Curriculum for B. Tech under AEC Autonomy

Electronics and Computer Science

Department: Electronics and Computer Science

Curriculum Structure

(Effective from 2024-25 admission batch)

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(Effective from 2024-25 admission batch)

1st Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS101	Basic Electrical and Electronics Engineering	3	0	0	3	3
2	ENGG	Minor	CS(ECS)102	Programming for Problem Solving	3	0	0	3	3
3	SCI	Multidisciplinary	PH(ECS)101	Engineering Physics	3	0	0	3	3
4	SCI	Multidisciplinary	M(ECS)101	Engineering Mathematics –I	3	0	0	3	3
5	HUM	Value Added Course	HU104	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU105	Indian Knowledge System	1	0	0	1	1
7	HUM	Ability Enhancement Course	HU(ECS)101	Quantitative Aptitude	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	ECS191	Basic Electrical and Electronics Engineering Lab	0	0	3	3	1.5
2	ENGG	Minor	CS(ECS)192	Programming for Problem Solving Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	PH(ECS)191	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	ME(ECS)191	Engineering Graphics &Design Lab	0	0	3	3	1.5
		TOTAL CREDIT						**29**	**22**

HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project

2nd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS201	Data structure and Algorithm	3	0	0	3	3
2	SCI	Multidisciplinary	CH(ECS)201	Engineering Chemistry	2	0	0	2	2
3	SCI	Multidisciplinary	M(ECS)201	Engineering Mathematics – II	3	0	0	3	3
4	HUM	Ability Enhancement Course	HU201	Professional Communication	2	0	0	2	2
5	HUM	Value Added Course	HU202	Values and Ethics	2	0	0	2	2
6	HUM	Value Added Course	HU203	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	ECS291	Data structure and Algorithm Lab using C/ C++	0	0	3	3	1.5
2	HUM	Ability Enhancement Course	HU291	Professional Communication Lab	0	0	2	2	1
3	SCI	Skill enhancement course	CH(ECS)291	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill enhancement course	ME(ECS)291	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
		TOTAL CREDIT						**23**	**18**

3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS301	Digital Electronics Circuits	3	0	0	3	3
2	ENGG	Major	ECS302	Computer Organization and Architecture	3	0	0	3	3
3	ENGG	Major	ECS303	Object Oriented Programming with Java	3	0	0	3	3
4	ENGG	Minor	EE(ECS)301	Circuit Theory and Networks	3	0	0	3	3
5	ENGG	Minor	EC(ECS)301	Electromagnetic Theory and Transmission Line	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	ECS391	Digital Electronics Lab	0	0	0	3	1.5
2	ENGG	Major	ECS392	Computer Organization and Architecture Lab	0	0	3	3	1.5
3	ENGG	Major	ECS393	Object Oriented Programming with Java Lab	0	0	3	3	1.5
4	ENGG	Minor	EE(ECS)391	Circuits and Networks Lab	0	0	2	2	1
5	ENGG	Skill Enhancement Course	M(ECS)391	Numerical Method lab	0	0	2	2	1
		TOTAL CREDIT						**30**	**21.5**

4th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS401	Microprocessors and Microcontrollers	3	0	0	3	3
2	ENGG	Major	ECS402	Operating Systems	3	0	0	3	3
3	ENGG	Major	ECS403	Database Management System	3	0	0	3	3
4	ENGG	Minor	EC(ECS)401	Analog Electronics Circuits	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	ECS491	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5
2	ENGG	Major	ECS492	Operating Systems Lab	0	0	3	3	1.5
3	ENGG	Major	ECS493	Database Management System Lab	0	0	2	3	1.5
4	ENGG	Minor	EC(ECS)491	Analog Electronics Lab	0	0	3	3	1.5
5	ENGG	Skill Enhancement Course	ECS494	Python Programming Lab	0	0	2	2	1
6	HUM	Ability Enhancement Course	HU(ECS)491	Technical Report Writing and Seminar Presentation-I	0	0	1	1	0.5
		TOTAL						**25**	**19.5**

5th Semester									
Sl. No	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS501	Communication Engineering	3	0	0	3	3
2	ENGG	Major	ECS502	Formal Language and Automata theory	3	0	0	3	3
3	ENGG	Major	ECS503	Internet of Things and its Applications	3	0	0	3	3
4	ENGG	Minor	EC(ECS)501A	Digital Signal Processing	3	0	0	3	3
			EC(ECS)501B	VLSI and Microelectronics					
			EC(ECS)501C	Sensors and Applications					
5	HUM	Ability Enhancement Course	HU(ECS)501	Economics for Engineers	2	0	0	2	1
B. PRACTICAL									
1	ENGG	Major	ECS591	Communication Engineering Lab	0	0	3	3	1.5
2	ENGG	Major	ECS592	Internet of Things Lab	0	0	3	3	1.5
3	ENGG	Skill Enhancement Course	ECS593	Design & simulation lab	0	0	3	3	1.5
4		Internship	ECS581	Industrial Training (Minimum 2 weeks)	0	0	0	0	1
5	PRJ	Project	ECS582	Minor Project- I	0	0	2	2	1
		TOTAL CREDIT						**25**	**19 .5**

6th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS601	Computer Networking	3	0	0	3	3
2	ENGG	Major	ECS602	Control System Engineering	3	0	0	3	3
3	ENGG	Major	ECS603	Artificial Intelligence	3	0	0	3	3
4	ENGG	Major	ECS604A	Cyber Law and Ethics	3	0	0	3	3
			ECS604B	Introduction to Data Science					
			ECS604C	Introduction to Robotics					
5	ENGG	Minor	CS(ECS)605A	Cyber Security & Cryptography	3	0	0	0	3
			CS(ECS)605B	Soft Computing					
			CS(ECS)605C	Mobile Computing					
B. PRACTICAL									
1	ENGG	Major	ECS691	Computer Networking Lab	0	0	3	3	1.5
2	ENGG	Major	ECS692	Control System Engineering Lab	0	0	3	3	1.5
3	ENGG	Major	ECS693	Artificial Intelligence Lab	0	0	3	3	1.5
4	HUM	Ability Enhancement Course	HU(ECS)691	Technical Report Writing and Seminar Presentation-II	0	0	2	2	1
5	PRJ	Project	ECS681	Minor Project- II	0	0	2	2	1
		TOTAL CREDIT						**25**	**21.5**

7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS701	Industrial Automation	3	0	0	3	3
2	ENGG	Major	ECS702A	Machine Learning	3	0	0	3	3
			ECS702B	Digital Image Processing					
			ECS702C	Embedded System Design					
3	ENGG	Major	ECS703A	Computer Graphics	3	0	0	3	3
			ECS703B	Software Engineering					
			ECS703C	Cloud Computing					
4	ENGG	Minor	EC(ECS)704A	Information Theory and Coding	3	0	0	3	3
			EC(ECS)704B	Fiber Optics Communication					
			EC(ECS)704C	Wireless Sensor Networks					
B. PRACTICAL									
1	ENGG	Major	ECS791	Industrial Automation Lab	0	0	3	3	1.5
2	ENGG	Major	ECS792A	Machine Learning Lab	0	0	3	3	1.5
			ECS792B	Digital Image Processing Lab					
			ECS792C	Embedded System Design Lab					
3	ENGG	Major	ECS793A	Computer Graphics Lab	0	0	2	2	1
			ECS793B	Software Engineering Lab					
			ECS793C	Cloud Computing Lab					
8	HUM	Ability Enhancement Course	HU(ECS)791	Business Communication	0	0	0	2	1
4		Internship	ECS781	Internship (Minimum one month)	0	0	0	0	2
5	PRJ	Project	ECS782	Major Project-I	0	0	8	8	4
		TOTAL CREDIT						**29**	**23**

8th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	ECS801A	Real-Time Systems	3	0	0	3	3
			ECS801B	MEMS Technology					
			ECS801C	Multimedia and Virtual Reality					
2	ENGG	Minor	EC(ECS)801A	Mobile Communication	3	0	0	3	3
			EC(ECS)801B	Nanoelectronics					
			EC(ECS)801C	Biomedical Electronics					
3	ENGG	Minor	CS(ECS)801A	Quantum Computing	3	0	0	3	3
			CS(ECS)801B	Big Data Analytics					
			CS(ECS)801C	Neural Networks and Deep Learning					
4	HUM	Ability Enhancement Course	HU(ECS)801	Principles of Management	1	0	0	1	1
B. PRACTICAL									
1			ECS881	Grand Viva	0	0	0	0	1
2	PRJ	Project	ECS882	Major Project-II	0	0	12	12	6
		TOTAL CREDIT						22	17

Total Credit = 162

Course Name: Basics Electrical and Electronics Engineering
Course Code: ECS101
Contact:3L/Week
Credit: 3
Total Lecture: 36

Prerequisites:
Basic 12thstandard Physics and Mathematics, Concept of components of electric circuit.

Course Objectives:

- To expose to the field of electrical Circuits and Electrical Machine.
- To study the basic devices in the field of electronics.
- To acquire the knowledge to use of devices to make various electrical and electronic circuits.

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

CO1: Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO2: Solve simple ac circuits in steady state
CO3: Impart the knowledge of Basic Electronics Devices
CO4: Analyze the simple electronics circuits

MODULE1: Elementary Concepts of Electric Circuits 6L

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

MODULE 2: Electrical machine 8L

Construction and Working principle- DC Separately and Self Excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Transformers -Construction, Working principle and Applications of Transformer, autotransformers,

MODULE 3: Fundamentals of Semiconductor Devices: 6L

Introduction to Semiconductor: Concept of energy band diagram;

Comparison

among metal, insulator, semiconductor; Semiconductors-classifications and Fermi energy level; Charge neutrality and Mass-Action law in semiconductor; Current flow in semiconductor due to drift &diffusion process; Einstein relation.

MODULE 4: PN Junction Diode and its applications: 8L

Principle of operation; V-I characteristics; principle of avalanche & Zener breakdown; V-I characteristics of Zener diode.

Working principle of half wave and full wave rectifier; Rectifiers-Average output current and voltage, ripple factor, power conversion efficiency; LC filters; working principle of Zener voltage regulator; Block diagram description of DC power supply; Clipper and Clamper circuit.

MODULE 5: Bipolar Junction Transistors: 4L

PNP and NPN structures; Principle of operation; Current gains in CE, CB and CC mode; input and output characteristics; Biasing & Stability Analysis-Concept of Fixed Bias, Collector to base Bias & voltage divider bias.

MODULE 6: Field Effect Transistors: 4L

JFET and MOSFET- P Channel& N Channel structures; Principle of operation; CS, CD and CG configurations; Transfer Characteristics and Drain characteristics; FET parameters.

Text books:

1. A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering) & Volume II (Ac & DC Machines)-B. L Theraja & A.K. Teraja,
S. Chad,23rd Edition,1959
2. D. Chattopadhyay, P.C Rakshit, "Electronics Fundamentals and Applications", New Age International (P) Limited Publishers, Senenth Edition,2006
3. Basic Electrical & Electronics Engineering by J.B. Gupta ,S.K. Kataria & Sons,2013
4. Basic Electrical and Electronics Engineering-I by Abhijit Chakrabarti and Sudip Debnath, McGraw Hill, 2015
5. M.S. Sukhijaand T. K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press,2012.
6. DP Kothari and IJ Nagrath, "BasicElectrical& Electronics Engineering", TataMcGraw Hill,2020.

Reference Books:

1. DC Kulshreshtha, "Basic Electrical Engineering", Tata McGrawHill,2010.
2. T.K. Nagsarkar, M.S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
3. Hughes, "Electrical and Electronic Technology", Pearson Education".

4. Parker and Smith, "Problemsin Electrical Engineering", CBS Publishers and Distributors.
5. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
6. Bernard Grob, Basic Electronics, McGrawHill.
7. Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics-Principles and Applications, Cambridge University Press, 2018.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	1	-	-	-	-	-	-	2	2
CO2	3	3	2	1	-	-	-	-	-	-	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	2
CO4	2	3	2	1	-	-	-	-	-	-	2	1

Course Name: Programming for Problem Solving
Course Code: CS(ECS)102
Contact (Periods/Week):3L/Week
Total Contact Hours: 36
Credits: 3
Pre-requisite: None

Course Objective: The objective of this course is to:

1. Design solutions to simple engineering problem by applying the basic programming principles of C language and basic mathematical knowledge.
2. Choose a suitable C-construct to develop C code for a given problem.
3. Apply the C-language syntax rules to correct the bugs in the C program.
4. Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.

Course Outcomes:

After completion of the course students will be able to:

CO1: identify the working principle of input and output devices of Computers memorize the basic terminology used in computer programming.

CO2: express programs in C language and use different data types for writing the programs.

CO3: implement programs using the dynamic behaviour of memory by the use of pointers.

CO4: explain the difference between call by value and call by address.

CO5: write programs using basic data files and developing applications for real world problems.

Course Content:

Module-1: Fundamentals of Computer [9L]

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using 1's complement and 2's complement). Representation of Characters-ASCII Code, Basics of Compiler, Interpreter and Assembler

Problem solving–

Basic concept of Algorithm. Representation of algorithm using flowchart and pseudo code, Some basic examples.

Module-2: Introduction to C Programming [5L]

Overview of Procedural Vs Structural language; History of C Programming Language. Variable and Data Types: The C characters identifiers and keywords, datatype &sizes, variable names, declaration, statements.

Operators & Expressions: Arithmetic operators, relational operators, Logical operators, increment and decrement operators, bitwise operators, Assignment operators, conditional operators, special operators-type conversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output–printf, formatted input scanf.

Module-3: Branch and Loop [5L]

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder. Switch Case: break and continue; switch-case, concept to fgoto and labels

Loops- while, for, do while

Module-4: Program Structures [4L]

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function.

Storage Class in C: Storage Class- auto, external, static and register storage class, scope rules and life time of variables C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer [7L]

Arrays: One dimensional arrays, Two- dimensional arrays

Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions. Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String.Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum [3L]

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C [3L]

Files handling-opening and closing a file in different mode, formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y.-LetusC, BPBPublication,15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M.Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad– MASTERINGC, TMH,2nd Edition

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2						2	3
CO2	2	2	3	3	3							3
CO3	2	3	2	2	2							3
CO4	3	2	2	3	3							2
CO5	2	2	2	1	1						2	3

Course Name: Engineering Physics

Course Code: PH(ECS)101

Contact: (3:0:0)

Total Contact Hours: 36

Credits: 3

Prerequisites: Knowledge of Physics up to 12^{th} standard.

Course Objectives:

The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students should be able to

CO	Description
CO1	explain basic principles of laser, optical fiber and holography.
CO2	understand the properties of Nano material and semiconductor.
CO3	understand the macro state for thermodynamic system, thermodynamic probability and phase space.
CO4	analyze different crystallographic structures according to their co-ordination number and packing factors.
CO5	justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

Course Content:

Module 1 (12L)

Modern Optics

1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and

equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems.

6L

1.02-Fibre optics-Principle and propagation of light in optical fibers (Step index, index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems.

3L

1.03-Holography-Theory of holography, viewing of holography, applications
3L

Module 2 (6L)

Solid State Physics

2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.
3L

2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 3L

Module 3 (8L)

Quantum Mechanics

3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 4L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement).
4L

Module 4 (4L)

Physics of Nanomaterials

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5 (6L)

Statistical Mechanics

Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level, relevant problems, Position of Fermi level for a semiconductor (intrinsic & extrinsic) - Qualitative discussion.

Recommended Text Books for Physics I:

Text Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers).
3. Perspective & Concept of Modern Physics -Arthur Baiser (Publisher: MaGrawhill) Principles of engineering physics – Md. N Khan and S Panigrahi (Cambridge University Press).
4. Concepts of Modern Engineering Physics-A. S. Vasudeva. (S. Chand Publishers)
5. Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers).
6. Physics Volume 1&2 - Haliday, Resnick &Krane, Publisher: Wiley India).
7. Engineering Physics-B. K. PandeyAnd S. Chaturvedi (Publisher: Cengage Learning, New Delhi).

