Science of Visualization, Visualization Periodic Table.

**Concepts of measurement:** scales of measurement, Design of data collection formats,

**Principles of data visualization:** different methods of presenting data, Concepts of Size, Shape, Color,

**Various Visualization types:** Bubble charts, Geo-maps (Chloropleths), Gauge charts, Tree map, Heat map, Motion charts, Force Directed Charts etc.,

**Text Books:**

1. Python for Data Analysis- Wes McKinney, O'Reilly,
2. Introducing Data Science; Davy Cielen, Arno D Meysman and Mohamed Ali; Dreamtech Press
3. Machine Learning, First Edition, T. Mitchell, McGraw-Hill, 1997

**Reference Books:**

1. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2010.
2. Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures- Claus O. Wilke, Shroff/O'reilly
3. Data Visualization: Ultimate Guide to Data Mining and Visualization- Alex Campbell, Independently published, ISBN-13: 979-8697812983
4. Data Science for Beginners: Comprehensive Guide to Most Important Basics in Data Science- Alex Campbell, Independently Published, ISBN 9798593883094

<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>
	<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:

- AEIE4122.1** Derive mathematical model of physical and simulated systems.
- AEIE4122.2** Execute block diagram reduction and signal flow graph to calculate overall system gain.
- AEIE4122.3** Investigate the time response of systems and calculate performance indices.
- AEIE4122.4** Analyze the stability of linear systems using Routh stability criterion and root locus method.
- AEIE4122.5** Explain frequency response of a process and determine stability using Bode plot.
- AEIE4122.6** Understand the concept and utility of control actions and its usages.

#### **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.

#### **Text Books:**

1. Nagrath I. J. and Gopal M., “Control System Engineering”, 5th Ed., New Age International Private Ltd. Publishers.

#### **Reference Books:**

1. Kuo B. C., “Automatic Control Systems”, 8th Ed., Wiley India
2. Ogata K., “Modern Control Engineering”, 4th Ed., Pearson Education.
3. Dorf R. C. and Bishop R. H., “Modern Control Systems”, Pearson Education.
4. Norman S. N., “Control Systems Engineering”, 4th Ed., Wiley India.
5. B.W. Bequette, “Process Control Modeling, Design and Simulation”, Prentice Hall of India, New Delhi.

<b>Course Name: INDUSTRIAL TOTAL QUALITY MANAGEMENT</b>					
<b>Course Code: CHEN4126</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CHEN4126.1** Identify and control the quality of processes and hence that of products or goods & services by applying basic statistical tools.
- CHEN4126.2** Draw various types of Control Charts and analyze to ascertain the state of the process.
- CHEN4126.3** Develop different sampling plans to evaluate the quality of various types of defects.
- CHEN4126.4** Apply the techniques of Quality Circles and Kaizen in order to enhance work culture and Total Quality status in an organization.

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

**Basic concepts:** Three paradigms of management and evolution of concept of quality management,

**Organization:** Its basic objectives and goal, Mission and Vision, customer and secondary customer, Deming's wheel, bottom line: profit vs quality, historical developments with contribution of different scientists. Basic statistical concepts associated with quality management, measurement of central tendency and dispersion, range versus variance, Random variables and expected value calculations, quality and process capability, probability distributions, concept of statistical quality control.

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

**Tools and techniques for improvement in TQM:** type A and type B techniques with a special reference to SWOT Analysis, brainstorming, stratification, Pareto Analysis, Ishikawa diagram, check sheet. Use of control charts and process engineering techniques for implementing the quality plan: X—R chart, moving average chart, p-chart and c-chart.

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

**Principles of Acceptance sampling:** Single–double and multiple sampling, AOQ, AQL, LTPD, Chain sampling plan, Dodge-Romig plan.

**Philosophy and concept of quality circle:** Formation, steering committee, power and functions of leader, dy. Leader, coordinator, facilitator, case studies.

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

Principles of Kaizen and Gemba principles. Concept of Six Sigma standards, case studies.

**Different standards:** ISO, BS and Bureau of Indian Standards, details of ISO 9000 series, ISO 14000 series and SA 8000, OSHAS 18000 and the certification authorities.

#### **Text Books:**

1. Grant, Eugene and Leavenworth, Richard, Statistical Quality Control, TMH, 7th Edition 2012.
2. Udpa, S R , Quality Circles: Progress through Participation, TMH, 1992.
3. Bedi, Kanishka, Quality Management, Oxford University Press.

**Reference Books:**

1. H. Lal Total Quality Management- A Practical Approach (1st Edition): New Age International, 1990.
2. Sundararaju, S. M., Total Quality Management – A Primer: TMH, 1995.
3. Mitra, Amitava, Fundamentals of Quality Control and Improvement, 2nd Edition.; Prentice- Hall of India, 1998.
4. Subburaj Ramasamy, Total Quality management, Mc-Graw Hill Education (India) Pvt. Ltd, 2012.

<b>Course Name: SOFTWARE DEFINED RADIO</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>
	<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:**

- ECEN4122.1** Understand the technological differences between families of radios.
- ECEN4122.2** Explain the function of reconfigurable hardware.
- ECEN4122.3** Analyze the processing techniques required for software defined radio.
- ECEN4122.4** Evaluate the effects of probability in communication reliability.
- ECEN4122.5** Analyze the synchronization requirements in SDR and SDR based networks.
- ECEN4122.6** Analyze functioning of different families of radios.

**MODULE – I [10L]**

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

**MODULE –II [12L]**

Signals and Systems in relation to SDR, Probability in Communications- the effects on reliability, Understanding SDR hardware, Timing and Carrier synchronization, Frame synchronization, Channel coding.

Receive techniques for SDR, Transmit Power, Bandwidth, Spectral Efficiency, Interference.

**MODULE –III [8L]**

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

**MODULE – IV [6L]**

SDR – some applications, future directions.

SDR-3000 series Software Defined Radio Transceiver Systems

Smart Antenna API for SDR

Networking and SDR- some case histories, Vehicular networking.

**Text Books:**

1. T.Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski, “Software Defined Radio for Engineers” Artech House



## Reference Books:

1. Cognitive Radio Techniques: Spectrum Sensing, Interference Mitigation and Localization- By
2. Sithampanathan, Kandeepan; Giorgetti, Andrea, Artech House, 2012
3. Cognitive Radio Technology- By Bates, Martin; Fettee, Bruce A, Elsevier Science & Technology
4. Software Defined Radios: From Smart(er) to Cognitive By Liesbet Van Der Perre, Michael Timmers and SofiePollin, Springer

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

<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>
	<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:

- ECEN4123.1** Find the equations for entropy, mutual information and channel capacity for all types of channels, utilizing their knowledge on the elements.
- ECEN4123.2** Analyse a discrete memory less channel, given the source and transition probabilities.
- ECEN4123.3** Demonstrate encoder and decoders for Linear Block Codes, Cyclic codes, etc.
- ECEN4123.4** Apply the concept of modern linear algebra for the error control coding technique.
- ECEN4123.5** Select decoding algorithms for efficient decoding of Block codes and Convolution codes.
- ECEN4123.6** Develop overall understanding about different types of codes applied to both source and channel end during data transmission.

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

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

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

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

### **MODULE-II [7L]**

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

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

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

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

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

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

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

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

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

**Text Books:**

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

**Reference Books:**

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

<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>
	<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:

- MATH4121.1** Describe the way of writing mathematical model for real-world optimization problems.
- MATH4121.2** Identify Linear Programming Problems and their solution techniques.
- MATH4121.3** Categorize Transportation and Assignment problems.
- MATH4121.4** Apply the way in which Game theoretic models can be useful to a variety of real-world scenarios in economics and in other areas.
- MATH4121.5** Apply various optimization methods for solving realistic engineering problems and compare their accuracy and efficiency.
- MATH4121.6** Convert practical situations into non-linear programming problems and solve unconstrained and constrained programming problems using analytical techniques.

### **Detailed Syllabus:**

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

##### **Linear Programming Problem (LPP)-I**

Formulation of an LPP; Graphical Method of solution of an LPP; Convex Combination and Convex Set; Convex Hull and Convex Polyhedron; Canonical and Standard form of an LPP; Basic Solution of a system of linear equations; Simplex Method; Big-M Method; Concept of Duality; Mathematical formulation of duals.

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

##### **Linear Programming Problem (LPP)-II and Game Theory**

Transportation Problems (TP) ; Representation of Transportation Problems as LPP; Methods of finding initial basic feasible solution of TP: North-West Corner Rule, Matrix Minima Method, Vogel's Approximation Method; Optimality test of the basic feasible solution; Assignment Problems; Hungarian Method. Strategies; The Minimax and Maximin Criterion; Existence of Saddle Point; Games without a Saddle Point; Mixed Strategies; Symmetric Games; Dominance Principle; Two-Person Zero-Sum Game; Graphical Method of Solution; Algebraic Method of Solution.

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

##### **Non-Linear Programming Problem (NLPP)-I**

Single-variable Optimization; Multivariate Optimization with no constraints: Semidefinite Case, Saddle Point; Multivariate Optimization with Equality Constraints: Method of Lagrange Multipliers; Multivariable Optimization with inequality constraints: Kuhn-Tucker Conditions.

## **MODULE – IV [10L]**

### **Non-Linear Programming Problem (NLPP)-II**

Unimodal Function; Elimination Methods: Interval Halving Method, Fibonacci Method, Golden Section Method; Interpolation Methods: Quadratic Interpolation Methods; Cubic Interpolation Method, Newton Method, Quasi-Newton Method, Secant Method.

#### **Text Books:**

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

#### **Reference Books:**

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

<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>
	<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:

- AEIE4127.1** Explain the definitions, components and requirements of the Embedded System.  
**AEIE4127.2** Acquire knowledge in the area of embedded system using AVR microcontroller.  
**AEIE4127.3** Develop the interfacing and communication techniques of the Embedded System.  
**AEIE4127.4** Learn the basic concept of RTOS.  
**AEIE4127.5** Understand the message passing technique, task synchronization techniques.  
**AEIE4127.6** Develop algorithms for real time applications of Embedded System.

### **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 I2C 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 I2C bus.

### **Text Books:**

1. Raj Kamal, "Embedded System-Architecture, Programming, Design", Mc Graw Hill
2. Elliot Williams, "AVR Programming: Learning to Write Software for Hardware", Maker Media, Incorporated

**Reference Books:**

1. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, “The AVR Microcontroller and Embedded Systems: Using Assembly and C”, Pearson
2. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”, McGraw Hill Education,
3. Silberschatz Galvin Gagne, “Operating System Concepts”, WILEY
4. Shibu K.V, “Introduction to Embedded Systems”, Tata McGraw Hill

<b>Course Name: 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>
	<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:**

- MATH4126.1** Explain concepts of diagonalization, orthogonal diagonalization and Singular Value Decomposition (SVD).
- MATH4126.2** Discuss basis, dimension and spanning sets.
- MATH4126.3** Design Gram-Schmidt Orthogonalization Process and QR decomposition using concepts of inner product spaces.
- MATH4126.4** Analyze Least squares solutions to find the closest line by understanding projections.
- MATH4126.5** Define linear transformations and change of basis.
- MATH4126.6** 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

**MODULE-I [9L]**

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

**MODULE- II [9L]**

Definition of Field, Vector Spaces, Elementary Properties in Vector Spaces, Subspaces, Linear Sum of Subspaces, Spanning Sets, Linear Dependence and Independence, Basis and Dimension. Application to matrices and system of linear equations.

**MODULE- III [9L]**

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

**MODULE- IV [9L]**

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

**Text Books:**

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



**Reference Books:**

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

<b>Course Name: BIOSENSOR</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>
	<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:

- BIOT4124.1** State types of bio-recognition elements and describe the fundamental components required to make a viable biosensor.
- BIOT4124.2** Illustrate types of enzyme immobilization methods used to make a biosensor and immobilize it to a transducer for the construction of biosensor.
- BIOT4124.3** Describe each types of biosensing element in relation to their uses in biosensors.
- BIOT4124.4** Understand the classification, construction and working principle of various transducers.
- BIOT4124.5** Understand the concepts, types, working principles and practical applications of important biosensors.
- BIOT4124.6** Explain the working principle of different types of inhibition based biosensors.

### **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.

**Text Books:**

1. Tran Minh Canh, "Biosensors", London. Chapman and Hall
2. Turner, A.P.F, Karube.I.,and Wilson, G.S, "Biosensors Fundamentals and applications", Oxford Univ. Press.

**Reference Books:**

1. Ajit Sadana..San Diego, "Engineering Biosensors, kinetics and design applications", Academic Press,
1. D.Thomas and J.M. Laval – Enzyme Technology in concepts in Biotechnology by Balasubramaniam et al, Univ. Press, 1996.