Recommended Reference Books for Physics I:

Modern Optics:

1. A text book of Light- Brijlal &Subhramanium, (S. Chand publishers).
2. Optics-Ajay Ghatak (TMH)

Solid State Physics:

1. Solid state physics- S. O. Pillai.
2. Introduction to solid state physics-Kittel (TMH).

Quantum Mechanics:

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House).
2. Quantum mechanics -A.K. Ghatak and S Lokenathan

Physics of Nanomaterials

1. Introduction to Nanotechnology, B.K. Parthasarathy.
2. Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J. Owens.

Statistical Mechanics

1. Fundamental of Statistical Mechanics: B. B. Laud
2. Fundamental of Statistical and Thermal Physics: F. Reif

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO1 1	PO1 2
CO1	3	3	2	2	--	--	--	--	--	--	--	2
CO2	3	3	2	2	--	--	--	--	--	--	--	2
CO3	3	3	2	2	--	--	--	--	--	--	--	1
CO4	3	2	2	2	--	--	--	--	--	--	--	2

CO5	**3**	**2**	**3**	**3**	--	--	--	--	--	--	--	**1**

Course Name: Engineering Mathematics -I
Course Code: M(ECS)101
Contact (Periods/Week):3L/Week
Total Contact Hours: 36
Credit: 3

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) algebra and calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties and formula related to Matrix Algebra, Differential Calculus and Laplace Transforms

CO2: Determine the solutions of the problems related to Matrix Algebra, Differential Calculus and Laplace Transforms

CO3: Apply the appropriate mathematical tools of Matrix Algebra, Matrix Algebra, Differential Calculus and Laplace Transforms

CO4: Analyze different engineering problems linked with Matrix Algebra, Matrix Algebra, Differential Calculus and Laplace Transforms

Course Content:

Module-I: Matrix Algebra (10)

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors, Cayley-Hamilton theorem.

Module II: Differential Calculus (12)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian. Maxima and minima of functions of two variables

Module III: Laplace Transform (LT): (14 Lectures)

Improper integrals; Beta and Gamma functions and their properties.
Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $tf(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
6. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

Course Name: Environmental Science

Course Code: HU104
Contact (Periods/Week):2L/Week
Total Contact Hours: 24
Credit: 2

Course Objective(s)

This course will enable the students to:

- Realize the importance of environment and its resources.
- Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Solve scientific problem-solving related to air, water, land and noise pollution.

Course Outcome

On successful completion of the learning sessions of the course, the learner will be able to:

CO	Statement
CO1	Able to understand the natural environment and its relationships with human activities
CO2	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk
CO3	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Module 1 - Resources and Ecosystem (6L)

1. **Resources (2L)**

Types of resources, resistance to resources, Human resource, Population Growth models: Exponential Growth, logistic growth

2. **Ecosystem (3L)**

Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Food chain, Food web.

3. **Energy and Environment(1L)**

Conventional energy sources, coal and petroleum, Green energy sources, solar energy,

tidal energy, geothermal energy, biomass

Module 2 – Environmental Degradation (9L)

1. **Air Pollution and its impact on Environment (3L)**

   Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.

2. **Water Pollution and its impact on Environment (3L)**

   Water Pollutants, Oxygen demanding wastes, heavy metals, BOD, COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal poisoning and toxicity.

3. **Land Pollution and its impact on Environment (2L)**

   Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes

4. **Noise Pollution and its impact on Environment (1L)**

   Types of noise, Noise frequency, Noise pressure, Noise intensity, Noise Threshold limit, Effect of noise pollution on human health.

Module 3 – Environmental Management (6L)

1. **Environmental Impact Assessment (1L)**

   Objectives of Environmental management, Components of Environmental Management, Environmental Auditing, Environmental laws and Protection Acts of India

2. **Pollution Control and Treatment (2L)**

   Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator, etc., Waste Water Treatment, Noise pollution control.

3. **Waste Management (3L)**

   Solid waste management, Open dumping, Land filling, incineration, composting, E-waste management, Biomedical Waste management.

Module 4 – Disaster Management (3L)

1. **Study of some important disasters (2L)**

   Natural and Man-made disasters, earthquakes, floods drought, landside, cyclones, volcanic eruptions, tsunami, Global climate change. Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

2. **Disaster management Techniques (1L)**

   Basic principles of disasters management, Disaster Management cycle, management policy, Awareness generation program

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT),

Gour Krishna Das mohapatra, Vikas Publishing.

2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.

3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC,Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana& Dr. Meera Asthana, S.ChandPublications.

2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	-	-	2	3	3	-	-	1	2
CO 2	3	3	3	1	1	2	3	3	-	-	1	2
CO 3	3	3	3	2	1	2	3	3	-	-	1	2
CO 4	1	1	1	1	2	2	3	3	-	-	1	2

Course Name: Indian knowledge System
Course Code: HU105
Credit: 01
Total No. of

lectures: 12

Prerequisite: Nil

Course Outcome

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: To recall & state thought process of social setting in ancient India to identify the roots and details of some contemporary issues faced by Indians

CO 2: The students are able to identify & inspect the importance of our surroundings& culture to design & formulate sustainable developmental solutions

CO 3: To develop the ability to understanding the issues related to 'Indian' culture, tradition and its composite character to apply the same in the socio-technological developm present scenario

CO 4: The students are able to relate & assess Indian Knowledge System in the health care,architecture, agriculture & other systems.

Module-1 **3L**

An overview of Indian Knowledge System (IKS): Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.
The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life.
Indian philosophical systems: Different schools of philosophy.

Module-2 **3L**

Salient features of the Indian numeral system: Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers.

Highlights of Indian Astronomy: Historical development of astronomy in India

Module-3 **3L**

Indian science and technology heritage: Metals and metalworking - Mining and ore extraction –Physical structures in India - Irrigation and water management - Dyes and painting technology - Surgical Techniques - Shipbuilding

Module-4 **3L**

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs.

Text Book:

1) Introduction to Indian knowledge system: concepts and applications-MahadevanB.Bhat, VinayakRajat, NagendraPavanaR.N.,PHI

Reference Books:

1) Traditional Knowledge system in India, AmitJha, Atlantic Publishers

2) S. N. Sen and K. S. Shukla, *History of Astronomy in India*, Indian National Science Academy, 2nd edition, New Delhi, 2000

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	-	-	2	3	-	3	-	2	3	1	-	2
CO 2	-	-	2	-	-	3	3	2	3	3	-	

CO 3	-	-	2	-	-	3	3	1	3	1	-	2
CO 4			2			3	3	2	3			

Course Name: Quantitative Aptitude

Course Code: HU(ECS)101
Contact Hours: 1P/Week
Total Contact Hours: 12
Credit: 1

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) standard algebra.

Course Objectives:

The objective of this course is to familiarize prospective engineers with techniques of using algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well in tackling the aptitude level of mathematics and applications that they would find useful for competitive examinations.

Course Outcome:

CO1: Recall the concept of Algebra.

CO2: Determine the solutions to the problems of Quantitative Aptitude.

CO3: Apply the appropriate mathematical tools to solve the aptitude problems.

CO4: Analyze different aptitude problems with the help of the various tools.

Course Content:

1. Problems on Number Series, AP and GP
2. Problems on Age
3. Problems on Percentage
4. Problems on Profit and Loss
5. Problems on Ratio & Proportion, Partnership
6. Problems on Chain Rule
7. Problems on Time and Work
8. Problems on Pipe and Cisterns
9. Problems on Time and Distance
10. Problems on Train, Boat and Stream
11. Problems on Simple and Compound Interest
12. Problems on Stock and Share
13. Problems on Calendar and Clock

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	2
CO2	1	3	-	-	-	-	-	-	-	-	-	3
CO3	2	3	2	2	3	-	-	-	-	-	2	3
CO4	2	3	2	3	3	-	-	-	-	-	2	3

Course Name: Basics Electrical and Electronics Engineering LaboratoryCourse Code:
ECS191
Contact (Periods/Week): 3PL/Week
Credit:1.5
Total Lecture: 36
Prerequisite:
Basic concepts of physics and mathematics.
Course Objective:

- To study the basic laws of circuit.
- To study the function of dc motor, generator, and transformer.
- To examine the characteristics of diode and transistors
- To know the use of semiconductor devices in various electronic circuits.

Course Outcome:
After successful completion of the course students will be able to:

CO1: To Analyze a given network by applying KVL and KCL.
CO2: To Examine the Operation of DC Motor.
CO3: To Examine the Operation of Basic Electronics Devices**CO4**: To design simple electronics circuits.

List of Experiments: -

1. Familiarization with different passive and active electrical & electronic components.
2. Familiarization with different Electrical & Electronics Instruments.
3. Verification of KVL and KCL.
4. Forward and reversal of DC shunt motor.
5. Speed control of DC shunt motor.
6. Study of the P-N junction diode V-I characteristics (Forward & Reverse

Bias).

7. Study of the Characteristics of Zener diode (Forward & Reverse Bias).
8. Study of half wave and full wave rectifier.
9. Study of clipper and clamper circuit.
10. Study of the Input and Output characteristics of BJT in CE mode.
11. Study of transfer and drain characteristics of JFET.
12. Extramural Experiment.

Textbooks:
Reference Books

1. Basic Electrical and Electronics Engineering,Author:S. K. Bhattacharya,Publisher:Pearson Education India,2011
2. Practical Electrical Engineering
3. By Sergey N. Makarov, Reinhold Ludwig, Stephen J. Bitar,Publisher: Springer International Publishing, 2016
4. Electronics Lab Manual (Volume 2) By Navas, K. A. Publisher: PHI Learning Pvt.Ltd. 2018
5. Practical Electronics Handbook,Ian R. Sinclair and John Dunton,Sixth edition 2007,Published by Elsevier Ltd.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	3	2	-	2	-	-	2	-	2	3
CO2	3	3	2	3	-	2	-	-	3	-	2	2
CO3	3	2	2	3	-	2	-	-	2	-	3	3
CO4	3	3	2	2	-	2	-	-	3	-	2	3

Course Name: Programming for Problem Solving Lab
Course Code: CS(ECS)192
Contact Hours: 3P/Week
Total Contact Hours: 36
Credits: 1.5
Prerequisites: None

Course Outcomes:
Upon successful completion of the course students will be able to:

CO1: Identify the working of different operating systems like DOS, Windows, Linux
CO2: Express programs in C language
CO3: Implement programs connecting decision structures, loops
CO4: Experiment with user defined functions to solve real time problems
CO5: Write C programs using Pointers to access arrays, strings, functions, structures and files

Course Content:

Module-1:
Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE,compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types
b) Different arithmetic operators.
c) Printf() and scanf()functions.

Module-3: Problem based on conditional statements using

a) if-else statements
b) different relational operators
c) different logical operators

Module-4: Problem based on

a) **for** loop
b) **while** loop
c) **do-while** loop

Module-5:

Problem based on

a) How to write a menu driven program using switch- case statement
b) How to write a function and passing values to a function
c) How to write are cursive function.

Module-6: Problem based on

a) How to use array(bothI-Dand2-D) .
b) How to pass an array to a function .

Module-7: Problem based on manipulation of strings in different way.

Module-8: Problem based on

a) How to handle compound variables in C
b) How to handle file in C
c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C ,Mc Graw-Hill
2. Kanetkar Y.-Letus C, BPBPublication,15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India, KR Venugopal & SR Prasad– MASTERINGC, TMH,2ndEdition

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	-	2	3
CO2	2	2	3	3	3	-	-	-	-	-	-	3
CO3	2	3	2	2	2	-	-	-	-	-	-	3
CO4	3	2	2	3	3	-	-	-	-	-	-	2
CO5	2	2	2	1	1	-	-	-	-	-	2	3

Course Name: Engineering Physics Lab

Code: PH(ECS)191

Contact Hours: 0:0:3

Credit: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' will be able to

CO1: demonstrate experiments allied to their theoretical concepts

CO2: conduct experiments using LASER, Optical fiber.

CO3: participate as an individual, and as a member or leader in groups in laboratory sessions actively

CO4: analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiment.

CO5: Design solutions for real life challenges.

Course Content:

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for experiment.

Experiments on Classical Physics (Any 4 to be performed from the following experiments):

1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.

Experiments on Quantum Physics (Any 2 to be performed from the following experiments):

7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10. Study of characteristics of solar cell.

Perform atleast one of the following experiments:

11. Determination of Q factor using LCR Circuit.
12.Study of I-V characteristics of a LED/LDR

**In addition it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Study of dispersive power of material of a prism.
2. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Recommended Text Books for Engineering Physics Lab:

Waves & Oscillations:

1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit Classical & Modern

Optics:

2. A text book of Light- K.G. Mazumder &B. Ghosh (Book & Allied Publisher)

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

Solid State Physics:

1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:

1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)

2. Practical Physics by K.G. Mazumder (New Central Publishing)

3. Practical Physics by R. K. Kar (Book & Allied Publisher)

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3	--	--	--	--	--	--	--
CO2	2	3	2	3	3	--	--	--	--	--	--	--
CO3	2	3	2	3	3	--	--	--	--	--	--	--
CO4	2	2	3	2	3	--	--	--	--	--	--	--
CO5	2	2	3	2	3	--	--	--	--	--	--	--

Course Name: Engineering Graphics & Design Lab
Course Code: ME(ECS)191
Contact Hours: 3P/Week
Total Contact Hours: 36
Credits: 1.5

Prerequisites: Basic knowledge of geometry

Course Outcomes: Upon successful completion of this course, the student will be able to:

CO1: Learn the basics of drafting

CO2: Understand the use of drafting tools which develops the fundamental skills of industrial drawings.

CO3: Apply the concept of engineering scales, dimensioning and various geometric

curvesnecessary to understand design of machine elements.

CO4: Analyze the concept of projection of line, surface and solids to create the knowledgebase of orthographic and isometric view of structures and machine parts.

CO5: Evaluate the design model to different sections of industries as well as for research & development.

Course Contents:

Basic Engineering Graphics: 3P

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module1: Introduction to Engineering Drawing 6P

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales–Plain, Diagonal and Vernier Scales.

Module2: Orthographic & Isometric Projections 6P

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module3: Sections and Sectional Views of Right Angular Solids 6P

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: 3P

Engineering Graphics Software; - Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multiview Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module4: Overview of Computer Graphics 3P

Demonstration of CAD software [The Menu System, Tool bars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module5: CAD Drawing, Customization, Annotations, layering 6P

Set up of drawing including scale settings, ISO and ANSI standards for dimensioning

And tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD m parts and assemblies with animation, Parametric and non-parametric sd surface and wire frame modeling, Part editing and printing documents.

Module6: Demonstration of a simple team design project 3P

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid- modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. &Ingle P. R, (2014), Engineering Drawing, Charotar Publishing House
2. K. Venugopal, Engineering Drawing +Auto CAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari,
2. A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Shah, M.B.& Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L.&P Kannaiah (2008),Text book on Engineering Drawing, Scitech Publishers.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	2	-	-	-	-	-	-	-	-
CO2	2	-	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	3	2	-	-	-	-	-	-	-

Course Name: Data structure and Algorithm

Course Code: ECS 201
Contact (L-T-P): 3-0-0
Credit: 3
Total Lecture: 36

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language

2. A solid back ground in mathematics, including probability, set theory.

Course Objectives:

1. To learn the basics of abstract data types.

2. To learn the principles of linear and non- linear data structures.
3. To build an application using sorting and searching.

Course Outcomes:

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

CO1. Differentiate how the choices of data structure & algorithm methods impact the performance of program.

CO2. Solve problems based upon different data structure & also write programs.

CO3. Identify appropriate data structure & algorithmic methods in solving problem.

CO4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

CO5. Compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module 1:

Linear Data Structure

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
[1L]
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations
[1L] Array: Different representations – row major, column major
[1L]
Sparse matrix - its implementation and usage, Array representation of polynomials
[1L]
Linked List: Singly linked list – operations, doubly linked list – operations [3L]
Circular linked list – operations, Linked list representation of polynomial and applications
[1L]
Asymptotic Notations Time Complexity, Space Complexity, Big-oh Notation, Big-omega Notation and Big-theta Notation [2L]

Module 2: Linear Data Structure

Stack and Queue: Stack and its implementations (using array and linked list) [1L]
Applications (infix to Postfix, Postfix Evaluation) [1L]
Queue: Linear queue, Circular queue, de-queue, Priority queue [1L]
Implementation of queue- linear and circular (using array and linked list) [1L]
Recursion: Principles of recursion - use of stack, tail recursion. [1L]
Applications - The Tower of Hanoi [1L]

Module 3: Nonlinear Data structures

Trees: Basic terminologies, forest, tree representation (using array and linked list) [1L]
Binary trees - binary tree traversal (pre-, in-, post- order) [1L]
Binary search tree- operations (creation, insertion, deletion, searching) [1L]
Threaded binary tree [1L]
Height balanced binary tree – AVL tree (insertion with examples only) [1L
Height balanced binary tree – AVL tree (deletion with examples only) [1L]
m –Way Search Tree, B Tree, B^+ Tree and Red-Black Tree– operations (insertion, deletion

with examples only) [2L]
Graphs : Graph theory review [1L]
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) [2L]
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) [1L]

Module 4: Searching, Sorting Algorithms:
Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L) Quick sort, Merge sort – with complexity
[2L]

Concept of Max-Heap and Min-Heap (creation, deletion), Heap sort [1L]

Radix sort – with complexity [1L]

Searching : Sequential search – with complexity [1L]
Binary search, Interpolation Search– with complexity [1L]
Hashing : Introduction to Hashing and Hashing functions and Collision resolution techniques [2L]

Text books:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed2nd Edition, Universities Press

Reference books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India)Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1st Edition,Pearson

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	1	1	3	2	3
CO2	3	2	2	2	2	-	-	2	2	3	3	2
CO3	3	3	3	2	1	1	-	2	2	3	3	2
CO4	3	3	3	3	1	-	-	1	1	3	3	3
CO5	3	3	3	3	1	-	2	1	1	3	3	3

Course Name: Engineering Chemistry

Course Code: CH (ECS)
201Contact (L T P): 2-0-0
Total Contact Hours: 24

Credit: 2
Prerequisites: 10+2

Course OBJECTIVE

- To understand the basic principles of elements, organic reactions, drug synthesis and computational chemistry
- To apply the knowledge of different engineering materials, advanced polymers, and nano materials to solve complex engineering problems
- To analyze and evaluate quality parameters of water and its treatment
- Apply the knowledge of free energy, energy storage device, semiconductors and corrosion to design environment friendly & sustainable devices
- Apply the knowledge of different instrumental techniques to analyze unknown engineering materials.