<b>Course Name: MARKETING RESEARCH</b>					
<b>Course Code: HMTS4125</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:**

- CSBS4125.1** Understand the fundamental principles , concepts and measurement tools essentials for planning, conducting & evaluating market research
- CSBS4125.2** Design a market research plan in a logical and systematic manner
- CSBS4125.3** Learn the difference between qualitative and quantitative techniques of research.
- CSBS4125.4** Operationalise concepts for the purpose of developing testable propositions.
- CSBS4125.5** Conduct exploratory research and can utilize secondary information to formulate proper research question

**Module I [10L]**

**Marketing Research:** Introduction, Application of research in managerial decision making, Aims, roles, functions and sources of research, Client-user interface – role conflict and resolution

**Research Process:** Steps in planning – research purpose and objectives, Converting a manager’s problem to a researcher’s problem, Problem formulation, research design, data collection, analysis, report presentation, Preparation of the research proposal

**Module II [8L]**

**Research Design:** Types of research-exploratory studies, descriptive studies, causal studies, Types of information needed - behavioural and non-behavioural correlates

**Sources of Data:** Primary and secondary source (govt., non-govt. and syndicated research), Errors in data collection

**Module III [4L]**

**Primary Source – Methods of Data Collection:** Focus groups, Observations, Case histories; Surveys – survey methods - structured and unstructured, direct and indirect methods, indepth interviews, panels, interview media: personal, telephone, internet and mail, questionnaire construction and pre-testing, qualitative and quantitative research.

**Measurement and Scaling:** Types of scales (data/levels of measurements), nominal, ordinal, interval, ratio scales, Attitude measurement methods - variability methods (paired comparison, ranking, rating, ordered category sorting), Quantitative judgment methods

**Module IV [8L]**

**Sampling:** Census vs. sample, Steps in sampling process, Definition of population, frame, unit and element, Types of sampling: Probabilistic and non-probabilistic sampling techniques Determination of sample size

**Analysis of Data:** Classification of data, Analytical techniques – Brief introduction of univariate analysis, and multivariate analysis techniques and brief overview of multiple regression, discriminant analysis, factor analysis, cluster analysis, multi - dimensional scaling and conjoint analysis, Hypothesis Testing.

**Text Books:**

1. Marketing Research: D.R. Cooper and P.S. Schindler; TMH
2. Research for Marketing Decisions: P. Green and D. Tull and G. Albaum; PHI

**Reference Books:**

1. Marketing Research: Text and Cases; Boyd and Westfall; AIT Bookseller
2. Marketing Research: Luck and Rubin; PHI
3. Marketing Research: D.R. Cooper and P.S. Schindler; TMH
4. Marketing Research: Naresh K Malhotra; Pearson
5. Marketing Research: G C Beri; Tata McGraw Hill
6. Marketing Research: C. R. Kothari; New Age International











## Open Elective-IV offered by CSBS Department

<b>Course Name: SOFT COMPUTING FUNDAMENTALS</b>					
<b>Course Code: CSBS4121</b>					
<b>Contact Hours per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit points</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:

- CSBS4121.1.** Describe about soft computing concepts, technologies and their role in problem solving.
- CSBS4121.2.** Analyze the genetic algorithms and their applications to solve optimization problems.
- CSBS4121.3.** Demonstrate different neural network architectures, algorithms, applications and their limitations.
- CSBS4121.4.** Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
- CSBS4121.5.** Identify the need for approximation analysis and rough set theory in developing applications.
- CSBS4121.6.** Inspect various soft computing techniques in order to solve Multi-Objective Optimization Problem (MOOP).

### **Module I [7L]**

#### *Introduction*

Introduction to soft computing, Different tools and techniques, Usefulness and applications.

#### *Genetic algorithm (GA)*

Basic concepts, Working principle, Encoding, Fitness function, Genetic modeling: Inheritance, Selection, Cross over, Mutation, Bitwise operator, Convergence of GA,

### **Module II [8L]**

#### *Neural Network*

Structure and function of biological neuron, Artificial neuron, Definition of Artificial Neural Network (ANN), Taxonomy of neural net, 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, Applications of neural networks.

### **Module III [9L]**

#### *Fuzzy sets and Fuzzy logic systems*

Overview of classical set theory, Fuzzy sets and Fuzzy relations, Fuzzy set operations, Properties of Fuzzy sets, Cardinality, Properties of Fuzzy relations.

#### *Membership functions*

Features of membership functions, Standard forms and boundaries, Standard Fuzzification methods.

#### *Fuzzy to Crisp conversions*

Lambda cuts for Fuzzy sets, Fuzzy relations, Overview of classical predicate logic, Fuzzy logic, Approximate reasoning and Fuzzy implication, Defuzzification methods.

Overview of fuzzy rule based systems.

## **Module IV [8L]**

### ***Rough Set***

Introduction to Rough sets, Decision table, Indiscernibility relations and set approximation, Reducts & Core, Rough approximation, Decision matrix, and Application of Rough set.

***Multi-Objective Optimization Problem (MOOP):*** Introduction to MOOP, Mathematical formulation, Examples, Decision space and Objective space, Single Objective vs Multi-Objective, Ideal solution vs Real solution, Concept of Domination – Non-dominated set, Pareto optimal set, Pareto optimal front.

Introduction to Multi-Objective Genetic Algorithm (MOGA).

***Overview of Evolutionary Algorithm-*** Ant colony optimization (ACO), Particleswarm optimization (PSO)

### **Text Books:**

1. Principles of Soft Computing -S. N. Sivanandam, S. N. Deepa, Wiley India Pvt. Ltd.,
2. Neural Networks, Fuzzy Logic and Genetic Algorithms - S.Rajasekaran and G.A.V.Pai, PHI.
3. Introduction to soft Computing, Neuro-Fuzzy and Genetic Algorithms- Samir Roy, Udit Chakraborty, Pearson

### **Reference Books:**

1. Soft Computing and Its Applications, Volume One: A Unified Engineering Concept, Volume 1 –Kumar S. Ray, CRC Press.
2. Fuzzy logic with Engineering Applications - Timothy J. Ross, John Wiley and Sons.
3. Genetic Algorithms in search, Optimization & Machine Learning - David E. Goldberg, Pearson India.
4. Artificial Neural Networks - B. Yegnanarayana, PHI.
5. Soft computing - Dilip K. Pratihar, Alpha Science International.

### Professional Elective-IV

<b>Course Name: Consumer Behavior</b>					
<b>Course Code: CSBS4231</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:

- CSBS4231.1** Understand consumer behavior in an informed and systematic way.
- CSBS4231.2** Analyze consumer behavior and its impact on buying patterns.
- CSBS4231.3** Analyze personal, socio-cultural, and environmental dimensions that influence consumer decisions making.
- CSBS4231.4** Explain consumer's perception in determining brand preferences.
- CSBS4231.5** Compile the components and stages of the individual decision-making process.
- CSBS4231.6** Designing and evaluating the marketing strategies based on fundamentals of consumer buying behavior.

#### **Module I [8L]**

**Introduction to Consumer Behavior and Consumer Research:** Consumer Behavior – Definition, Consumer and Customers, Buyers and Users, Organizations as Buyers, Development of Marketing Concept, Consumer Behavior and its Applications in Marketing; Consumer Research Process; Consumer Behavior Models – Black Box & Nicosia Models.

**Marketing Segmentation and Positioning:** Requirements for Effective Segmentation, Bases for Segmentation, Determining How Many Segments to Enter; Product Positioning - Positioning Strategy, Positioning Approaches.

#### **Module II [7L]**

**Consumer Motivation:** Needs and Goals, Motivational Conflict, Motive Arousal, Motivational Theories - Maslow's Hierarchy of Needs, Motivation Research.

**Consumer Personality and Perception:** Self-Concept, Personality Theories, Brand Personality, Emotions, Sensation (Exposure to Stimuli); Perceptual Selection, Perceptual Organization, Factors that Distort Individual Perception.

### **Module III [7L]**

**Consumer Learning, Memory and Involvement:** Components of Learning, Behavioral Theory, Cognitive Learning Theory; Concept of Involvement, Dimensions of Involvement.

**Consumer Attitudes:** Functions of Attitude, Attitude Models, Relationship between Beliefs, Feelings and Behavior, Learning Attitudes, Changing Attitudes, Attitude Change Strategies.

### **Module IV [8L]**

**Social Class and Group Influences on Consumer Behavior:** Nature of Social Class, Social Class Categories; Source of Group Influences, Reference Groups, Family Life Cycle Stages, Word-of-Mouth Communications within Groups, Opinion Leadership.

**Consumer Decision-making Process:** Problem Recognition, Information Search, Evaluation of Alternatives, Outlet Selection, Purchase and Post Purchase Behavior.

#### **Text Books:**

1. Leon G. Schiffman & Leslie Lazar Kanuk - Consumer Behavior; Pearson
2. Loudon & Bitta - Consumer Behavior; McGraw Hill International

#### **Reference Books:**

1. Glenn Walters & Blaise J. Bergiel - Consumer Behavior: A Decision-making Approach; South-Western Publishing Company
2. Mothersbaugh, Hawkins & Kleiser - Consumer Behavior: Implications for Marketing Strategy; McGraw Hill
3. Michael R. Solomon - Consumer Behavior: Buying Having and Being; Pearson

<b>Course Name: Digital Marketing</b>					
<b>Course Code: CSBS4232</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:**

**CSBS4232.1** Describe digital business and innovation and the elements of its infrastructure and to apply contemporary business.

**CSBS4232.2** Knowledge to create a strategic plan to manage the digital marketing.

**CSBS4232.3** Differentiate between traditional and digital marketing.

**CSBS4232.4** Understand the strength, weakness, opportunities and threat of digital marketing.

**CSBS4232.5** Explore various tools for digital marketing.

**CSBS4232.6** Comprehend the importance of conversion and working with digital relationship marketing.

**Module I [8L]**

**Introduction to Digital Marketing:** Definition, 4Ps of Web Marketing, Need for Digital Marketing, Foundations of an Effective Digital Marketing Strategy, Differences between Traditional and Digital Marketing, Digital Marketing Process.

**Module II [8L]**

**Tools Used in Digital Marketing:** Concept of - SEO Enabled Tool, SEM Activities, Content Marketing, Remarketing, Email Marketing, Social Media Marketing, Influencer Marketing, Video Marketing, Enhancing Responsiveness in Web Designs.

**Module III [7L]**

**Aligning Internet with Business Objectives:** Internet Marketing and Digital Marketing Mix, Internet Marketing - Opportunities and Challenges; Digital Marketing Framework; Impact of Digital Channels on IMC.

**Module IV [7L]**

**Digital Marketing Strategy:** Product Opportunity Evaluation Matrix (POEM) Framework, Digital Landscape, SWOT Analysis, Target Group Analysis.

**Digital Marketing Model and CRM:** Digital Marketing Models; Introduction to CRM, CRM Platform and CRM Models.

**Text Books:**

1. Damian Ryan - Understanding Digital Marketing; Kogan Page Ltd.
2. Puneet Singh Bhatia - Fundamentals of Digital Marketing; Pearson

**Reference Books:**

1. Rajendra Nargudkar&RomiSainy- Digital Marketing cases from India; Notion Press
2. Tracy L Tuten& Michel R Solomon - Social Media Marketing; SAGE
3. Ward Hanson &KirthiKalyanan – Internet Marketing & e-Commerce; Cengage Learning

<b>Course Name: Advanced Business Research</b>					
<b>Course Code: CSBS4233</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:**

**CSBS4233.1** Identify a business research opportunity.

**CSBS4233.2** Synthesize a range of literature on a business problem.

**CSBS4233.3** Reflect on research processes within a specific context.

**CSBS4233.4** Develop argumentation for the hypotheses.

**CSBS4233.5** Apply appropriate research methods, and plan and design a research project.

**CSBS4233.6** Justify the techniques associated with qualitative and quantitative business research methodologies.

**Module I [5L]**

**Introduction to research:** Meaning, Objectives, Characteristics, Significance, Types and steps of Research.

**Defining the Research Problem:** Definition, Selection of Research Problem, Necessity and Techniques.

**Module II [10L]**

**Research Design:** Meaning, Need, Features, Types, Concepts and Principles of Research Design.

**Sampling Design:** Implications, Steps, Criteria, Characteristics and Types of Sampling Design.

**Scaling Techniques:** Measurement Scales, Sources of Error, Test of Sound Measurement, Scaling – Meaning, Classification, Scale Construction Techniques.

**Methods of Data Collection:** Collection of Primary and Secondary Data, Selection of Appropriate Method for Data Collection.



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

**Processing and Analysis of Data:** Statistics in Research, Simple Regression Analysis, Multiple Correlation and Regression

**Testing of Hypotheses:** Concept, Procedure, Power of the Test, Parametric and Non-Parametric Tests.

### **Module IV [5L]**

**Interpretation and Report Writing:** Techniques of Interpretations; Layout, Steps and Types of Reports.

**Statistical Software in Business Research:** SPSS

#### **Text Books:**

1. Cooper & Schindler – Business Research Methods; McGraw Hill
2. C.R. Kothari – Research Methodology: Methods and Techniques; New Age International

#### **Reference Books:**

1. R.S. Dwivedi – Research Methods in Behavioral Sciences; McMillan India Ltd.
2. Uma Sekaran & Roger Bougie – Research Methods for Business; Wiley

<b>Subject Name: Introduction to Cognitive Science</b>					
<b>Paper Code: CSBS4241</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

- CSBS4241.1.** Relate the contribution of disciplines such as philosophy, psychology, neuroscience and artificial intelligence to cognitive science.
- CSBS4241.2.** Choose an adequate method of cognitive science, in accordance with the research task.
- CSBS4241.3.** Understand the essence of the main methodological problems of cognitive science
- CSBS4241.4.** Use knowledge and methods of cognitive science in applied research
- CSBS4241.5.** Understand the variety of methodologies used to explore cognitive science, including the capabilities and limitations
- CSBS4241.6.** Understand the relationship between cognitive science and computing, including human-centered computing, robotics, design, and educational technology.