COURSE OUTCOME

CO1. Able to understand the basic principles of elements, organic reactions drug synthesis and computational chemistry
CO2. Able to apply the knowledge of different engineering materials, advanced polymers, and nano materials to solve complex engineering problems
CO3. Able to analyze and evaluate water quality parameters and its treatment
CO4. Able to the knowledge of free energy, energy storage device, fuels and corrosion to design environment friendly & sustainable devices
CO5. Able to apply the knowledge of different instrumental techniques to analyze unknown engineering materials

Course Content

Module 1 - Elements and their properties (6L)

4. **Elements and their properties (3L)**
   Bohr's theory for one electron system, Hydrogen spectrum, Quantum numbers, Atomic orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle, Electronic configuration and Magnetic properties.
5. **Periodic Table for Engineers (3L)**
   Modern Periodic table, Periodic properties, study of advanced functional materials like Silicones, Silicates, Zeolite and alloys like steel, mischmetall, Neodymium alloy and their applications

Module 2 - Energy devices and Semiconductors (6L)

5. **Use of free energy in chemical equilibria (3L)**
   Laws of Thermodynamics, Enthalpy, Entropy, Spontaneity, Electrochemical Ce
   Cell, Mercury Cell, Lead Storage batteries, Ni-Cd Cells, Fuel Cells, Solar Cells, Nernst equation and applications, Electrochemical sensors

6. **Crystals and Semiconductors (3L)**
   Crystals and their defects, Stoichiometric and Non-stoichiometric defects, Band theory and Doping, n-type and p-type semiconductors, Superconductors

Module 3 –Industrial Applications of Chemistry (8L)

4. **Advanced Polymeric materials (3L)**
   Classification, Engineering Plastics, conducting polymers, bio polymers, polymer composites

5. **Industrial corrosion (2L)**
   Classification, Effects of corrosion, Preventive measures

6. **Analysis of Water Quality (1L)**
   Water quality parameters and treatment

7. **Nano materials (1L)**
   Synthesis of Nano materials, Applications in modern devices

8. **Basic Computational Chemistry (1L)**
   Introduction of computational chemistry and their applications

Module 4 – Organic Reaction Products and their spectroscopic analysis (4L)

3. **Organic Reactions (2L)**
   Substitution, Elimination and Addition reactions

4. **Drug designing and synthesis (1L)**
   Paracetamol, Aspirin

5. **Spectroscopic Analysis (1L)**
   UV – Visible Spectra, IR spectra

Text Books:

1. Fundamentals of Engineering Chemistry, Dr. Sudip Bandopadhyay & Dr. NirmalHazra, latest edition, Chhaya Prakashani Pvt. Ltd.
2. Chemistry –I, Gourkrishna Das Mohapatro, 3rd Edition, Vikas Publications, 2016
3. A text book of Engineering Chemistry, 2nd Edition, Dr. Rajshree Khare, S.K. Kataria & Sons, 2022
4. Engineering Chemistry, N Acharjee & P. Dhar, Latest Edition, U. N. Dhar & Sons Pvt. Ltd., 2020
5. Physical Chemistry, P.C. Rakshit, 7th edition, Sarat Book House, 2018

Reference Books

1. Engineering Chemistry, Jain &Jain, 16th Edition, Dhanpat rai Publishing Company, 2016
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishna, 2019
3. Text book of Engineering Chemistry, Jaya Shree Anireddy, 1st Edition, Wiley, 2018

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	2	2	-	-	-	-	-	2	2
2	3	3	3	3	-	-	2	-	-	-	2	2
3	3	3	-	-	-	-	3	-	-	-	3	2
4	3	3	3	2	-	-	3	-	-	-	3	2
5	3	3	3	3	2	-	-	-	-	-	2	2

Course Name: Engineering Mathematics -II
Course Code: M (ECS) 201
Contact (L T P): 3-0-0
Total Contact Hours: 36
Credit: 3

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) algebra and calculus.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to Fourier series, Fourier Transformations and Numerical Methods.

CO2: Determine the solutions of the problems related to matrix algebra, probability and Numerical Methods.

CO3: Apply the appropriate mathematical tools of matrix algebra, probability and Numerical Methods.

CO4: Analyze different engineering problems linked with matrix algebra, probability and Numerical Methods.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

Course Content:

Module I: Numerical Methods (12L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward

and backward interpolation, Lagrange's interpolation, **Numerical integration:** Trapezoidal rule, Simpson's 1/3 rule. **Numerical solution of ordinary differential equation:** Euler method, Modified Euler method, Fourth order Runge- Kutta method.

MODULE II: ***Fourier series and Fourier Transform: (13 Lectures)***

Fourier series: Dirichlet's Conditions; Euler's Formula for Fourier Series; Fourier Series for functions of period 2π; Sum of Fourier series (examples); Theorem for the convergence of Fourier series (statement only); Fourier series of a function with its periodic extension; Half range Fourier series: Construction of half range Sine series and half range Cosine Series; Parseval's identity (statement only) and related problems.

Fourier Transform: Fourier Transform, Fourier Cosine Transforms, Fourier Sine Transforms (problems only); Properties of Fourier Transform: Linearity, Shifting, Change of Scale, Modulation (problems only); Fourier Transform of Derivatives (problems only); Convolution Theorem (statement only), Inverse of Fourier Transform (problems only).

MODULE III: ***Calculus of Complex Variable: (13 Lectures)***

Functions of a Complex Variable Analytic Functions (definition and examples); Cauchy-Riemann Equations (statement only& related problems); Sufficient condition for a function to be analytic (statement only & related problems).

Cauchy's Theorem (statement only & related problems); Cauchy's Integral Formula statement only & related problems); Cauchy's Integral Formula for the derivative of an analytic function(statement only & related problems); Cauchy's Integral Formula for the successive derivatives of an analytic function (statement only & related problems); Taylor's series and Laurent's series (problems only).

Zero of an Analytic Function and its order (definition & related problems); Singularities of an Analytic Function: Isolated Singularity and Non-isolated Singularity (definition & related problems); Essential Singularities, Poles (Simple Pole and Pole of Order) m and Removable Singularities (definition & related problems); Determination of singularities and their nature (problems only); Residue (definition & examples); Determination of the residue of a given function; Cauchy's Residue theorem (statement only & related problems).

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint,

6. Samanta Guruprasad, A text book of Engineering Mathematics-III, New age International Publishers

7. Mollah, S. A, Numerical Analysis and Computational Procedures, Books and Allied (P) Ltd.

Reference Books:

1. Dey, Sukhendu, Gupta Sisir, Numerical Methods, Mc Graw Hill Education (India) Private Limited.

2. Jain, M. K., Iyengar, S. R. K., Jain, R. K., Numerical Methods, New age International Publishers

Course Name: Professional Communication
Course Code: HU201
Contact (L T P): 2:0:0
Total Contact Hours: 24
Credit: 2

Pre-requisites: Basic (10+2) level of knowledge of English grammar, vocabulary reading and writing skills.

Course Objectives: The course aims to impart domain and industry-specific communication skills in a globalized context and to promote the understanding of business communication practices and cross cultural dynamics.

Course Outcomes: By pursuing this course the students shall be able to

1. Define, describe and classify the modalities and nuances of communication in a workplace context.
2. Review, appraise and understand the modes, contexts and appropriacy of communicating across cultures and societies.
3. Identify, interpret and demonstrate the basic formats, templates of business and official communication.
4. Identify, compare and illustrate reading strategies and basic writing strategies.
5. Interpret, analyze and evaluate semantic-structural, interpersonal and multicultural dynamics in business communication.

Course Content:

Module1:

Verbal and Non **4L**

Definition, Relevance and Effective Usage
Components of Verbal Communication: Written and Oral Communication
Components of Nonverbal Communication: Kinesics, Proxemics, Chronemics, Haptics
Para language
Barriers to Effective Communication

Module2:

Workplace Communication Essentials and Cross Cultural Communication **4L**

Communication at the Workplace—Formal and Informal Situations
Language in Use—Jargon, Speech Acts/Language Functions, Syntactical and Grammatical Appropriacy Cultural Contexts in Global Business: High Context and CulturesUnderstanding Cultural Nuances and Stereo typing Achieving Culturally N Communication in Speech and Writing

Module3: **4L**

Reading Strategies and Basic Writing Skills

Reading: Purposes and Nature of Reading
Reading Sub-Skills—Skimming, Scanning, Intensive Reading
Reading General and Business Texts (Reading for Comprehension and Detailed Understanding)
Basic Writing Skills—Paragraph and Essay writing, writing technical documents
Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Module4: **4L**

Report Writing

Nature and Function of Reports
Types of Reports
Researching for a Business Report
Format, Language and Style
Report Documentation

Module5:

Employment Communication

a. Writing Business Letters— (Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer) 2**L**

b. Creating an Employee Profile—Preparing a CV or Résumé. Creating a Digital/Online Profile–Linked in (Résumé/Video Profile) **2L**

c. Writing Other Interoffice Correspondence--E-mails: types, convention, and etiquette, Memo, Notices and Circulars **2L**
d. Preparing Meeting Documentation—Drafting Notice and Agenda of Meetings, Preparing Minutes of Meetings. **2L**

Reference Books: -

1. Meenakshi Raman and Sangeetha Sharma. *Technical Communication*. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. *Cambridge English for Engineering*. Cambridge: Cambridge University Press, 2008.
3. MarkIbbotson. *Professional English in Use: Engineering*. Cambridge: Cambridge UP, 2009.
4. Lesikaretal. *Business Communication : Connecting in a Digital World.* NewDelhi: Tata McGraw-Hill, 2014.
5. John Seeley. *Writing Reports.* Oxford: Oxford University Press, 2002.
6. Judith Leigh. *CVs and Job Applications*. Oxford: Oxford UniversityPress,2002.
7. Judith Leigh. *Organizing and Participating in Meetings*. Oxford: Oxford

University Press, 2002.
8. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking.*
10. 8thed.London: Longman, 2001.
11. Diana Booher. *E-writing: 21st Century Tools for Effective Communication*.

Links: -

1. Purdue University's Online Writing Lab(OWL)-https://owl.purdue.edu/

2. Business English Pod-https://www.businessenglishpod.com/

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	2	1	1	2	3	-	2
CO2	-	-	-	-	-	1	1	2	2	3	-	3
CO3	-	-	-	-	-	3	3	1	1	3	2	3
CO4	-	-	-	-	-	3	3	1	-	3	-	3
CO5						2	2	2	2	3	-	3

Course Name: Values & Ethics
Course Code: HU202
Credit: 02
Contact (L T P): 2:0:0
Total No. of lectures: 24

Prerequisite: Nil

CO1: Understand the core values that shape the ethical behaviour of an engineer and Exposed awareness on professional ethics and human values.
CO2: understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories
CO3: understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field
CO4: Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer
CO5: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Module 1:
Value: Definition- Importance and application of Value in life- Formation of Value-Process of Socialization- self and integrated personality.
Types of Values-Social, Psychological, Aesthetic, Spiritual, and Organizational-Value crisisin contemporary society: individual, societal cultural and management level.
Module-2
Effects of Technological Growth- Rapid Technological growth and depletion of resources,

Reports of the Club of Rome.
Problems of Technology transfer- Technology assessment impact analysis.
Human Operator in Engineering projects and industries- Problems of man, machine-interaction- Impact of assembly line and automation-Human centered Technology. **(4)**

Module-3

Impact of Ethics on Business Policies and Strategies – Utilitarianism – Principles of Utilitarianism - Criticism of Utilitarianism - Impact on Business Culture - Role of CEO in shaping Business Culture – Ethical Leadership – Characteristics **(4)**

Module-4

Types of Ethical issues - Internal Ethics of Business – Hiring Employees – Promotion - Wages – Job discrimination - its nature and extent- Exploitation of Employees – Discipline and Whistle Blowing **(2)**

Module-5

Markets and consumer Protection – Consumer rights – Unethical Practices in Marketing – Ethics of Competition and Fair Prices – Ethics in Advertising and False Claims - Environmental Protection and Ethics –Pollution Control – Ecological ethics **(4)**

Module-6

Social Responsibilities of Business – Definition and case study of Corporate Compliance; Responsibilities towards Customers, shareholders, employees – Social Audit – Objectives and Need for Social Audit – Methods of Social Audit – Benefits – Obstacles – Social Audit in India. **(6)**

Text Books:

1) A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996
2) .S. K. Chakraborty: Values and Ethics in Organization, OUP

Reference Books:

1) U.C.Mathur, Corporate Governance & Business Ethics, Macmillan, 2005

2. Fernando. A. C., Business Ethics – An Indian Perspective, Pearson Publication, 2009.

3) Prem Vir Kapoor, Professional Ethics & Human Values, Khanna Publishing House, New Delhi

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	-	-	-	-	2	-	3		1	2	1
CO2	-	2	-	-	-	1	-	2	3	3	3	2
CO3	-	-	-	-	-	3	3	2	3	1	3	2
CO4		2				3	3		3		3	2
CO5						3					2	

Course Name: Constitution of India

Course Code: HU203
Credit: 01
Contact (L T P): 1:0:0
Total No. of lectures: 12

Prerequisite: Nil

Course Outcome: On Completion of this course student will be able to

CO1: To Identify and explore the basic features and modalities of Indian constitution.

CO2: To Differentiate and relate the functioning of Indian parliamentary system at the centre and state level.

CO3: To Differentiate the various aspects of Indian Legal System and its related bodies.

Module 1: **History of Making of the Indian Constitution:** History. Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution: Preamble Salient Features **3L**

Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy: 6L

The Right to Equality
The Right to Freedom: I (Article 19)
The Right to Freedom: II (Articles 20, 21 and 22)
The Right against Exploitation
The Right to freedom of Religion
Cultural and Educational rights
The Right to Property
The Right to Constitutional Remedies

Fundamental Duties

Module-3: Organs of Governance: 3L

Parliament - Composition - Qualifications and Disqualifications -Powers and Functions – Executive- President -Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

Text Book:

1) Indian Constitution by D. D. Basu, The Publisher, LexisNexis
2) PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books:

1) Constitution of India by Subhas C Kasyap, Vitasta Publishing
2) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
3) Indian Constitution Text Book - Avasthi, Avasthi,Publisher: LAKSHMI NARAIN AGARWAL

4) Introduction to the Constitution of India, Brij Kishore Sharma, PHI

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	-	-	-	-	2	-	3		1	-	
CO2	-	-	-	-	-	1	-	2		3	-	
CO3	-	-	-	-	-	3	-	2		1	-	

Course Name: Data structure and Algorithm Lab using C/C++
Course Code: ECS 291
Category: -Major Core)
L-T-P: 3-0-0
Credit: 3
Total Lecture: 36

Perquisites: Programming for Problem Solving Lab

Course Objectives:

1. To write and execute programs in C/C++ to solve problems using data structures such asarrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
2. To write and execute write programs in C/C++ to implement various sorting and searching methods

Course Outcome: On Completion of this course student will be able to

CO1: Choose appropriate data structure as applied to specified problem definition.

CO2: Handle operations like searching, insertion, deletion, traversing mechanism on various data Structures.
CO3: Have practical knowledge on the applications of data structures.

CO4: Able to store, manipulate and arrange data in an efficient manner.

CO5: Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

List of Experiments:
1. Basic programming with C++
2. Write a C/C++ program to implement Single Link List
3. Write a C/C++ program to implement Double Link List
4. Write a C/C++ program to implement Single Circular Link List
5. Write a C/C++ program to implement Double Circular Link List
6. Write a C/C++ program to implement Polynomial addition and Polynomial multiplication

using Linked List.