**MODULE-I [10L]**

Philosophical Approach: Philosophical assumption of Cognitive Science, Mind-Body Problem, Mystery of Consciousness, understanding attention through philosophical approach.

Cognitive Approach: Mind as information processing, modular approach, understanding attention thought and cognitive approach.

Neuropsychology Approach: Mind as Neuropsychological Matter, methodological approach in Neuroscience, understanding attention through neuroscience approach.

Connectomes Approach: Mind as a Connectomes, methodological approach in connectomes, understanding attention through connectome approach.

**MODULE-II [8L]**

Perception and Attention: Bottom-up and Top-down processing, Recognition of letters and objects, Heuristics for perceiving perception and attention, early, intermediate and late selection model.

Behavioural Contrast, Errorless discrimination learning, social media framework, game development, virtual reality and augmented reality framework.

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

Brain Imaging: Computed Axial Tomography (CAT), Diffused Optical Tomography (DOT), Event Related Optical Signal (EROS), Magnetic Resonance Imaging (MRI), Functional MRI, Methodological Considerations for using Bold fMRI in the clinical neuroscience, Application of functional Neuro-imaging to examination of Nicotine Dependence, The relationship between mood, stress and tobacco smoking.

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

Statistical Model: Measure of association, frequency of categorical data, Goodness-of-Fit Test, Post-hoc Test, Repeated-measure ANOVA, Linear and Multiple regression analysis.

### **Text books**

1. Wilson, Robert A., & Keil, Frank C. (eds.), The MIT Encyclopedia of the Cognitive Sciences (MITECS), MIT Press
2. Vans, Vyvyan and Melanie Green; Cognitive linguistics: an introduction, Routledge
3. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, SAGE Publication.
4. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, Cambridge University Press

<b>Subject Name: Cyber Security</b>					
<b>Paper Code: CSBS4242</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

- CSBS4242.1.** Define the concept of Cybercrime and Cybercriminals.
- CSBS4242.2.** Discuss the different tools for Active attack and Passive attack.
- CSBS4242.3.** Compare the attacks on mobile/Cell phones.
- CSBS4242.4.** Explain types of Virus and Worms, Trojan Horse and Backdoor.
- CSBS4242.5.** Explain Denial of Service (DOS) attacks, DDOS attack and SQL injection.
- CSBS4242.6.** Explain Phishing and Identity theft and Digital Forensic Analysis.

**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, Key loggers and Spywares, Types of Virus, Types of Worms, Trojan Horses 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, Geo-tagging, 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>Subject Name: Business Analytics</b>					
<b>Paper Code: CSBS4243</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

**CSBS 4243.1.** Understand the emergence of Business Analytics as a competitive strategy

**CSBS 4243.2.** Learn Data Visualization and storytelling through data

**CSBS 4243.3.** Learn Descriptive Analytics techniques and tools

**CSBS4243.4.** Learn Predictive Analytics techniques and tools

**CSBS4243.5.** Learn Prescriptive Analytics techniques and tools

**CSBS4243.6.** Analyse and solve problems from different industries such as manufacturing, service, retail, banking and finance etc.

**Module 1 [8 L]**

What is Business Analytics, Impacts and Challenges, Evolution of Business Analytics, Modern Business Analytics , Software Support and Spreadsheet Technology, Analytics in Practice: Social Media Analytics, Analytics in the Home Lending and Mortgage Industry; Models in Business Analytics, Problem Solving with Analytics;

Descriptive Analytics- Data Visualization, Tools and Software for Data Visualization, Excel Data Visualization Tools, Descriptive Statistics, Metrics and Data Classification, Frequency Distributions and Histograms, Percentiles and Quartiles, Descriptive Statistical Measures, Computing Descriptive Statistics for Frequency Distributions , Measures of Association, Outliers, Statistical Thinking in Business Decisions

**Module II [10 L]**

Probability Distributions and Data Modeling - Basic Concepts of Probability, Random Variables and Probability Distributions , Discrete Probability Distributions, Continuous Probability Distributions, Data Modeling and Distribution Fitting.

Sampling and Estimation - Statistical Sampling, Estimating Population Parameters, Sampling Distributions, Interval Estimates, Using Confidence Intervals for Decision Making, Prediction Intervals; Statistical Inference - Hypothesis Testing, One-Sample Hypothesis Tests, Two-Sample Hypothesis Tests, ANOVA, Chi-Square Test for Independence.

### **Module III [12 L]**

Predictive Analytics -Trendlines and Regression Analysis - Modeling Relationships and Trends in Data, Simple Linear Regression, Multiple Linear Regression, Building Good Regression Models; Forecasting Techniques - Qualitative and Judgmental Forecasting, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality;

Spreadsheet Modeling and Analysis- Model-Building Strategies, Implementing Models on Spreadsheets, Descriptive Spreadsheet Models, Predictive Spreadsheet Models, Prescriptive Spreadsheet Models, Analyzing Uncertainty and Model Assumptions; Simulation and Risk Analysis- Monte Carlo Simulation, Random Sampling from Probability Distributions, Generating Random Variates using Excel Functions, Monte Carlo Simulation in Excel, Dynamic Systems Simulation.

### **Module IV [8 L]**

Prescriptive Analytics- Linear Optimization, Developing Linear Optimization Models, Solving Linear Optimization Models, Solver Outcomes and Solution Messages, Applications of Linear Optimization; Integer and Nonlinear Optimization- Integer Linear Optimization Models, Models with Binary Variables, Nonlinear Optimization Models,

Optimization Analytics- What-If Analysis for Optimization Models And Integer Optimization Models, Decision Analysis, Decision Strategies without Outcome Probabilities And with Outcome Probabilities, Decision Trees, Sensitivity Analysis in Decision Tree

#### **Text Book:**

1. *Business Analytics: Methods, Models, and Decisions* By James R. Evans, 3rd Edition, Pearson

#### **Reference Books:**

1. *Business Analytics: The Science of Data - Driven Decision Making* By U. Dinesh Kumar, 2nd Edition, Wiley

2. *Business Analytics: Data Analysis And Decision Making* by Wayne Winston and S. Albright, 6th Edition, Cengage Learning

<b>Subject Name: Natural Language Processing</b>					
<b>Paper Code: CSBS4244</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

- CSBS4244.1.** Learn various models, methods, and algorithms of Natural Language Processing (NLP) to build an automation tool to solve like, speech recognition, machine translation, spam filtering, text classification, spell checking etc.
- CSBS4244.2.** Understand and estimate the parameters of the probabilistic models.
- CSBS4244.3.** Identify problems solvable in language automation environments and also identify certain tasks that are challenging to carry out with traditionally existing statistical models.
- CSBS4244.4.** Compare various part of speech tagging algorithms.
- CSBS4244.5.** Understand the linguistic phenomena and will explore the linguistic features relevant to each NLP task.
- CSBS4244.6.** Identify the opportunities for research await and prepare to conduct research in NLP or related fields

**Detailed Syllabus:**

**MODULE-I [8L]**

**Introduction to NLP:** Natural language processing issues and strategies. Tools of NLP, Linguistic organization of NLP, NLP as an Application domain.

**Word Classes:** Regular Expressions: Chomsky hierarchy, CFG and different parsing techniques. Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules. Probabilistic Language modeling and it's Applications.

**MODULE-II [11L]**

**Language Modeling and Naïve Bayes:** Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition, Markov models

**Part of Speech Tagging and Hidden Markov Models:** Part of Speech tagging, Indian Language on focus Morphology Analysis, Accuracy Measure and Probability, HMM, Viterbi algorithm for finding most likely HMM Path. HMM tagging, transformation-based tagging.

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

**Semantics:** Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language. Semantic Analysis: NLP and IR, How NLP has used IR Towards Latent Semantic.

**Lexical Semantics:** Lexemes (synonymy, hyponymy etc), WordNet, metonymy and their computational approaches Supervised and Unsupervised methods.

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

**Pragmatics:** Information Theory: Entropy, Cross-entropy, information gain. Reference resolution and phenomena, syntactic and semantic constraints. Pronoun resolution algorithm, text coherence, and discourse structure. Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations). Resource Constrained WSD, Parsing Algorithms, Parsing Ambiguous Sentences, Probabilistic Parsing Algorithms.

#### **Textbooks**

1. D. Jurafsky., J. H. Martin., Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, Pearson Education.

#### **Reference Books**

1. Allen, James, Natural Language Understanding, Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal., Natural Language Processing- “A Pananian Perspective”, Prentice Hall India, Eastern Economy Edition.
3. Eugene Cherniak, Statistical Language Learning, MIT Press, 1993.
4. Manning, Christopher and Heinrich Schutze., Foundations of Statistical Natural Language Processing, MIT Press.
5. Cognitively Inspired Natural Language Processing, Abhijit Mishra, Pushpak Bhattacharyya, Springer.



<b>Subject Name: Distributed Database</b>					
<b>Paper Code: CSBS4245</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

### Course Outcome:

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

- CSBS4245.1. Understand the need of distributed database and various architectures of DDBMS.
- CSBS4245.2. Apply various distribution fragmentation techniques given a problem.
- CSBS4245.3. Analyze and apply query optimization algorithms.
- CSBS4245.4. Apply the different distributed transaction protocols and recovery techniques.
- CSBS4245.5. Compare various approaches to concurrency control in Centralized and Distributed database.
- CSBS4245.6. Design a normalized centralized database and can convert into distributed database with respect to a given Problem

### Detailed Syllabus:

#### MODULE-I [8L]

##### **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

##### **Distributed DBMS Architecture**

Models- Autonomy, Distribution, Heterogeneity. DDBMS Architecture – Client/Server, Peer to peer, MDBS. Heterogeneous Databases-Federated database, Reference architecture, loosely and tightly coupled.

#### MODULE-II [12L]

##### **Principles of Distributed Databases:**

**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, Applications.

**Design Alternatives** – localized data, distributed data

**Data Fragmentation:** Rules of Fragmentation, Types of Data Fragmentation: Horizontal Fragmentation, Vertical Fragmentation, Derived Horizontal Fragmentation, Mixed Fragmentation. Correctness rules.

**Design of Distributed Database:** A Framework for Distributed Database Design. Design of Database Fragmentation. Allocation of Fragments.

**Impact of distribution on user queries** – No Global Data Dictionary(GDD), GDD containing location information, Example on fragmentation

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

#### **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 [8L]**

#### **Distributed Transactions and Recovery 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

#### **Text Books:**

1. Stefano Ceri and Giuseppe Pelagatti, —Distributed Databases – Principles and Systems, 1st Edition, Tata McGraw-Hill, Edition, 2008
2. M Tamer Ozsu and Patrick Valduriez, —Principles of Distributed Database Systems, 2nd Edition, Pearson Education

**Reference Books:**

1. Distributed Databases, Sachin Deshpande, Dreamtech
2. Distributed Database Mangement Systems, Rahimi&Haug, Wiley
3. Distributed Database Systems, Chanda Ray, Pearson Publication
4. Silberschatz, Korth and Sudarshan: Database System Concepts, TMH
5. Ramakrishnan and Gehrke: Database Management Systems, TMH
6. Elmasri and Navathe: Fundamentals of Database Systems, Pearson.

<b>Subject Name: Process Instrumentation</b>					
<b>Paper Code: AEIE4221</b>					
<b>Contact Hours per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

- AEIE4221.1.** Acquire knowledge about the characteristics of different process instruments.
- AEIE4221.2.** Explain the working principle and functions of displacement, strain, pressure, temperature, flow and level measuring instruments.
- AEIE4221.3.** Formulate the mathematical equation of the linear processes and derive their response.
- AEIE4221.4.** Apply their knowledge of controllers and final control element in various control schemes for effective process control.
- AEIE4221.5.** Gain knowledge of industrial signal transmission and transmitters.
- AEIE4221.6.** Choose proper automation system for specific application.

**Module – I [9L]**

Introduction to process and instrumentation, static and dynamic characteristics of instruments, active and passive transducers; measurement methods and applications: displacement, strain, pressure, temperature, flow and level measurement.

**Module – II [9L]**

Introduction to process control, open and closed loop process, mathematical model and transfer function, dynamic behavior of first and second order processes; feedback controllers: on-off controllers, basic control modes, PID controllers.

**Module – III [9L]**

Control system instrumentation: transducers and transmitters, two wire and four wire transmitters, smart transmitters, final control elements; feed forward, ratio and cascade control; basic concept of stability.

**Module – IV [9L]**

Introduction to process automation, brief idea and application of PLC, DCS and SCADA; case study: boiler drum level control/ distillation column control.