7. Write a C/C++ program to convert a given infix expression into its postfix Equivalent.
8. Write C/C++ programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
9. Write a C/C++ program to implement Binary Search Tree (BST).
10. Write C/C++ programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Insertion sort
    b. Merge sort
11. Write C/C++ programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Quick sort
    b. Selection sort
12. Write C/C++ programs for implementing the following searching methods:
    a. Linear Search
    b. Binary Search
13. Write a C/C++ program to implement all the functions of a dictionary (ADT) using hashing.
14. Write C/C++ programs for implementing the following graph traversal algorithms:
    a. Depth first search
    b. Breadth first search
15. Innovative Experiment

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**1**
CO2	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**3**
CO5	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Course Name: Professional Communication Lab
Course Code: HU291
Contact: (0:0:2)
Total Contact Hours: 26
Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcome:
By pursuing this course the students will be able to:
CO1: Recognize, identify and express advanced skills of Technical Communication in English through Language Laboratory.

CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3: Articulate and present the skills necessary to be a competent Interpersonal communicator.
CO4: Deconstruct, appraise and critique communication behaviors.
CO5: Adapt, negotiate and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Listening in Business Telephony

Module 3: Speaking
a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice
f. Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations

Module 4: Lab Project Work
a. Writing a Book Review
b. Writing a Film Review
c. Scripting a Short Presentation (2 minutes)
d. Making a short video CV (1-2 minutes)

References:
1. IT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasi Kumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
CO1	-	-	**2**	-	-	**1**	**1**	-	**2**	**3**	-	**2**
CO2	-	-	**2**	**2**	-	**3**	**3**	-	**2**	**3**	-	**3**

CO3	**-**	**-**	**2**	**2**	**-**	**3**	**3**	**2**	**2**	**3**	**-**	**3**
CO4	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**2**	**3**	**-**	**3**
CO5	**-**	**-**	**2**	**2**	**-**	**3**	**3**	**2**	**2**	**3**	**-**	**3**

Course Name: Engineering Chemistry Lab
Course Code: CH (ECS) 291
Total Contact Hours: 24
Credit: 1
Contact (L T P): 2:0:0
Prerequisites: 10+2

Course Objective

- Study the basic principles of pH meter and conductivity meter for different applications
- Analysis of water for its various parameters & its significance in industries
- Learn to synthesis Polymeric materials and drugs
- Study the various reactions in homogeneous and heterogeneous medium

Course Outcome

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: Able to analyze and determine the composition and physical property of liquid and solid samples when working as an individual and also as a team member
CO3: Able to analyze different parameters of water considering environmental issues
CO4: Able to synthesize drug and sustainable polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of modern chemistry

Course Content

1. Synthesis of Silver Nano particles doped organic thin film for organic transistors.
2. Preparation of Si-nano crystals for future memory devices.
3. Determination of the concentration of the electrolyte through conductance measurement.
4. Green Synthesis of ZnO based Polymer Nano composites.
5. Determination of the concentration of the electrolyte through pH measurement.

6. Determination of water quality measurement techniques.
7. Isolation of graphene from dead dry batteries and their use for temporary soldering.
8. Synthesis of polymers for electrical devices and PCBs.
9. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
10. Computational optimization of molecular geometry
11. Drug design and synthesis
12. Rheological properties of the Newtonian fluids
13. Innovative Experiments

Mapping of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	-	-	-	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Name: Workshop and Manufacturing Practices Lab
Course Code: ME(ECS)291
Contact: 0:0:3
Credits: 1.5
Prerequisite: Physics & Mathematics (10+2Level)

CO1: Gain basic knowledge of Workshop Practice and Safety useful for our daily living.

CO2: Understand the use of Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc.

CO3: Apply and performing operations like such as Marking, Cutting etc used in manufacturing processes.

CO4: Analyze the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

CO5: Get hands on practice of in Welding and apply various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

Course Content:

3P

(i) Theoretical discussions:

1. Manufacturing Methods-casting, forming, machining, joining, advancedmanufacturing methods
2. Fitting operations &power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing, 3D Printing
8. Plastic moulding &Glass Cutting

(ii) Workshop Practice:

At least 6 modules should be covered

Module 1-Machineshop **6P**

Typical jobs that may be made in this practice module:

i. To make a pin from a mild steel rod in a lathe.

ii. To make rectangular and veeslot in a block of cast iron or mild steel in a shaping and/ or milling machine.

Module2-Fitting shop **6P**

Typical jobs that may be made in this practice module: To make a Gauge from MS plate.

Module3 –Carpentry Shop **6P**

Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.

Module4-Welding & Soldering shop **6P**

Typical jobs that may be made in this practice module:

I. Arc Welding: To join two thick (approx5mm) MS plates by manual metal arc welding.
II. Gas Welding: To join two thin mild steel plates or sheets by gas welding.
III. House wiring, soft Soldering

Module 5–Smithy & Casting **6P**

Typical jobs that may be made in this practice module:

i. As implejob ofmakingasquarerodfromaroundbar or similar.

ii. One/twogreensandmouldstoprepare, andacastingbedemonstrated.

Module6– CNC Machining & LaserCutting **6P**

Typicaljobsthatmaybemadeinthispracticemodule:

i. Atleastonesample shape on mild steel plate shouldbe made using CNC Milling / CNC Lathe Machine

ii. Atleastonesampleshape onglassshouldbe madeusinglasercuttingmachine.

Module 7 – 3D Printing **6P**

i) Exposure to a 3D printing machine,

ii) 3D printing of at least one sample model using available materials.

Examinationscouldinvolvetheactualfabricationofsimplecomponents, utilizingoneormoreofthetechniques coveredabove.

TextBooks:

1. HajraChoudhuryS.K., HajraChoudhuryA.K.andNirjharRoyS.K.,–ElementsofWorkshopTechnology‖,Vol.I2008andVol.II2010,Media promotersandpublishersprivatelimited,Mumbai.
2. RaoP.N.,–ManufacturingTechnology‖,Vol.Iand Vol.II, TataMcGrawHillHouse,2017.

ReferenceBooks:

1. GowriP.,HariharanandA.SureshBabu, ManufacturingTechnology–I,PearsonEducation,2008.
2. RoyA.Lindberg,–Processes and MaterialsofManufacture‖, 4thedition,PrenticeHallIndia,1998.
KalpakjianS.andStevenS.Schmid,Manufacturing EngineeringandTechnology,4thedition,PearsonEducationIndiaEdition,2002.
4. ManufacturingScience byA.GhoshandA.K.Mallick,WileyEastern.
5. PrinciplesofMetalCutting/PrinciplesofMachineTools by G.C. SenandA.Bhattacharya,NewCentralBookAgency,Kolkata.

of COs with POs: (Detailed: High:3; Medium:2; Low:1):

CO Codes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	2	-	2	2	-	-
CO2	3	-	-	-	-	-	2	-	2	2	-	-
CO3	3	-	-	-	-	-	2	-	2	2	-	-
CO4	3	-	-	-	-	-	2	-	2	2	-	-
CO5	3	2	2	-	-	-	2	-	2	2	-	-

Course Name: Digital Electronic Circuits

Course Code: ECS301

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Prerequisite: Concept of basic electronics and number system

Course Objective:

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To introduce number systems and codes

3. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
4. To give students the basic tools for the analysis and design of combinational circuits and sequential circuits
5. To introduce the concept of memories, programmable logic devices and digital ICs.
6. To acquire the knowledge of Digital-to-Analog Conversion, Analog-to-Digital Conversion.

Course Outcome(s):
On completion of this Subject/Course the student shall be able to:

CO1: give Interpretation of the fundamental concepts and techniques used in digital electronics.
CO2: apply the concept of various number systems in digital design.
CO3: analyze and design various cost effective combinational and sequential **circuits.**
CO4: solve real life complex circuit problems by applying knowledge of digital electronics.

Module1:
Introduction:
Digital system, Comparison between Analog and Digital system, Logic level, Element of Digital Logic, Functions of Digital logic.
Data and number systems:
Number system: Binary, Octal and Hexadecimal representation and their conversions.
Number Representation: Signed binary number representation with 1's and 2's complement methods, Fixed point - Floating point
Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting codes- properties
Binary Arithmetic: Addition, subtraction, Multiplication, Division, Addition and subtraction by 1's and 2's complement, BCD addition and subtraction [5]

Boolean algebra:
Theorems and operations, Boolean expressions and truth tables, Representation in SOP and POS forms Boolean functions; Min-term and Max-term expansions Minimization of logic expressions by algebraic method, K-map method and Quine- Mc Clauskey method

Various Logic gates- their truth tables and circuits; Design of circuits with universal gates. Exclusive-OR and Exclusive NOR and equivalence operations [6]

Module II:
Design procedure–Adder: and Subtractor circuit: half and full adder and subtractor, BCD adder and subtractor, controlled inverter.
Convertors: BCD to excess-3 and vice versa, Binary to BCD, Gray to binary and vice versa.
Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker. [7]

Module III:
Sequential Logic:
Basic memory Element-S-R, J-K, D and T Flip Flops-Truth table and Excitation table, Conversion of Flip-flop, Various types of Registers and their design and application, Synchronous and Asynchronous counters, Irregular counter- counter design [5]

Sequential Circuits Design: State diagrams and tables, transition table, excitation table, Examples using flip-flops. Analysis of simple synchronous sequential circuits, construction

of state diagram, State Machine-Mealy and Moore machine [5]

Module IV:
Memory Systems: RAM: Static RAM and Dynamic RAM, ROM, EPROM, EEROM
Programmable logic devices: programmable read only memory, programmable logic arrays and programmable array logic, Design using PLA, PAL, PROM [2]

Logic families:
TTL, ECL, MOS and CMOS, their operation and specifications: Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin. Implementation of Logic gate using TTL, MOS [2]

Different types of A/D and D/A:
Conversion techniques: analog-to- digital (successive approximation, Dual slope, flash) and digital-to- analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADCs and DACs (resolution, quantization, significant bits, [4]

Text Books:
1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2. Morries Mano- Digital Logic Design- PHI
3. R.P.Jain—Modern Digital Electronics
4. Digital Integrated Circuits -- Taub and Schilling .Mcgraw Hill

Reference Books*:*
1. Digital Fundamental, Floyd-PHI
2. Digital, Principle and Application, Leach Malvino,Mcgraw Hill

Mapping of COs with POs and PSOs:: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	3	-	-	-	-	-	-	-	-	2	2	3

Course Name: Computer Organization and Architecture

Course Code: ECS302

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Course Outcome(s):
On completion of this Subject/Course the student shall be able to:

CO1: To implement pipelining concepts and parallelism techniques with a knowledgeof stored program methods.
CO2: To evaluate the performance of each type of memory in the hierarchy

CO3: To evaluate different mapping techniques.
CO4: To analyze the SIMD and MIMD architecture and their interconnection techniques**.**

Course Content:

Module1: Introduction
Introduction to basic computer architecture, Stored Program Concepts: Von Neumann & Havard Architecture, RISC VS CISC, Amdahl's law, Performance Measure: MIPS, Benchmark Programs(SPECINT, SPECFP)
[5L]

Module2:
Different Classification Scheme: Serial Vs. Parallel, Pipelining: Basic concepts, Linear vs. Nonlinear, Static vs. Dynamic, Unifunction vs. Multifunction, Instruction Pipeline, Arithmetic pipeline, Hazards: Data hazards, control hazards and structural hazards, Techniques for handling hazards

[7L]
Module 3:
Pipeline vs. Parallelism, Levels of parallelism, Instruction-Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures, Array and Vector Processors

[5L]

Module 4:
Memory Hierarchy: Secondary memory, Main Memory, Cache Memory, Cache coherence and synchronization mechanisms, Mapping Technique in cache memory: Direct, Full Associative and Set Associative, Performance Implementation in Cache Memory, Virtual memory Concepts, page replacement policies
[
11L]

Module 5:
Multiprocessor
architecture Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW, CREW, CRCW) , Centralized and Shared-memory architecture: synchronization, Interconnection Network (Omega, Baseline, Butterfly, Crossbar)

[8L]

Text Books*:*
1. 'Advanced Computer Architecture Parallelism Scalability Programmability', Tata McGraw Hill Education Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10: 0-07-053070-X **2.** Hwang &Briggs—Computer Architecture & Parallel Processing, TMH

Reference Books:
1. Patterson D.A. and Hennessy, J.L. "Computer architecture a quantitative approach", 2nded., Morgan Kaufman, 1996
2. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill

3. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed.,Mc GrawHill, 1990
4. Design and Analysis of Parallel Algorithm-Schim G. Akl

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3

Course Name: Object Oriented Programming with Java

Course Code: ECS303

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Course Objectives:

1. It allows to map with real world Object (Object orientation) rather than action (Procedure) that comes to produce software as separated code modules which rise up decoupling and increases code re-usability.
2. It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
3. It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
4. It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
5. It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcomes:

CO1: Design the process of interaction between Objects, classes & methods with respect to ObjectOriented Programming.

CO2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CO3: Analyze various activities of different string handling functions with various I/O operations.CO4: Discuss basic code reusability feature with respect to Inheritance, Package and Interface.

CO5**:** Implement Exception handling, Multithreading and Applet (Web program in java)programming concept in Java

Course Content:

Module 1: Introduction:
Object Oriented Analysis & Design-Concepts of object-oriented programming language, Object, Class**;** Relationships among objects and Classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class**;** Object Oriented Programming concepts - Difference between OOP and other conventional programming advantages and disadvantages. Class, object, Method**;** Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction**;** Difference between different OOPs Languages.

[5L]

Module 2: Java Basics:
Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables**;** Access specifiers, Operators, Control statements & loops**;** Array**;** Creation of class, object, method**;** Constructor- Definition, Usage of Constructor, Different types of Constructor**;** finalize method and garbage collection, Method & Constructor overloading**;** this
keyword, use of objects as parameter & methods returning objects**;** Call by value & call by reference**;** Static variables & methods. Nested & inner classes.

[9L]

Module 3: Basic String handling & I/O:
Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring()**;** toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt()**;**ensure Capacity(), getChars(), indexOf(), insert(), length(), setCharAt(), set Length(), substring(), to String()**;** Command line arguments, basics of I/O operations – keyboard input using Buffered Reader & Scanner classes.

[
5L]

Module 4: Inheritance and Java Packages:
Inheritance - Definition, Advantages, Different types of inheritance and their implementation; Super and final keywords, super() method; Method overriding, Dynamic method dispatch; Abstract classes & methods; Interface - Definition, Use of Interface; Multiple inheritance by using Interface; Java Packages -Definition, Creation of packages; Importing packages, member access for packages.
[8L]

Module 5: Exception handling, Multithreading and Applet Programming:
Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception**;** Try & catch related case studies, Throw, throws & finally**;** Creation of user defined exception**;** Multithreading - Basics, main thread, thread life cycle**;** Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), is Alive()**;**Thread priorities, thread synchronization**;** Interthread communication, deadlocks for threads**;** Applet Programming - Basics, applet life cycle, difference between application & applet programming**;** Parameter passing in

[10
L]

Text books:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall,India
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks:Theory and Practice"

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	-	1	-	-	-	1	1	3	2	2
CO2	3	2	3	1	2	-	-	-	-	-	1	1	3	2	1
CO3	3	3	2	3	2	-	2	-	1	-	2	2	2	2	1
CO4	2	-	2	2	2	-	-	-	2	-	1	2	2	2	2
CO5	2	-	3	1	2	-	-	-	2	-	2	2	2	1	3

Course Name: Circuit Theory and Networks

Course Code: EE(ECS)301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3
Pre-Requisite: Concept of Basic electrical and circuitry

Course Outcomes:

On completion of this Subject/Course the student shall be able to:

CO1: Solve complex circuit problem by applying knowledge of circuit theorems.

CO2: Analyze dynamic performance of the networks using Laplace Transform.

CO3: Find out resonance of different circuit.

CO4: Analyze two port networks using A, B, C, D and Z, Y Parameter Model.

Course Contents:

Module1:

Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent Source Transformation, Star-Delta conversion

[
5L]

Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Loop variable analysis, Super mesh Analysis, Node variable analysis, Supernode Analysis

Network theorem: Superposition, Thevenin's, Norton's, Maximum power transfer, Compensation & Reciprocity theorem. Millman's theorem and its application. Solution of Problems with DC & AC sources. [7L]

Module 2:

Laplace transforms: Concept of complex frequency, properties of Laplace Transform, Initial ValueTheorem and Final Value Theorem, Concept of Convolution theorem and its application, Transformation of step, ramp, impulse, exponential, damped and undamped sine & cosine functions. Laplace Transform of Gate function & its application. Laplace transform of Periodic function. Inverse Laplace Transform, application of Laplace Transform in circuit analysis [7L]

Circuit Transients: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions using AC & DC source. Solutions of Problems with DC & AC sources [5L]

Module 3:

Two port network analysis: Open circuit Impedance & Short circuit Admittance parameters, Transmission parameters, Hybrid parameters and their inter relations. Condition of Reciprocity & symmetry. Interconnection of two port networks. Solution of Problems with DC & AC sources. [6L]

Resonant Circuits: Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Solution of problems [3L]

Module 4:

Graph of Network: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality of networks, solution of problems.[3L]

Text Books:

1. Network Analysis, M.E.Van Valkenburg (Prentice H all)
2. Engineering Circuit Analysis, W.H.Hayt, J.E.Kenmerly, S.M.Durbin,(TMH)
3. Network and Systems, D.Roychowdhury,(New Age International)

Reference Books:

1. Network and Systems, Ashfaq Husain,(Khanna Book Publisher)
2. Modern Netwok Analysis, F.M.Reza & S.Seely, McGraw Hill.
3.Circuits and Networks: Analysis and Synthesis Paperback , A. Sudhakar, Shyamm o Palli(TMH)

4. Network Analysis And Synthesis, C L Wadhwa ,(New Age International)

Mapping of COs with POs and PSOs:: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO2	3	2	1	2	2	-	-	-	-	-	-	-	3	1	3
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	1	3
CO4	3	2	1	1	1	-	-	-	-	-	-	-	2	2	3

Course Name: Electromagnetic Theory and Transmission Line

Course Code: EC(ECS)301

Contact (periods/week): L-T-P: 3-0-0

Credit point: 3

Total number of lectures: 36

Course Objectives:

1. To acquire the knowledge of Electromagnetic field theory that makes the student to get a theoretical foundation to be able in the future to design emission, propagation and reception of electromagnetic wave systems
2. To identify, formulate and solve the problems related to fields and electromagnetic waves propagation in a multidimensional frame
3. Understand the basic concepts of electric and magnetic fields
4. To provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies
5. Understand the concept of conductors, dielectrics, inductance and Capacitance, Gain knowledge on
6. the nature of magnetic materials. Understand the concept of static and time varying fields.

Course Outcomes:

Student will be able to:

CO1: understand and interpret the physical meanings of gradient, divergence and curl, vector calculus and orthogonal coordinates.

CO2: apply the concept of steady fields and different associated laws in different cases and mediums and realize the physical significances of Maxwell's equations for static field.

CO3: solve different problems of the time varying fields and correlate the Poynting ve theorem.

CO4: understand the thorough treatment of the theory of electro dynamics, mainly from a classical field theoretical point of view, and includes such things as electrostatics and magneto statics, boundary conditions.

CO5: analyze the wave equations, and be able apply the concepts in transmission line, wave guide.

CO6: explain universal concepts in three-dimension real world, i.e., electro-magnetic wave propagation in free-space, dielectrics, conductors.

Module I

Introduction to the Electromagnetic Theory, Vector calculus – orthogonal Coordinate Systems, Curvilinear co-ordinate system (basics). Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl – their physical interpretations; Divergence Theorem, Stoke's Theorem, Laplacian operator. 6L

Module II

Coulomb's law, electric field intensity, charge distribution.; Gauss' law, flux density and electric field intensity. Current Densities, Conductors, Poisson's & Laplace's equations, Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential. Maxwell's equations for static field. Study of different Applications on static fields using MATLAB Programming . 6L

Module III

Faraday's law & Lenz's law, Displacement Current, J C – J D Relation, Maxwell's equations for time varying field, Time harmonic fields, Maxwell's equations for time harmonic field, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Free space, good conductor, skin effect and skin depth. Poynting Theorem, Power flow, Poynting vector. Wave polarizations. 10L

Module IV

Transmission Lines: Concept of Lump parameters and Distributed parameters, Line Parameters, Transmission line equations and solutions, Physical significance of the solutions. Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation, group velocity, phase velocity; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith chart, Load Matching Techniques. 9L

Module V

Transmission line at microwave frequency; brief of rectangular waveguide, circular w resonators, concept of cavity, Basics of Antenna. 5L

Text Books:

1. Mathew N.O. Sadiku , Principles of Electromagnetics, 4th Edition
2. W.H. Hayt & J.A. Buck, Engineering Electromagnetics, 7th Edition, Tata- McGraw-Hill
3. Edminister , Theory and Problems of Electromagnetics , 2nd Edition, Tata-McGraw- Hill

References:

1. S.P. Seth, Elements of Electromagnetic Fields
2. Syed Hasan Saeed And FaizanarifKhan , Electromagnetic Field Theory
3. G.S.N. Raju , Electromagnetics Field Theory & Transmission Lines, Pearson

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	1	1	1	1	1	1	1	2	2	3	1
CO2	3	3	1	3	1	1	1	1	1	1	1	2	2	2	1
CO3	3	3	1	3	1	1	1	1	1	1	1	2	2	3	1
CO4	3	3	1	3	1	1	1	1	1	2	1	3	2	3	3
CO5	3	3	2	3	2	1	1	1	1	2	1	1	1	2	2
CO6	3	3	2	3	2	2	1	1	1	1	1	1	1	2	2

Course Name: Digital Electronic Circuits Lab

Course Code: ECS391

Contact: 0:0:3

Credits: 1.5

Course Outcome:

On completion of this course students will be able to:

CO1: operate laboratory equipment.

CO2: design digital circuits

CO3: construct, analyze, and troubleshoot the digital circuits.

CO4: measure and record the experimental data, analyze the results and prepare a formal laboratory report

List of Experiment:

1. Realization of basic gates using Universal logic gates
2. Code conversion circuits- BCD to Excess-3 & vice-versa
3. 4-bit parity generator & comparator circuits
4. Construction of simple Decoder & Multiplexer circuits using logic gates
5. Design of combinational circuit for BCD to decimal conversion to drive 7segment display using multiplexer
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK & D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops & logic gates.
9. Realization of Universal Register using multiplexer & flip-flops.
10. Realization of Asynchronous and Synchronous Up/Down counter.

11. Design of Sequential Counter with irregular sequences.
12. Realization of Ring counters.
13. Innovative Experiment.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	3	1	1	1	1	1	1	1	3	3	2
CO2	2	2	3	1	1	1	1	1	1	1	1	2	2	2	2
CO3	2	2	3	2	1	1	1	1	1	1	1	1	1	2	2
CO4	3	3	2	2	1	1	1	1	2	1	1	2	1	2	1

Course Name: Computer Organization and Architecture

Course Code: ECS392

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Course Outcomes:

CO1: To implement pipelining concepts and parallelism techniques with a prior knowledgeof stored program methods.

CO2: To evaluate the performance of each type of memory in the hierarchy

CO3: To evaluate different mapping techniques.

CO4: To analyse the SIMD and MIMD architecture and their interconnection techniques.

Course Content:

Module1: Introduction

Introduction to basic computer architecture, Stored Program Concepts: Von Neumann & Havard Architecture, RISC VS CISC, Amdahl's law, Performance Measure: MIPS, Benchmark Programs(SPECINT,SPECFP)

[5L]

Module2:

Different Classification Scheme: Serial Vs. Parallel, Pipelining: Basic concepts, Linear vs. NonLinear, Static vs. Dynamic, Unifunction vs. Multifunction, Instruction Pipeline, Arithmetic pipeline, Hazards: Data hazards, control hazards and structural hazards, Techniques for handling hazards

[7L]

Module 3:

Pipeline vs. Parallelism, Levels of parallelism, Instruction-Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures, Array and Vector Processors

[5L]

Module 4:

Memory Hierarchy: Secondary memory, Main Memory, Cache Memory, Cache coherence and synchronization mechanisms, Mapping Technique in cache memory: Direct, Full Associative and Set Associative, Performance Implementation in Cache Memory, Virtual memory Concepts, page replacement policies

[

11L]

Module 5:

Multiprocessor

architecture Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW, CREW, CRCW) , Centralized and Shared-memory architecture: synchronization, Interconnection Network (Omega, Baseline, Butterfly, Crossbar)

[8L]

Text Books:

1. 'Advanced Computer Architecture Parallelism Scalability Programmability', Tata McGraw Hill Education Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10: 0-07-053070-X **2.** Hwang &Briggs—Computer Architecture & Parallel Processing, TMH

Reference Books:

1. Patterson D.A. and Hennessy, J.L. "Computer architecture a quantitative approach", 2nded., Morgan Kaufman, 1996
2. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill
3. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed.,Mc GrawHill, 1990
4. Design and Analysis of Parallel Algorithm-Schim G. Akl

Mapping of COs with POs and PSOs:: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	3	-	-	-	-	-	-	-	-	3	2	3

Course Name: Object Oriented Programming with Java

Course Code: ECS393

Contact: 0:0:3

Credits: 1.5

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Objectives:

- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the samejob, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't haveto write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changingor copying them in any way. (Inheritance)

Course Outcome(s):

CO1: Create the procedure of communication between Objects, classes & methods.

CO2: Understand the elementary facts of Object Orientation with various characteristics as wellas several aspects of Java.

CO3: Analyze distinct features of different string handling functions with various I/O operations.

CO4: Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.

CO5: Apply Exception handling, Multithreading and Applet (Web program in java)programming concept in Java.

Course Contents:

Module 1: Java Basics:

1. Simple Java programming using operators, control statements & loops, array.
2. Programming on class, object, and method, access specifier.
3. Programming on constructor, method/constructor overloading.
4. Programming on this keyword, call by value & call by reference, static variables & methods, innerclasses.

Module 2: Basic String handling & I/O: Programming to show the use of String class methods - charAt(), compareTo(), equals(), equals Ignore Case(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods.

1. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(),

delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods.

2. Programming on Command line arguments.
3. Programming using keyboard input by implementing Buffered Reader & Scanner classes.

Module 3: Inheritance, Interface and Java Packages:

1. Programming on Simple Inheritance, super and final keywords, super () method.
2. Programming on method overriding, dynamic method dispatch, abstract classes & methods, multiple inheritance by using interface.
3. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, sub classing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package.

Module 4: Exception handling, Multithreading and Applet Programming:

1. Programming on exception handling using try-catch block, implementing throw and throwskeywords, using finally block, creating user-defined exception.
2. Programming on creating child threads i) by extending thread class ii) by implementing runnableinterface, creating child threads by assigning thread priorities.
3. Programming on creating simple applet to display some message, creating applet two add 2integers, creating applet to do GUI based programming.

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming with Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall,India

Mapping of COs with POs and PSOs:: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	-	-	-	1	-	-	1	3	3	3
CO2	3	2	2	-	1	-	-	-	1	-	-	2	3	2	3
CO3	2	3	2	3	-	-	-	-	2	-	-	-	2	2	3
CO4	1	-	-	-	-	-	-	-	1	2	-	2	3	2	3

Course Name: Circuits and Networks Lab
Course Code: EE(ECS)391

Contact: 0:0:2
Credits: 1

Course Objectives:

1. To acquaint students with the simulation software such as MATLAB to carry out designexperiments as it is a key analysis software of engineering design
2. To generate different signals and transform those to s- domain using MATLAB
3. To verify various network theorem and other network aspects using SIMULINK.
4. To provide basic laboratory experience with analyzing the frequency response of differentfilters using simulation software.

Course Outcomes:

On completion of this Subject/Course the student shall be able to:

CO1: Apply the techniques and skills of modern engineering tools necessary for engineering practice.
CO2: Identify, formulate and solve engineering problems with simulation software.
CO3: Analyze transient response of series /parallel R-L-C circuit usingsimulation software.
CO4: Determine frequency response of different filters using simulation software

List of Experiments:

1. Introduction to MATLAB
2. Generation of Periodic, Exponential, Sinusoidal, damped sinusoidal, Step, Impulse,Ramp signals using MATLAB in both discrete and analog form
3. Verification of Network Theorems using simulation software
4. Determination of Laplace transform and inverse Laplace transformation using MATLAB
5. Transient response in R-L and R-C Network: Simulation/hardware
6. Transient response in R-L-C Series circuits Network: Simulation and hardware.
7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
8. Frequency response of LP and HP filters: Hardware
9. Frequency response of BP and BR filters
10. Evaluation of convolution integral for periodic & non-periodic signal using MATLAB
11. Innovative Experiment

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2		

CO2	**3**	**2**	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**3**
CO3	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**
CO4	**1**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**3**

Course Name: Numerical Method Lab
Course Code: M(ECS)391
Contact: 0:0:2
Credits: 1
Prerequisite: The students to whom this course will be offered must have the concept of any introductory course on programming language (C/ Matlab).

Course Objective: The purpose of this course is to provide basic programming skills for solving the Problems in numerical methods.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Apply the programming skills to solve the problems using numerical approaches.

CO2: Analyze and interpret the results of numerical approaches using command.

CO3: Judge the multiple numerical approaches in terms of their accuracy level.

CO4: Design and develop effective programs for numerical approaches to solve the engineering problems.

Course Content:

List of Programming:

1. Assignments on Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule and Romberg Integration.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method,

Runge-Kutta methods, Taylor series method.

6. Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

Text Books:

1. Scarborough, J. B., Numerical Mathematical Analysis, Oxford University Press.
2. Kanetkar, Y., Let us C, BPB Publication,15 th Edition
3. Gupta, S. and Dey, S., Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
4. Balagurusamy, E., Numerical Methods, Scitech. TMH.

Reference Books:

1. Xavier, C., C Language and Numerical Methods, New age International Publisher.
2. Venugopal, K. R. and Prasad, S.R., Mastering-C, TMH, 2 nd Edition.
3. Guha, S. and Srivastava, R. Numerical Methods, Oxford Universities Press.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PS O3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO2	3	3	2	-	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	3	3	3

Course Name: Microprocessors and Microcontrollers
Course Code: ECS401
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36
Prerequisite: Concept of Digital electronics
Course Objectives:

1. To understand the architectures of 8085 & 8086 microprocessors and 8051 microcontrollers.
2. To familiarize with the assembly level programming technique.
3. To understand interfacing of 8-bit microprocessor /microcontroller with memory and peripheral chips involving in system design.
4. To be able to design a microprocessor /microcontroller-based system.

Course Outcomes:

On completion of this course, students will be able to

CO1: Apply the knowledge of the internal architecture of 8085 microprocessor for a specific application.
CO2: Apply the knowledge of the internal architecture of 8051 microcontroller for a specific application.
CO3: Apply the knowledge of interfacing circuits to some real time applications.
CO4: Write 8085 & 8051 Assembly level programs using instruction set.

Course Contents:

Module1: Microprocessor Architecture and Interfacing

Introduction to microprocessors, Evolution of microprocessors, The 8085 Internal architecture, Instruction set and Assembly Language Programming. Addressing Modes. Timing diagrams, Interfacing memory, Interfacing I/O devices. Programmable peripheral Interface (PPI) – Intel 8255. **[12L]**

Module 2: Microcontroller Architecture: Intel 8051

Microcontroller 8051 - Organization and Architecture, pin configuration, memory Organization, I/O ports functions, External Memory interfacing. I/O Ports, Timers-Counters, Serial Communication and Interrupts. **[12L]**

Module 3: Assembly Language Programming with 8051

Instruction set: Addressing modes, Data Processing - Stack, Arithmetic, Logical; Branching – Unconditional and Conditional, Calls & Subroutines. Assembly language program. **[8L]**

Module 4: I/O interfacing with 8051

LCD, LED, Keypad, Analog-to-Digital Convertors, Digital-to-Analog Convertors, Sensor with Signal Conditioning Interface. **[4L]**

Text Books:

1. Ramesh S. Gaonkar , Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989.
2. Muhammed Ali Mazidi and Janice GillispieMazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education Inc.
3. Kenneth J. Ayala – The 8051 Microcontroller, Architecture, Programming and Applications, West Publishing Company

Reference Books:

1. B.Ram , Fundamental of Microprocessor and Microcontrollers, DhanpatRai Publications.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley interscience publications, 1980.
3. Ajay V Deshmukh – Microcontrollers Theory and Applications, Tata McGraw-Hill

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	P O1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	1	1	1	1	1	3
CO2	3	3	2	3	2	2	1	1	1	1	1	3
CO3	3	2	3	2	2	2	1	1	1	1	1	3
CO4	3	2	3	3	2	2	1	1	1	1	1	3

Course Name: Operating Systems
Course Code: ECS402
Contact Hours: 3:0:0
Credit: 3
Total Contact Hours: 36L

Course Objectives

1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.
3. To understand what a process is and how processes are synchronized and scheduled.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.
6. Students should understand the data structures and algorithms used to implement an OS.

Course Outcomes

CO1: Describe how computing resources such as CPU, memory and I/O are managed by the operating system.

CO2: Analyze kernel and user mode in an operating system.

CO3: Solve different CPU scheduling problem to achieve specific scheduling criteria.

CO4: Apply the knowledge of process management, synchronization, deadlock to solve basic problems.CO5: Evaluate and report appropriate design choices when solving real-world problems

Course Content:

Module1:

Functionalities of Operating System, Evolution of Operating System. Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security. [5L]

Module2:

Processes: Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, Inter process communication: Message passing, Inter process communication of multi core processor.