**References:**

- 1.** B. G. Liptak, Instrumentation Engineers Handbook ( Measurement), Chilton Book Co.; 1994

2. John P. Bentley, Principles of Measurement Systems, Third edition, Addison Wesley Longman Ltd., UK, 2000.
3. E.O. Doebelin, Measurement Systems - Application and Design, Fourth edition, McGrawHill International Edition, New York, 1992.
4. U. A. Bakshi, A.V.Bakshi; Instrumentation Engineering; Technical Publications; 2009.
5. Harold E. Soisson; Instrumentation in Industry; John Wiley & Sons Canada, Limited, 1975.
6. B.E. Noltingk, Instrumentation Reference Book, 2nd Edition, Butterworth Heinemann, 1995.
7. L.D. Goettsche, Maintenance of Instruments and Systems – Practical guides for measurements and control, ISA, 1995.

<b>Subject Name: Non-conventional Energy</b>					
<b>Paper 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>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Outcome:**

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

- BIOT4222.1.** Understand the concept and necessity of non-conventional energy as an alternative source of energy.
- BIOT4222.2.** Comprehend and apply the concepts of solar energy to design Photovoltaic cells and wind energy to design wind turbine.
- BIOT4222.3.** Classify and design different biogas production processes.
- BIOT4222.4.** Design a production process for biodiesel.
- BIOT4222.5.** Understand the concept of hydrogen energy as a clean fuel and characterize the hydrogen production process.
- BIOT4222.6.** Comprehend the importance and classification of hydrogen fuel cells.

**Module – I [9L]**

**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 [9L]**

**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 [9L]**

**Bio-diesel**

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 – III [8L]**

### **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.

### **Text/Reference Books:**

1. J.E. Smith, Biotechnology, 3rd ed. Cambridge University Press.
2. S. Sarkar, Fuels and combustion, 2nd ed., University Press.
3. Donald L. Klass, Biomass for renewable energy, fuels and chemicals, Academic Press.

<b>Course Name: Advanced Finance</b>					
<b>Course Code: HMTS4226</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:**

**HMTS4226.1** Critically evaluate the impact of financial decisions on the strategic direction of the Organization.

**HMTS4226.2** Identify and evaluate the exposure of a company to financial risk and the techniques required to manage this risk.

**HMTS4226.3** Explain alternative sources of finance and investment opportunities and their suitability in particular circumstances.

**HMTS4226.4** Evaluate complex investment appraisal situations and appreciate the importance of the cost of capital to the organization and how the capital structure chosen will impact upon this.

**HMTS4226.5** Analyze the key strategic financial issues that must be considered in an acquisition or merger, including valuation of the target company.

**HMTS4226.6** Analyze a company's performance and make appropriate recommendations.

**Module I [8L]**

**Introduction:** Financial Decisions in a Firm, Goals of Financial Management, Fundamental Principles of Finance, Risk – Return Tradeoff, Forms of Business Organization, Agency Problem, Emerging Role of the Financial Manager in India.

**Analysis of Financial Statements:** Financial Ratios and Du Pont Analysis.

**Module II [8L]**

**Capital Budgeting:** Techniques – NPV, Profitability Index, IRR, MIRR, Payback Period, ARR.

**Cost of Capital:** Cost of Debt, Preference and Equity, WACC

**Module III [8L]**

**Long Term Financing:** Sources of Long-Term Finance

**Capital Structure:** Capital Structure and Firm Value – Assumptions, Net Income Approach, Net Operating Income Approach, Traditional Position, Modigliani & Miller Position, Leverage Analysis.



**Module IV [6L]**

**Dividend Policy:** Walter Model, Gordon Model and MM Position

**Working Capital Management:** Factors influencing Working Capital Requirements, Operating Cycle and Cash Cycle, Cash and Liquidity Management.

**Text Books:**

1. Prasanna Chandra - Financial Management - Theory & Practice; Tata McGraw Hill

**Reference Books:**

1. Khan M.Y. and Jain P.K. - Financial Management: Text and Problems: Tata McGraw Hill
2. Srivastava and Misra - Financial Management; Oxford University Press

<b>Course Name: Organizational Behavior</b>					
<b>Course Code: HMTS4225</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:**

**HMTS4225.1** Understand the basic concepts of Organizational Behavior and its applications in contemporary organizations.

**HMTS4225.2** Understand how individual, groups and structure have impacts on the organizational effectiveness and efficiency.

**HMTS4225.3** Appreciate the theories and models of organizations in the workplace.

**HMTS4225.4** Creatively and innovatively engage in solving organizational challenges.

**HMTS4225.5** Appreciate different cultures and diversity in the workplace.

**HMTS4225.6** Effectively manage and cope with changes, stress and power politics at workplace

**Module I [8L]**

**Introduction:** Meaning, Definition, Characteristics and Importance of OB, Disciplines that contribute to OB, Levels and Models of OB, Challenges and Opportunities for OB.

**Learning and Attitude:** Nature and Theories of Learning, Conditioning, Shaping and Reinforcement; Components, Characteristics, Sources and Formation of Attitude, Types of Work-related Attitude – Job Satisfaction, Job Involvement and Organizational Commitment.

**Personality:** Definition, Characteristics and Factors of Personality, Theories of Personality - Myers-Briggs Type Indicator (MBTI) and Big Five Model, Other Personality Traits - Authoritarianism, Locus of Control, Machiavellianism, Type A & B, Self-Monitoring, Achievement Orientation, Risk Taking, Self-Esteem.

**Module II [8L]**

**Motivation:** Definition, Nature and Theories of Motivation - Hierarchy of Needs, Alderfer's ERG Theory, McGregor's Theory X and Theory Y, Herzberg's Two Factor Theory, McClelland's Theory of Needs, Victor Vroom's Expectancy Theory, Goal setting Theory, Self-

efficacy, Equity Theory, Job Characteristics Model, Redesigning Job, Practical Application of Motivational Techniques.

**Perception and Decision Making:** Factors that influence Perception, Attribution Theory, Common Shortcuts in Judging; Decision Making – Rational Model, Bounded Rationality and Intuition, Biases and Errors in Decision Making.

### **Module III [8L]**

**Emotions:** Emotions and Moods - Functions and Sources, Emotional Labor and Emotional Intelligence.

**Group Behavior:** Five Stage Model of Group Development, Group Properties, Groupthink and Groupshift; Group Decision-making, Difference between Groups and Teams, Types of teams.

**Leadership:** Trait Theories, Behavioral Theories (Ohio and Michigan Studies), Managerial Grid, Contingency Theories (Fiedler and Others), LMX Theory, Charismatic and Transformational Leadership.

### **Module IV [6L]**

**Organizational Culture and Structure:** Concept of Culture, Creating and Sustaining Culture; Organizational Structure – Types, Specialization, Departmentalization, Chain of Command, Span of Control, Centralization and Decentralization, Formalization.