[2L]

Module 3:

Threads: overview, benefits of threads, user and kernel level threads, Thread models, Programmingon Multithreading using Pthread. [2L]

Module 4:

CPU scheduling: scheduling criteria, preemptive& non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling), Overview of thread scheduling [5L]

Module 5:

Process Synchronization: background, critical section problem, synchronization hardware, classicalproblems of synchronization (producer-consumer, readers-writer, dining philosophers, etc), semaphores, monitors. [6L]

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

Module 6:

Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB. [3L]

Virtual Memory: background, demand paging, replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model. [3L]

Module 7:

Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK,C-LOOK etc),disk reliability, disk formatting, boot block, bad blocks. [2L]

File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit

vector). Overview ofNTFS and FAT [2L]

I/O: I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O. [2L]

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.
2. Operating Systems& Systems Programming by P Balakrishna Prasad

Reference Book:

1. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.
2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall. 3. William Stallings, OperatingSystems, Prentice Hall.

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	3	2	2	3	3	3	2	3	3	3	3
CO2	3	2	2	2	2	2	3	2	2	3	3	2	3	1	3
CO3	3	3	3	2	3	3	3	2	2	3	3	2	2	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2

Course Name: Data Base Management System
Course Code: ECS403
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depicta database system
2. To design system using E-R diagram.
3. To learn SQL& relational database design.
4. Tounderstandtheinternalstoragestructuresusingdifferentfileandindexingtechniques.
3. To know the concepts of transaction processing, concurrency control techniques and recoveryprocedure

Course Outcomes

On completion of the course students will be able to
CO1: Apply the knowledge of Entity Relationship (E-R) diagram for an application.CO2: Create a normalized relational database model
CO3: Analyze real world queriest o generate reports fromat.
CO4: Determine whether the transaction satisfies the ACID properties.
CO5: Create and maintain the database of an organization.

Course Contents

Module 1: Introduction

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

[3L]

Module 2: Entity-Relationship and Relational Database Model

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. E-R Model to Relational Model Mapping.

[5 L]

Module3:

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

[4L]

Module 4: SQL and Integrity Constraints

Concept of DDL, DML, DCL. Basic Structure, set operations, Aggregate Functions, Null Values, Primary Key Integrity Constraints, Referential Integrity Constraints, Domain Constraints, assertions, views, Nested Sub-queries, Database security application development using SQL, Stored procedures and triggers. **[6L]**

Module 5: Relational Database Design

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, 1NF, 2NF, 3NF, Boyce-Codd Normal Form, Normalization using multi- valued dependencies, 4NF, 5NF, Case Study **[6L**

Module 6: Internals of RDBMS

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling **[6L]**

Module 7: File Organization & Index Structures

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

[6L]

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramezand Novathe Shamkant, "Fundamentals of Database systems",BenjaminCummings Publishing Company.

Reference Books:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, AddisonWesley Publishing Edition
4. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGrawHill
5. Ramakrishnan: Database Management System , McGraw-Hill
6. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques",Moragan Kauffman Publishers.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Mapping of COs with POs and PSOs:: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	1	1	2	2	3	3	3	3	3
CO2	2	3	3	3	3	1	1	1	2	2	3	3	3	1	2
CO3	3	3	2	3	3	2	2	2	3	3	3	3	2	2	1
CO4	3	3	2	2	2	1	1	1	1	1	2	3	3	1	2

Course Name: Analog Electronic Circuits
Course Code: EC(ECS)401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Concept of basic electronics devices, basic law of circuit analysis

Course Objective:

1. Provide a strong foundation on Linear Circuits.
2. Familiarize students with applications of various IC's.
3. Having a broad coverage in the field that is relevant for engineers to design Linear circuits using Op-amps.
4. Familiarize the conversion of data from Analog to Digital and Digital to Analog.

Course Outcome:
At the end of this course students will be able to
CO1: Explain the characteristics of diodes and transistors
CO2: Illustrate working principle of various rectifier and amplifier circuits and their application in real life.
CO3: Design and analysis of negative feedback amplifiers and oscillators.
CO4: Analyse the functioning of OP-AMP and design OP-AMP based circuits
CO5: Design ADC and DAC

Module I: **[4]**
Small signal amplifiers: Introduction to Analog Integrated Circuits, BJT Modeling-hybrid model of transistors; Emitter follower circuits, High frequency model of transistors. FET Small signal analysis – Source follower

Module II: **[9]**
Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

Feedback Amplifiers & Oscillators: Feedback concept, Voltage series-shunt, current series-shunt feedback Configurations, Barkhausen criterion, Colpitts, Hartley's, Phase shift, Wien bridge and crystal oscillators

Module III: **[14]**
Operational Amplifier: Introduction to Integrated Circuits, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Block Diagram of OPAMP, Ideal OPAMP

Applications of Operational Amplifiers: analog adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Analog multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running Multivibrator , zero crossing detector

Multivibrator – Monostable, Bistable, Astable multivibrators ; Monostable and astable operation using

555 timer.

Module IV: **[9]**

Large signal Amplifiers: Introduction to power amplifiers (Class A, B, AB)

Power Supply:

Analysis for DC voltage and ripple voltage with C, L-C and C-L-C filters in Rectifier Circuit - Regulated DC power supplies- Line regulation, output resistance and temperature coefficient, Series and Shunt Voltage Regulation – percentage regulation, Fixed output voltage IC regulator 78xx and 79xx series, Adjustable output voltage regulator, LM 337 series power supply ICs, "Concept of Switched Mode Power Supply`

Text Books:

1. Millman Halkias – Integrated Electronics, McGraw Hill
2. Schilling & Belove—Electronic Circuit: Discrete & Integrated, 3/e, McGraw Hill
3. Ramakant A. Gayakwad —Op- Amps and linear Integrated Circuits, Pub: PHI
4. Boylested&Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. "Operational Amplifiers and Linear Integrated Circuits" by Robert F. Coughlin, Frederick F. Driscoll

Reference Books:

1. Rashid-Microelectronic Circuits- Analysis and Design- Thomson (Cenege Learning)
2. Linear Integrated Circuits – D. Roy Choudhury &Shail B. Jain
3. Analog Integrated Circuits – J. B. Gupta

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	1	1	1	1	1	1	1	1	1	3	3	3
CO2	3	1	1	1	1	2	1	1	1	1	1	1	3	1	2
CO3	3	2	3	1	1	1	1	1	1	1	1	1	3	2	3
CO4	2	3	1	1	1	1	1	1	1	1	1	1	3	2	2

Course Name: Microprocessor and Microcontroller Lab
Course Code: ECS491
Contact: 0:0:3
Credits: 1.5

Course Objectives:

1. To enable the students, analyze microprocessors and microcontrollers.
2. To grow programming concept using microprocessor.
3. To make students able to write programs, interface with peripherals and implement them in projects.
4. To be able to choice suitable microprocessors and microcontrollers for any design and implementations.
5. To be able to interfacing microprocessors and microcontrollers with peripheral devices.

Course Outcomes:

After completion of this course, the students will be able to

CO1: Write microprocessor based programs to solve any given problem statement.

CO2: Write microcontroller based programs to solve any given problem statement.

CO3: Design microprocessor based systems for real time applications.

CO4: Design microcontroller based interfacing as per the requirements.

List of Experiment:

1. Familiarization with 8085 and 8051 trainer kit components.
   a) Program development using basic instruction set (data transfer, Load/ Sore, Arithmetic, Logical) using 8085 and 8051 trainer kit such as
   b) Addition and subtraction
   c) Copying and shifting a block of memory
   d) Packing and unpacking of BCD numbers
   e) Addition of BCD numbers
   f) Binary to ASCII conversions
   g) String matching
   h) Multiplication of two numbers
   i) Sorting of array of numbers
2. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit, write subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc.
3. ADC interfacing with 8051 trainer kit.
4. Innovative experiment

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	3	3
CO2	1	2	-	3	-	-	-	-	-	-	-	1	1	2	2
CO3	1	2	-	-	-	-	-	-	3	-	-	1	2	2	3
CO4	2	3	1	1	1	-	-	1	-	-	-	1	2		

Course Name: Operating Systems Lab
Course Code: ECS492
Contact: 0:0:3
Credits: 1.5

Course Objectives

1. To familiarize the students with the Operating System.
2. To demonstrate the process, memory, file and directory management issuesunder the UNIX/LINUX operating system
3. To introduce LINUX basic commands
4. To make students how to make simple programs in LINUX and administrative task of LINUX

Course Outcomes

CO1: Analyze different aspects of Linux.
CO2: Create or design different scripts using shell programming.
CO3: Implement process, thread, semaphore concept of operating system.
CO4: Create shared memory with the implementation of reading from, write into shared memory.

List of Experiments:

1. Essential Linux Commands: Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find, sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc. Mathematical commands –expr, factor, units, Pipes (use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)

2. Shell Programming: Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

3. Process [3P]: Starting new process, replacing a process image, duplicating a process image.

4. Semaphore: Programming with semaphores (use functions semget, semop, semaphore_p, semaphore_ v).

5. POSIX Threads: Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_ cancel)

6. Shared Memory: Create the shared memory, Attach the shared memory segment to the address space of the calling process, Read information from the standard input and write to the shared memory, Read the content of the shared memory and write on to the standard output, Delete the shared memory .

Text Books*:*

Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications
Beej'sGuide to Unix IPC
W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	1	-	-	-	-	-	-	1	-	2	3	3	3
CO2	-	3	2	2	-	-	1	-	-	-	-	2	3	3	3
CO3	3			3	-	-	-	-	1	-	-	-	3	2	3
CO4	-	3	2	-	-	1	-	-	-	-	1	2	2	2	2

Course Name: Data Base Management System Lab

Course Code: ECS493

Contact: 0:0:3

Credits: 1.5

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithm

Course Objectives

1. To learn the data models, conceptualize and depicta database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from therelational databases
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcomes:

On completion of the course students will be able to

CO1: Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CO2: Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CO3: Differentiate between DBMS and advanced DBMS and use of advanced database conceptsand become proficient in creating database queries.

CO4: Analyze database system concepts and apply normalization to the database.

CO5: Apply and create different transaction processing and concurrency control applications.

List of Experiment:

1. Structured Query Language (SQL)

a. Creating Database (SQL DDL):

b. Creating a Table Specifying Relational Data Types Specifying Constraints, Creating Indexes,DROP, ALTER, TRUNCATE

c. Table and Record Handling: (SQL DML):

d. INSERT, SELECT, UPDATE etc

2. a. Retrieving Data from a Database The SELECT statement

b. Using the WHERE clause

c. Using Logical Operators in the WHERE clause

d. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using

AggregateFunctions Combining Tables Using JOINS

3. Sub-queries
4. Creating Column Aliases Creating Database Users Using GRANT and REVOKE

5. PL/SQL: Functions and store procedure, trigger, cursors etc.

6. Design and implementation of some online system like Library Management System, HospitalManagement System etc

7. Extramural Experiment

Text Books:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	3	2	1	1	2	2	3	3	2	3	3
CO2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	3
CO3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	3
CO4	3	3	2	2	2	1	1	1	1	1	2	3	2	2	3

Course Name: Analog Electronics Circuits Lab

Course Code: EC(ECS)491

Contact: 0:0:3

Credits: 1.5

Course Objective:

1. Understand the scope of modern electronics.
2. Describe models of basic components.
3. Design and construct simple electronic circuits to perform a specific function, e.g. Designing of amplifiers,

ADC etc.

4. Understand capabilities and limitations and make decisions regarding their best utilization in a specific situation.

Course Outcome:

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

CO1: Verify the working of diodes, transistors and their applications.

CO2: Build a common emitter/base/collector amplifier and measure its voltage gain.

CO3: Explore the operation and advantages of operational amplifiers.

CO4: Design different types of filters and apply the same to oscillators and amplifiers.

CO5: Design a circuit to convert an analog signal to digital one.

List of Experiment:

1. Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter
2. Construction of a R-C coupled amplifier & study of its input impedance, output impedance and frequency response
3. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator
4. Study a linear voltage regulator using regulator IC chip
5. Construction of analog adder and subtractor using opamp
6. Construction of integrator and differentiator using opamp
7. Construction of precision rectifier using opamp
8. Construction of a simple function generator using opamp
9. Construction of a Schmitt trigger circuit using opamp
10. Design and testing of Wien bridge oscillator
11. Study and analysis of Instrumentation Amplifier
12. Innovative Experiment

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	1	1	1	1	1	1	1	2	1	3
CO2	2	1	3	1	1	1	1	1	1	1	1	1	2	1	3
CO3	2	2	1	3	1	1	1	1	1	1	1	1	3	2	3
CO4	2	2	3	1	1	1	1	1	1	1	1	1	2	2	3

Course Name: Python Programming Lab
Course Code: ECS494
Contact: 0:0:2
Credits: 1

Course Objectives:

1. To be able to introduce core programming basics and program design with functions using Pythonprogramming language.
2. To understand a range of Object-Oriented Programming, as well as in-depth data and informationprocessing techniques.
3. To understand the high-performance programs designed to strengthen the practical expertise.

Course Outcomes:

CO1: Student should be able to understand the basic concepts scripting and the contributions of scripting language

CO2: Ability to explore python especially the object-oriented concepts,

C O3: Ability to implement built-in objects of Python.

CO4: Ability to create practical and contemporary applications such as TCP/IP networkprogramming, Web applications, discrete event simulations

List of Programs:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-stringfrom a givenstring.
4. Write a python script to print the current date in the following format "Sun May 2902:26:23 IST2017"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [F c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

```
*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

11. Write a python program to find factorial of a number using Recursion.
12. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
13. Write a python program to define a module and import a specific function in that module to another program.
14. Write a script named **copyfile.py**. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
15. Write a program that inputs a text file. The program should print all of the unique words in the filein alphabetical order.
16. Write a Python class to convert an integer to a roman numeral.
17. Write a Python class to reverse a string word by word.

Text Book:

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

Reference Books / Weblinks:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1stEdition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
2. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts,Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Media, 2019. ISBN – 13: 978-9352139057.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India,2015. ISBN-13: 978-9332555365
4. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python", 2ndEdition, O'Reilly Media, 2018. ISBN-13: 978-1491991732. Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	3	3	1	2	-	-	-	-	-	2	2	2	3	3
CO2	3	3	2	1	1	-	-	1	-	-	1	2	2	2	3
CO3	1	2	3	2	2	-	-	2	-	-	1	1	3	2	3
CO4	1	2	1	-	1	-	-	1	-	-	1	2	2	2	3

Course Name: Communication Engineering

Course Code: ECS501

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Pre-Requisite: Signals and Systems, Analog and digital electronic circuits

Course Objectives:

1. To understand the building blocks of communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a communication system.
4. To analyze error performance of a communication system in presence of noise and otherinterferences.
5. To understand concept of spread spectrum communication system.

Course Outcomes:

CO1: Able to analyze the performance of a baseband and pass band communication system in termsof error rate and spectral efficiency.
CO2: Able to perform the time and frequency domain analysis of the signals in a communicationsystem.
CO3: Able to select the blocks in the design of a communication system.
CO4: Able to analyze Performance of spread spectrum communication system.

Course Contents:

Module1: Elements of communication system:

Basic elements of a communication system, Concept of transmitter and receiver, origin of noise and its effects in communication system, Concept and effects of SNR and its importance in

system design.
Linear (AM) modulation, Generation and demodulation of AM wave. Concept of DSBSC, SSBSC and brief discussion of VSBSC. Concept of QAM.
Basic principle of nonlinear (FM, PM) modulation and their relations. Generation and demodulation of FM waves.
[
10L]

Module 2: Sampling and Pulse Modulation techniques:

Sampling theorem, sampling rate, impulse sampling, natural & flat-top sampling, reconstruction ofsignal from samples, Concept of Aliasing and anti-aliasing filter.
Quantization noise, Uniform quantization, non-uniform quantization, A-law and μ-law. A/D and D/A conversion techniques, Concept of Bit rate, Baud rate, M-ary encoding. Analog pulse modulation-PAM, PWM, PPM.

Fundamentals of PCM, Block diagram of PCM, Linear and non-linear PCM basic concept of Deltamodulation, Adaptive delta modulation. Introduction to DPCM.
Different types of multiplexing: TDM, FDM.

[8L]

Module 3: Digital Transmission:

Basic concept of Digital communication, comparative study of digital communication and analog communication.
Encoding, coding efficiency. Line coding & its desirable properties, Different types of line coding: NRZ & RZ, AMI, Manchester coding and their spectra.
Base band pulse transmission, optimum filter, Matched filter and correlation filter, Inter Symbol Interference (ISI), Power Spectral Density (PSD)Eye pattern, Signal power in binary digital signal. [8L]

Module 4: Digital carrier modulation & demodulation technique:

Introduction to the digital modulation techniques- ASK. FSK, PSK, BPSK, QPSK, M-ary PSK and their comparisons.
Basic concept of spread spectrum modulation and CDMA. [6L]

Module 5: Introduction to coding theory:

Text Books:

1. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford University press
2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, S. K. Kataria & Sons
3. Analog communication system, P. Chakrabarty, Dhanpat Rai & Co.
4. Principle of digital communication, P. Chakrabarty, Dhanpat Rai & Co.

Reference Books:

1. Digital and Analog Communication Systems, Leon W Couch II, Pearson, Education Asia.
2. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
3. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill Education

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	2	2	2	3	-	-	-	-	1	1	1	3	3	2
CO2	1	2	1	3	2	-	-	-	-	2	3	1	2	2	2
CO3	2	2	3	2	2	-	-	-	-	2	2	2	3	2	3
CO4	1	3	2	3	3	-	-	-	-	2	2	1	2	2	3

Course Name: Formal Language and Automata Theory

Course Code: ECS502

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Prerequisite:

Digital Logic, Computer organization, Computer Fundamentals

Course Outcomes:

CO1: To acquire the knowledge of the basics of state machines with or without output and its different classifications

CO2: To understand synchronous sequential circuits as the foundation of digital system.

CO3: To apply techniques of designing grammars and recognizers for several programming languages.

CO4: To analyze Turing's Hypothesis as a foreword to algorithms.

CO5: To perceive the power and limitation of a computer, and take decisions on computability.

Course Content:

Module 1:

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram

Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automation (DFA) and Non-Deterministic Finite Automation (NFA),Transition diagrams, Transition tables and Language recognizers.

NFA with empty transitions, Equivalence between NFA with and without empty tr

NFA to DFA conversion.

Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill- Nerode

Theorem Limitations of FSM, Application of Finite Automata **[9**

L] Module 2:

Finite Automata with output − Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore &Mealy Machine – Inter-conversion.

Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of MealyMachine

Minimization of incompletely specified machine − Merger Graph, Merger Table, Compatibility Graph

Lossless and Lossy Machine – Testing Table, Testing Graph

[7L]

Module 3:

Regular Languages, Regular Sets, Regular Expressions, Algebraic Rules for Regular Expressions,Arden's Theorem statement and proof

Constructing Finite Automata (FA) for given regular expressions, Regular string accepted by FA

Constructing Regular Expression for a given Finite Automata

Pumping Lemma of Regular Sets. Closure properties of regular sets **[5L]**

Module 4:

Grammar Formalism - Context Free Grammars, Derivation trees, sentential forms. Right most andleftmost derivation of strings, Parse Tree, Ambiguity in context free grammars.

Minimization of Context Free Grammars, Removal of null and unit productionChomsky normal form and Greibach normal form.

Pumping Lemma for Context Free Languages.

Enumeration of properties of CFL, Closure property of CFL, Ogden's lemma & its applicationsRegular grammars − right linear and left linear grammars

Push down Automata: Push down automata, definition. Introduction to DCFL, DPDA, NCFL,NPDA

Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, inter-conversion.

[9L]

Module-5:

Turing Machine: Turing Machine, definition, model

Design of TM, Computable functions, Church's hypothesis, counter machine, Types of Turing machines

Universal Turing Machine, Halting problem **[6L]**

Textbook:

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D. Pearson Education.

Reference Books:

1. "Formal Languages and Automata Theory", C. K. Nagpal, Oxford

2. "Switching and Finite Automata Theory", Zvi Kohavi, 2nd Edition., Tata McGraw Hill

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

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CO2	3	1	2	-	3	-	-	-	-	2	1	1	2	2	2
CO3	3	-	2	2	2	-	-	-	-	2	1	-	3	1	3
CO4	2	3	2	3	1	-	-	-	-	1	2	2	3	1	3

Course Name: Internet of Things and its Applications

Course Code: ECS503

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Prerequisite:

1. Fundamental knowledge in computer networking.
2. Basic knowledge of Microcontroller fundamentals.

Course Objectives:

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcomes:

On completion of the course students will be able:

CO1 Understand and differentiate the concepts of Internet of Things and Internet
CO2 Identify appropriate MAC protocols and routing protocols while solving a problem **CO3** Analyze and compare the basic protocols in wireless sensor network and IoT
CO4 Solve different real life problems in different domains based upon the concept of IoT and sensor network
CO5 Implement basic IoT applications on embedded platform

Course Content:

Module 1:
Fundamentals of IoT

The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

[7L]**Module 2:**

Wireless Sensor Network

Network & Communication aspects, ISM Band, Wireless medium access issues, MAC protocol , routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

[6 L]

Module 3:

IoT and M2M

A Basic Perspective– Introduction, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. [7L]

Module 4:

IoT Architecture

Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. [7L]

Module 5:

IoT Applications for Value Creations

Introduction to Arduino and Raspberry Pi, Cloud Computing, Fog Computing and their comparison, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT in health care, Value for Industry, smart home Management [5L]

Module 6:

Internet of Things Privacy, Security and Governance

Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in smart cities, Security. IoT Protocols at different Layers: MQTT, AMQP, 6LowPAN, WiFi, NFC, BLE, LTE, LoRaWAN etc [4L]

Text books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-On-Approach)", 1st Edition,VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013.

Reference books:

1. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory andPractice"

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	1	2	2	2	3	2
CO2	3	3	3	3	2	-	-	-	-	2	2	1	2	2	2
CO3	3	3	3	2	2		1	-		-	1	2	3	1	3
CO4	3	3	3	3	3	2	2	-		-	-	1	3	1	3

Course Name: Digital Signal Processing
Course Code: EC(ECS)501A
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36L

Prerequisite: Analog Electronics circuit, Signals & Systems, Analog Filters

Course Objective:

1. To develop the knowledge on signals used in digital signal processing.
2. To impart the knowledge of the principles of discrete-time signal analysis to perform varioussignal operations
3. Apply the principles of Fourier transform analysis to describe the frequency characteristics ofdiscrete-time signals and systems
4. To study various sampling techniques and different types of filters
5. To learn the use of computer programming tools to create, analyze process and visualize signalsand to plot and interpret magnitude and phase of LTI system frequency responses
6. To understand the architecture of a digital signal processor and some programming issues infixed-point digital signal processor in real-time implementation.

Course Outcomes

The students will be able to:
CO1: Apply the knowledge about continuous and discrete time signals
CO2: Understand the Fourier Transform, and examine the process of Quantization and the effects of finite register length
CO3: Understand and implement DFTs on long data sets such as speech signals and images. CO4: Develop different types of FIR & IIR filter structures and theirimplementations
CO4: Use of FFTs for efficient implementation of linear convolution
CO5: Excel in fields such as speech processing, audio signal processing, digital imageprocessing, video and audio compression.

Course Content:

Module 1: LTI systems:

Concept of signals & systems, digital signal processing and its relevance to digital communication.
Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems.

[8L]

Module 2: Discrete Fourier Transform:

Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.
Concept and relations for DFT/IDFT; Relation between DTFT & DFT; Twiddle factors and their properties; DFT/DFT as linear transformation and matrices ; Computation of DFT/IDFT by matrix method; Properties of DFT – periodicity, linearity, time reversal, circular time & frequency shift, symmetry, circular symmetry, duality, multiplication of two DFTs, circulation convolution, circular correlation ; Computation of circular convolution by graphical; Linear filtering using DFT, aliasing error, filtering of long data sequences- Overlap- Save and Overlap- Add methods.
Fast Fourier Transforms: Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises. [14L]

Module 3: Filter Design:

Basic concepts of IIR and FIR filters, difference equations, design of using impulse invariant and bilinear transform. Concept of Chebyshev filters and
comparison with Butterworth filter. Design of linear phase FIR filters -no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization. Some examples on practical filters.

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, sampling rate conversion, multistage interpolator & decimator, digital filter banks. [2L]

Module 4: Digital Signal Processor:

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713processor, writing of small programs. [6L]

Text Books:

1. Digital Signal Processing–Principles, Algorithms and Applications,J.G. Proakis & D.G. Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K. Mitra, TMH PublishingCo.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH PublishingCo.
4. Digital Signal processing – A.V. Oppenheim, R. W. Schafer, Prentice Hall
5. Discrete-time Signal processing – A.V. Oppenheim, R. W. Schafer, John R. Buck,Prentice Hall

Reference Books:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH PublishingCo.
3. Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMHPublishing Co.
4. Digital Signal Processing,A. NagoorKani, TMH Education
5. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen,Oxford University Press
7. Texas Instruments DSP Processor user manuals and application notes.
8. Digital Signal Processing: A MATLAB-Based Approach, V.K.Ingle andJ.G.Proakis, Cengage Learning
9. Modern Digital Signal Processing,V. Udayashankara, PHI Learning

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

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CO2	3	3	1	2	1	1	2	1	1	1	1	1	2	2	2
CO3	3	3	1	3	3	3	1	1	1	1	1	1	3	1	3
CO4	3	3	3	3	1	2	1	1	1	1	1	1	3	1	3

Course Name: VLSI and Microelectronics
Course Code: EC(ECS)501B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Concept of courses Solid State Devices; Analog Electronic Circuit; Digital Electronicand Circuit

Course Objective(s):

Objective of the course is:

1. To understand the basic concepts of designing combinational and sequential circuits and the designof VLSI ICs
2. To motivate students to design VLSI circuits in the area of digital, analog
3. To encourage for the design of IC with low power and high speed.
4. To study various programmable logic devices like PLDs and FPGA.

Course Outcomes:

The students will be able to

CO1: Understand scale of integration and VLSI design flow and VLSI Design steps.

CO2: Calculate and analyze the different parameters related to the different MOS devices and todesign the combinational and sequential logic circuits.

CO3: Describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter andbasic gates based on Layout design rules.

CO4: Understand the VHDL basics and to construct the combinational and sequential logiccircuits.

Module –1: Introduction to VLSI Design:

Historical perspective development of VLSI from discrete electronic circuit to VLSI. IC, MSI, LSI, Microelectronics & VLSI.

Types of VLSI Chips (General purpose, ASIC, PLA, FPGA), photo-resist Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS proc VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSIDesign Steps. [9L]

Module-2: MOS structure:

E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect.

Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaling in MOSFET, General scaling, Constant Voltage & Field scaling.]

CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS. [2L]

Module-3: Micro-electronic Processes for VLSI Fabrication:

Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative ess, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.
[10L]

Module –4: Hardware Description Language:

VHDL or Verilog Combinational & Sequential Logic Circuit Design. [6L]

Text Books:

1. Digital Integrated Circuit , J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education
2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang & Y.Leblebici,TMH.
3. CMOS Analog Circuit Design , Allen & Holberg , Oxford
4. Design of Analog CMOS Integrated Circuits , Behzad Razavi , TMH .

Reference Books:

1. Microelectronic Circuits , Sedra & Smith , Oxford
2. Introduction to VLSI Circuits and System , Uyemura , Wiley
3. VLSI Design , Debaprasad Das , Oxford
4. VLSI Design and EDA Tools , Angsuman Sarkar , Swapnadip De , C.K. Sarkar , Scitech
5. VLSI Design Techniques for Analog and Digital Circuits , Geiger , Allen , Strader , TMH

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	-	-	2	3	1	2	1	3	3	2
CO2	3	2	1	2	1	-	-	1	2	2	1	2	2	2	2
CO3	3	3	3	2	1	-	-	1	2	1	1	2	2	1	3
CO4	2	2	1	1	1	-	-	1	2	1	1	2	2	1	3

Course Name: Sensors and Applications
Course Code: EC(ECS)501C
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Course Objective:

1. To deal with various types of Sensors & Transducers and their working principle.
2. To deal with Resistive, Capacitive and Inductive transducers.
3. To deal with some of the miscellaneous transducers.
4. To know the overview of different advance sensors.

Course Outcomes:

Students should be able to:
CO1: Illustrate the fundamental principles of various types of sensors.
CO2: Employ appropriate sensors to perform engineering tasks and scientific researches.
CO3: Reorganize the basics of modern sensors. **CO4:** Understand the basics of the bio sensors. **CO5:** Reorganize the basics of modern sensors

Course Content:

Module 1:
Introduction to the basic Sensors:
Introduction to sensors and transducers, Principles of sensing & transduction, Classification of sensors, sensitivity calculation, error estimation.
Resistive Sensing Element
Potentiometer: Loading effect, Strain gauge: Basics, types, temperature compensation, andapplications: force, velocity and torque measurements.
Inductive Sensing Element
Self-inductive transducer, Mutual inductive transducers, Variable Reluctance type, Linear Variable Differential Transformer (LVDT): construction, Characteristic Curve, application: LVDT Accelerometer, LVDT displacement sensors
Capacitive Sensing Element
Capacitive transducer: Basic concepts of Variable Area Type, Variable distance type, Variable Permittivity type, calculation of sensitivities, applications [13L]

Module 2:
Piezoelectric & Piezo resistive Sensing Element
Piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, piezoelectric accelerometer, piezo resistive sensor.
Tachometers: Stroboscopes, Encoders, seismic accelerometer, Measurement of vibration, Proximity switches, Load cells: pneumatic, piezoelectric, elastic and magneto-elastic types - theirmounting.
Optical Sensors:

Light Dependent Resistor, Optocoupler, Photodiode, Phototransistor, Photomultiplier tube, solarcell.

Magnetic Sensors

Sensors based on Villari effect for assessment of force, torque, rpm meters, Hall Effect and Hall drive, and performance characteristics

Radioactive sensors

Gieger counter, proportional counter, Scintillation detection, Ionization chamber . [6L]

Module 3:

Miscellaneous Sensors & Their Applications: -

IC temperature Sensor, Electrochemical Gas sensors, Fibre optic sensors- Thick film technology- MEMS sensors- Nano sensors- Sensors for intelligent systems- Introduction to Smart sensors andSensor network.

[6L]

Module 4:

Overview of biosensor & their applications in the field of medicine, agriculture, bio production, and environment. Desired characteristics of biosensors: reliability, simplicity, cost, and related parameters, operating conditions, calibration, positive and negative controls, Safety. Electrical signal transduction [5L]

Textbook:

1. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999.
2. John Brignell,"Intelligent Sensor Systems", CRC Press; 2nd Revised edition edition,1996
3. Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers,1996.

Reference Books:

1. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, NewYork, 2000.
2. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
3. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
4. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation",18th Edition, DhanpatRai& Company Private Limited, 2007.
5. Tran Minh Canh - Sensor Physics & Technology - Biosensors, First Edition, Champan & Hall, 1993.Elizabeth A Hall - Biosensors, First Edition, Open University, Milton Keynes, 1990.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**2**
CO2	**1**	**1**	**-**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**