**Organizational Change, Stress, Conflict and Power:** Forces of change, Planned Change, Resistance, Lewin's Model of Change, Organizational Development; Work Stress and its Management; Conflict - Traditional and Interactionists View, Conflict Process, Negotiation; Introduction to Power and Politics.

#### **Text Books:**

1. Robbins & Judge – Organizational Behavior; Pearson
2. Luthans - Organizational Behavior; McGraw Hill

#### **Reference Books:**

1. Amy C. Edmondson – The Fearless Organization, Wiley
2. Bolman & Deal – Reframing Organizations, Jossey-Bass (Wiley)

### Open Elective-IV offered by CSBS Department

<b>Course Name: Introduction to Industrial Sociology</b>					
<b>Course Code: CSBS4281</b>					
<b>Contact Hours Per Week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:

- CSBS4281.1 Critically understand the impact of industrial institutions on society
- CSBS4281.2 Implement the sociological theories in the industry context
- CSBS4281.3 Grasp the idea of trade union movement and class conflict in India
- CSBS4281.4 Understand the concepts of industrial relations
- CSBS4281.5 Apply the knowledge of labor laws and labor welfare in the relevant field
- CSBS4281.6 Effectively solve industrial disputes through prescribed tools

#### **Module I [6L]**

**Introduction:** Industrial Sociology - Concept, Scope and Significance; The Rise of Industrial Sociology; Hawthorne Experiment; Impact of Industrial Institutions on Society; Caste and Class Conflict in Industrial Society.

**Development of Industry:** Early Industrialism in Western Society: The Manorial System, Guild System, The Putting Out System; The Factory System: Its Characteristics; The Factory as a Social System; Industrial Policy, Labor Legislation.

#### **Module II [8L]**

**Organizational Structure of Industry:** Formal Organization: Line and Staff; Informal Organization; Industrial Bureaucracy; Division of Labor.

**Trade Union:** Trade Union Movements in India – History and Growth; Recognition, Election, Affiliation and Social Responsibilities of TUs; Employers' Association.

#### **Module III [8L]**

**Industrial Relations:** Industrial Development in India; Characteristics of Indian Labor and Labor Problems; Absenteeism in Indian Industries; Social Consequences of Industrialism in India.

**IR Mechanisms:** Conciliation, Arbitration and Adjudication; Collective Bargaining: Nature and issues involved; Tripartite consultation: Statutory and non-statutory Committees and Boards.

**Legal provisions:** Strikes and Lockouts, Prevention of Unfair Labor Practices, Change in Conditions of Service and Recovery of Dues.

**Module IV [8L]**

**Labor Laws:** Important provisions of Industrial Disputes Act, 1947; Trade Unions Act, 1926; Factories Act, 1948; Employees State Insurance Act, 1948; Labor Codes

**Labor Welfare:** Industrial Welfare and Benefit Administration; Social Security; CSR; Welfare Officer and Welfare Funds; Workers' Education; Women and Child Labor.

**Text Books:**

1. Arun Monappa - Industrial Relations and Labor Laws; McGraw-Hill
2. Ashok Raj - Industrial Sociology; S.K. Kataria & Sons

**Reference Books:**

1. S.L. Aggarwal - Labor Relations Law in India; Macmillan
2. Sharmistha Bhattacharjee – Industrial Sociology; Pointer Publishers

## Honours Course for 3<sup>rd</sup> Year 1<sup>st</sup> Semester

<b>Paper Name: ARTIFICIAL INTELLIGENCE</b>					
<b>Paper Code: CSBS 3111</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</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:

- CSBS3111.1.** Apply the basic principles of state-space to formulate classical AI problems.
- CSBS3111.2.** Demonstrate the uninformed and informed search techniques to solve the searching problems
- CSBS3111.3.** Illustrate adversarial searching algorithms and constraint satisfaction problems as and when required.
- CSBS3111.4.** Interpret the basic principles of knowledge representation and propositional logic.
- CSBS3111.5.** Investigate the knowledge using first-order predicate logic to solve various AI problems based on the human behavior.
- CSBS3111.6.** Construct AI models to solve real world problems using learning techniques and probabilistic models.

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

**Introduction:** Definition of AI, typical AI problems, practical impact of AI, approaches to AI, limits of AI today, AI history.

**Intelligent Agents:** Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, agent environment.

**Problem Solving using Search -(Single agent):** Introduction to State-space search, state-space search notation, search problem, Formulation of some classical AI problems as a state space search problem, Explicit Vs. Implicit State space.

**Uninformed Search:** Search strategies, search tree, Breadth First Search, Uniform-cost search, Depth First Search, Depth Limited Search, Bidirectional Search

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

**Informed Search Methods:** Basic Principles, Heuristics, A\* Search and its properties, Admissible & Consistent heuristic, Iterative deepening A\* (IDA\*) and AO\* search, Local Search Techniques – Hill climbing & Simulated Annealing

**Problem Solving using Search-(Multi agents):** Adversarial Search – Game Tree, MINIMAX Algorithm, Alpha-Beta Pruning, Performance Analysis.

**Constraint satisfaction problems (CSP):** Definition of CSP, Representation of CSP, Formulation of Various popular problems as CSP, Solution methods of CSP – Backtracking & Forward Checking.

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

**Knowledge Representation:** Knowledge representation issues, Approaches to knowledge representation

**Propositional Logic:** Its syntax & semantics, Inference rules, Resolution for propositions, Limitation of Propositional Logic.

**First Order Predicate Logic:** Syntax & Semantics of FOPL, Representation of facts using FOPL, Clauses, Resolution, Unification methods of inference, Default & Non-Monotonic reasoning.

**Rule based Systems:** Introduction, Horn clauses, Procedural vs. declarative knowledge, forward & backward reasoning.

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

**Planning:** Introduction to planning, Problem solving vs. planning, logic based planning, Planning algorithm - planning as search, Total-order vs. partial order planning.

**Learning:** Overview, various learning models, learning rules, Naïve Bayes classifier and Decision tree based learning.

**Reasoning with Uncertainty (Probabilistic reasoning):** Reasoning with uncertain information- Probabilistic reasoning, Probabilistic inference rules.

**Bayesian Networks:** Syntax & Semantics of Bayesian networks, learning of Bayesian Network parameters, inference in Bayesian Networks.

### **Text Books:**

1. Artificial Intelligence - A Modern Approach, S. Russell and P. Norvig, Pearson Education.
2. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson, PHI.

### **Reference Books:**

1. Artificial Intelligence and Soft Computing Behavioral and Cognitive Modeling of the Human Brain - Amit Konar, CRC Press.
2. Artificial Intelligence - Elaine Rich and Kelvin Knight, TMH.