CO3	**1**	**2**	**3**	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**2**	**1**	**3**
CO4	**2**	**2**	**2**	**1**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**1**	**3**

Course Name: Economics for Engineers
Course Code: HU(ECS)501
Contact: 1:0:0
Total contact hour: 12
Credits: 1

Prerequisites: NIL

Course Objective:

1. To develop decision making skills using basic economic Principles
2. To educate the students in evaluating various Business Projects

Course outcome:

On completion of the course students will be able to
CO1: Understand the role and scope of Engineering Economics and the process of economic decision making
CO2: Understand the different concepts of cost and different cost estimation techniques
CO3: Design sustainable and effective economic models in real life projects
CO4: Apply critical thinking skills in analyzing financial data and its impacts.

Course Content:

Module 1: Economics, Cost and Pricing Concepts: Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs. Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per- Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model
08 L

Module 2: Production Analysis 4L

Basic Production concepts, Production with one variable input and production in the long run, measuring production function, production decision

Text books:

1. Samuelson & Nordhus Economics, Tata McGraw Hill edition

3. Suma Damodaran, Managerial Economics, Oxford University Press

Reference books:

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	3	-	1	-	-	-	2	1	-	2	-	-	1	-
CO2		-		-	-	-	3	-	-	-	2	-	-	1	-
CO3	-	1	-	2	2	3	-	-	-	1	2	2	-	1	-
CO4	1	-	-	3		-	-	2	-	-	3	2	-	1	-

Course Name: Communication Engineering Lab
Course Code: ECS591
Contact: 0:0:3
Credits: 1.5

Course Objectives:

The course objectives are to enable the students to
1. Understand the fundamental concepts of communication systems.
2. Understand and compare different analog modulation schemes.
3. Understand and compare different digital modulation schemes.
4. Understand the design trade-offs and performance of communications systems.
5. Learn about practical communication systems

Course Outcomes:

CO1: To learn signal and linear time invariant system properties.
CO2: Study, design, and build modulation systems examining trade-offs indifferent communicationsystems.
CO3: To be able to perform experiments in converting analog information into digital data via sampling, quantization, and coding.
CO4: To be able to choose necessary modulation technique for specific signal transmission.

List of Experiments: -

1. Observation of modulation index in Amplitude modulation and construction of envelope fordifferent values of modulation index.
2. Observation and generation of Double Side Band Suppressed Carrier (DSB-SC) s ign
3. Observation and generation of Single Side Band Suppressed Carrier (SSB-SC) signal.

4. Observation of Frequency Modulation & Demodulation and calculation of modulation index.
5. Generation of Time Division Multiplexing (TDM) & DE multiplexing interlacing severalsampled signals using PAM.
6. To interpret Pulse Amplitude Modulation (PAM) and demodulation for various modulatingvoltages.
7. Generation of Pulse Width Modulation (PWM) and demodulation for various modulatingvoltages.
8. To analyze a FSK modulation system and interpret the modulated and demodulatedWaveforms.
9. Innovative Experiment

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	2	-	-	-	-	-	2	1	-	2	2	3
CO2	1	2	3	3	-	-	-	-	-	1	1	-	3	2	3
CO3	1	2	3	2	-	-	-	-	-	3	3	-	2	1	3
CO4	3	3	2	3	-	-	-	-	-	3	2	-	2	2	3

Course Name: Internet of Things Lab
Course Code: ECS592
Contact: 0:0:3
Credits: 1.5

Prerequisite: Sensors, System Integration Cloud and Network Security

Course Outcome:

After learning the course, the student will be able:
CO1: Understand internet of Things and its hardware and software components
CO2: Interface I/O devices, sensors & communication modules
CO3: Remotely monitor data and control devices
CO4: Develop real life IoT based projects

List of Experiments*:*

1. Definition, Characteristics, and Features of IoT.
2. Familiarization with Arduino IDE and writing a program using Arduino IDE for LED blinking.
3. Study of LM35temperature sensors and write programs to monitor them with Arduino with Thing Speak.
4. Study of DHT-11 sensors and write programs to monitor them with Arduino with Thing Speak
5. Study of ultrasonic sensors and write programs to monitor them with Arduino with Thing Speak
6. Familiarization with Node MCU and writing a program using it for LED blinking.

7.Study of LM35 temperature sensors and write programs to monitor them using Node MCU

8.Study of DHT-11 sensors and write programs to monitor them using Node MCU

9. Study of ultrasonic sensors and write programs to monitor them using Node MCU
10. Setup Raspbian on the Raspberry Pi and write a program to blink an LED using Python.
11. Interfacing digital sensors and relay boards with Raspberry Pi & ESP 8266
12. Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.
13. Define and Explain Eclipse IoT Project.
14. Introduction to Blink Application and implementation of small projects
15. Introduction to Cisco Packet Tracer
16. Case Study: Intelligent Traffic systems (case study), Smart Parking (case study), Smart water management (case study), Anyother innovative experiment

List of Open Source Software/learning website:

- https://github.com/connectIOT/iottoolkit
- https://www.arduino.cc/

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	3	2	1	1	2	2	3	3	3	2	2
CO2	2	3	3	3	3	1	1	1	2	2	3	3	3	1	3
CO3	3	3	2	3	3	2	2	2	3	3	3	3	2	1	3
CO4	3	3	2	2	2	1	1	1	1	1	2	3	2	2	3

Course Name: Design and Simulation lab
Course Code: ECS593
Contact: 0:0:3
Credits: 1.5

Course Objective:
The course Objectives are:
1.To develop basic LabVIEW/ MAT Lab programming skills
2.To develop the skills for application of LabVIEW/ MAT Lab programs to interface with the real time system using DAQ card.

Course Outcome:
On completion of this course students will be able to:

CO1: operate MAT Lab/LabVIEW software
CO2: explore the various programming techniques of MAT Lab/LabVIEW software
CO3: design different type of program based on data acquisition from real time system.
CO4: apply knowledge of Data acquisition for different real time applications.

LIST OF EXPERIMENTS:

1. Generation of Random Numbers using MAT Lab programming.
2. Testing Random Number Generators using MAT Lab programming.
3. Simulation of Single Server Queuing System using MAT Lab programming.
4. Simulation of Two-Server Queuing System using MAT Lab programming.
5. Simulate and control a conveyor belt system using MAT Lab programming.
6. To deploy a LabVIEW interface with an embedded board (Arduino or Raspberry Pi) and study it's response.
7. To design a program of Signal Generation using DAQ Cards in Labview platform.
8. To design a simple PC based controller using LabVIEW.
9. To design a temperature control Loop using LabVIEW with DAQ cards.
10. Innovative Experiment.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	3	-	-	2	2	1	2	3	2	2
CO2	2	1	3	3	2	2	-	-	2	2	2	2	3	2	3
CO3	2	3	1	2	2	2	-	-	2	1	1	1	2	2	3
CO4	1	3	2	3	2	1	-	-	2	1	-	-	2	2	3

Text Books:

1. MATLAB for Engineering Applications, 5th edition, William J. Palm III,2023,McGraw-Hill
2. LabVIEW for Data Acquisition, Bruce Mihura, edition (June 26, 2001),Prentice Hall

Reference Book:

1. MATLAB for Engineers, 6th edition, Holly Moore, 2022, Pearson Education Inc.
3. Hands-On Exercise Manual for LabVIEW Programming, Data Acquisition, and Analysis, Jeffrey Y. Beyon,1st edition (August 2000),Prentice Hall PTR

Course Name: Computer Networking
Course Code: ECS601
Contact: 3:0:0
Credits: 3
Total Contact Hours: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and Computer Architecture
2. Programming languages concepts like C, Java.

Course Objectives:

1. To educate basic knowledge of networking technologies and network management concepts
2. To interpret the layering concepts in computer networks.
3. To analyze the functions of each layer and gain knowledge in different applications that usecomputer networks.
4. To emphasize the hand-on experience of network topology in a laboratory environment
5. To be familiar with contemporary issues in networking technologies.

Course Outcomes:

After completion of the course students will be able to

CO1: Understand Basic introduction of Computer Network along with Physical layer ofOSI and TCP/IP model.
CO2: Analyze Datalink layer protocols with MAC and LANtechnologies.
CO3: Design applications using internet protocols, routing and UDP, TCP.
CO4: Develop application layer protocols and understand socketprogramming.

Course Contents:

Module1: Introduction to Computer Network:

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network

Physical Layer: Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network [6**L]**

Module 2: Data Link Layer:

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub- layer, The

Channel Allocation.

Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching. [10L]

Module 3: Network Layer:

IP Addressing, IPv4 and IPv6. Difference between IPv4 and IPv6, Conversion of IPv4 and IPv6, Sub netting, Super netting, ARP, IP, ICMP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network. Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, RIP, OSPF, BGP

Transport Layer:

Process to Process delivery; UDP; TCP, Congestion control in TCP, Quality of service:

Techniquesto improve QoS: Leaky bucket algorithm. [16L]

Module 4: Application Layer:

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Socket Programming: Introduction to Socket Programming, UDP socket and TCP Socket

[4L]

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) "– TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

Reference Books:

1. Kurose and Rose – "Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI
5. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ PearsonEducation
6. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	2	-	1	3	-	2	-	2	-	1	-	2	2	2
CO2	3	2	1	2	-	1	-	1	3	1	-	2	2	2	3
CO3	1	3	2	2	2	-	3	-	2	-	2	1	2	2	3
CO4	2	2	3	-	3	2	1	-	2	1	-	1	2	2	3

Course Name: Control System Engineering

Course Code: ECS602
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36L

Prerequisite:

The students to whom this course will offer must have the Knowledge of elec measurementsystems, basic laws of mathematics and formulation of integral and differential equations

Course Objective:

1. To apply Laplace transform and state space techniques to model dynamic systems.
2. To Demonstrate an understanding of the fundamentals of control systems.
3. To Determine the time domain responses of first and second-order systems.
4. To Analyze the system behavior in frequency domain & the system stability usingcompensator.

Course Outcomes:

CO1: Describe how computing resources such as CPU, memory and I/O are managed by the operating system.

CO2: Analyze kernel and user mode in an operating system.

CO3: Solve different CPU scheduling problem to achieve specific scheduling criteria.

CO4: Apply the knowledge of process management, synchronization, deadlock to solve basic problems.

CO5: Evaluate and report appropriate design choices when solving real-world problems

Course Contents:

Module1: Mathematical Model of Physical System & Analysis in Time Domain

Introduction to Elementary control concepts: -Brief introduction, Applications area. Open loop and close loop system and their comparison. Mathematical Model of Physical Systems: - Introduction, Differential equation representation of physical systems, Transfer function concepts, Block diagram algebra, Signal flow graphs :- Mason's gain formula. Time Response Analysis: - Introduction, Review of standard test signals-Step, Ramp , Impulse , sinusoid .Time response of first order system, Design specifications of first order systems, Time response of second order systems, Design specifications of second order systems. [1 2L]

Module2: Stability Analysis of System in Time Domain

Stability Analysis in Time Domain: The concept of stability, Assessment of stability from pole positions, Necessary conditions for stability, Routh Stability Criterion, Relative stability analysis, Illustrative examples. Root Locus Technique: Introduction, the root locus concept, Root locus construction rules, Root contours, Advantages & limitations, Relative stability analysis using root locus. [10L]

odule 3: Stability Analysis of System in Frequency Domain

Frequency Response Analysis: Introduction, Performance Indices, Frequency response of second order systems, Polar plots, Bode plots, All pass systems, Minimum-phase and Non-minimum- phase systems, Assessment of relative stability – Gain Margin and Phase Margin, examples. Stability Analysis in Frequency Domain: Introduction, A brief review of Principle of Argument, Nyquist stability criterion, Illustrative examples. Introduction to Design: The design problem, Concepts of cascade and feedback compensation, Realization compensators- Lead, Lag, Lag-Lead compensator. State variables: Concepts of s variables and state model, State models of linear continuous-time systems, Concept on

Controllability and Observability.

[14L]

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.

2. Operating Systems& Systems Programming by P Balakrishna Prasad

Reference Book:

1. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall. 3. William Stallings, OperatingSystems, Prentice Hall.

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	3	2	2	3	3	3	2	3	3	2	2
CO2	3	2	2	2	2	2	3	2	2	3	3	2	2	1	3
CO3	3	3	3	2	3	3	3	2	2	3	3	2	3	1	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3

Course Name: Artificial Intelligence
Course Code: ECS603
Contacts: 3:0:0
Total Contact Hours: 36

Prerequisites:
Linear algebra and probability theory. Basic understanding of control systems and computing.

Course Outcome:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI)and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference,perception, knowledge representation, and learning.

CO3: Gain knowledge of Elements of robots

CO4: Calculate the forward kinematics and inverse kinematics of serial and parallel robots

CO5: Able to do the motion planning & control for a robotic system

Course Contents:

Module-I: Introduction: [2L]
Foundations and History of Artificial Intelligence & Robotics, Turing Test, Intelligent Agents, classification and usage of robots.

Module-II: Searching and Problem Solving: [5L]
Problem formulation with suitable examples, -8 puzzle problem, Tower of Hanoi, Data drivenand goal driven search, Uninformed search strategies -Breadth-first search,

Depth first search,Bidirectional search, Hill climbing, simulated annealing.

Module-III: Knowledge Representation and Reasoning: [5L]
Introduction to data, information and Knowledge, Propositional logic, first order predicate logic (FOPL), Rule of inference, Inference engine, knowledge representation technique, Forward andBackward reasoning, Bayes' rule and Bayesian Networks.

Module-IV: Learning: [6L]
General model of learning agents, Inductive learning, learning decision trees, decision trees asperformance elements, induction decision trees from example, Neural Networks (Network structures, Single layer feed- forward neural network, Multilayer feed-forward neural network,learning weights), classification & clustering concept.

Module-V: Elements of robots: [6L]
Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo motors, Purpose of sensors– tachometers, strain gauge-based force-torque sensors, proximity sensors and vision.

Module-VI: Kinematics of robots: [8L]
Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace ofa serial robot, Inverse kinematics of constrained and redundant robots, Degrees of- freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallelmanipulators.

Module-VII: Motion planning and control: [4L]
Joint and Cartesian space trajectory planning and generation, Classical control concepts usingthe example of control of a single link, Independent joint PID control, Control of a multi-linkmanipulator, Non-linear model based control schemes.

Text Books*:*

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, OXFORD University Press.
3. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

Reference Book:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	3	1	1	1	1	1	1	3	3	2	1
CO2	3	3	3	1	3	1	1	1	1	1	1	3	2	2	2
CO3	3	3	3	3	3	2	2	1	1	1	2	3	3	1	2

CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**2**	**3**

Course Name: Cyber Law and EthicsCourse Code: ECS604A
Contacts: 3:0:0
Total Contact Hours: 36

Prerequisite:
1. Familiarity in computer Networking.
2. Basic concepts about network security.

Course Objective(s):
- To understand, explore and acquire a critical understanding of Cyber Law.
- To learn the basics of a Cyber security
- To develop competencies for dealing with frauds and deceptions (Confidence Tricks, Scams)

Course Outcome(s):

CO1: To understand the importance of professional practice, Law and Ethics in their personal lives andprofessional careers.
CO2: To acquire in depth knowledge of information technology act, security policies, and legalframework of right to privacy, data security and data protection
CO3: To develop the understanding of relationship between commerce and cyberspace
CO4: To be familiar with network security threats and countermeasures

Course Contents:
Module – 1: Introduction of Cybercrime [7L]
Cybercrime, Forgery, Hacking, Software Piracy, Computer Network Intrusion Jurisdiction to prescribe/Legislative Jurisdiction; Jurisdiction to adjudicate to enforce;Cyber Jurisdiction in Civil, Criminal & International Cases.
Criminals plan attacks, passive attack, Active attacks, cyberstalking.

Module – 2: Cybercrime Mobile & Wireless devices[8L]
Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.

Module -3: Tools and Methods used in Cyber-crime[7L]
Proxy servers, Password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: Buffer over flow Attacks, Scripts Kiddies and PackagedDefense.

Module – 4: Cybercrime & Cyber security[4L]
Phising methods, ID Theft; Online identity method Legal aspects, Indian laws, IT act, Public key certificate, Design of Cyber Security Policy of an Organization, Unicitral Model Law.

Module -5: Cyber Ethics[5L]
The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations Ethics in Information society, Introduction to Artificial Intelligence Ethics:Ethical Issues in AI and core Principles, Introduction to Block Chain Ethics.

Text Books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi,(2004)

Recommended Books:

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
2. Jonathan Rosenoer, "Cyber law: The Law of the Internet", Springerver lag, 1997
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York,
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003) .

CO PO Mapping: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	-	2	3	-	3	2	3	2	2	2
CO2	2	3	3	2	2	3	1	2	-	2	1	2	2	2	2
CO3	2	1	2	2	1	1	2	2	-	1	2	1	3	1	2
CO4	3	2	2	1	2	2	1	1	-	2	2	2	2	2	3

Paper name: Introduction to Data Science
Paper code: ECS604B
Contacts: 3L
Credits: 3
Total contact hours: 36

Course objectives:

1. To make the learner understand the data analysis, regression, and regularization
2. To make the learner acquainted with data classification, classification, and feature engineering
3. To make the learner able to apply text mining
4. To make the learner understand network analysis

Course Outcomes:

Upon completion of this course, the learner will be able to:

CO1: Select and evaluate a model
CO2: Classify data
CO3: Use the technique of clustering
CO4: Use text mining and retrieve information

Module I: [10L]

Introduction to data science, Exploratory data analysis, Linear regression and regularization,

Model selection and evaluation

Module II: [10L]
Classification: KNN, decision trees, SVM; Ensemble methods: random forests, Naïve Bayes and logistic regression [10L]

Module III: [8L]
Feature engineering and selection, clustering: k-means, hierarchical clustering, Dimensionality reduction: PCA and SVD [8L]

Module IV: [8L]

Text mining and information retrieval, Network Analysis, Recommender systems [8L]

Text Books:

1. Herbert Jones, Data Science, Bravex Publication, 2020
2. Joel Grus, Data Science from Scratch, O'Reilly, 2015

Reference Books:

1. G. Anand and R. Sharma, Data Science Fundamentals and Practical Approaches, BPBPublication, 2020
2. F. Provost and T. Fawcett, Data Science for Business, Shroff, 2013

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	2	2	1	1	1	1	2	3	1	2
CO2	3	2	3	2	3	2	1	1	2	1	2	1	3	2	2
CO3	3	3	3	3	3	1	1	1	2	2	2	1	3	1	2
CO4	3	3	3	2	3	2	1	2	2	2	2	2	2	2	3

Course Name: Introduction to Robotics
Course Code: ECS604C
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36L

Course Objective:

1. Impart knowledge about basic mathematics related to industrial robots for their control.
2. Design and application of robotics & automation in modern Industries.

Course Outcomes

CO1: Perform kinematic and dynamic analyses with simulation. Design control laws for a simplerobot.
CO2: Integrate mechanical and electrical hardware for a real prototype of robotic device.
CO3: Select a robotic system for given industrial application.
CO4: Use of robots in domestic applications.

Course Contents:

Module1: Introduction to Robotics:
Types and components of a robot, Classification of robots, Robotic kinematics systems; Concept of mechanisms and manipulators, Definition of Degrees of Freedom[6L]

Module2: Introduction to Robot Kinematics and Dynamics:
Concept of Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, Forward and inverse kinematics, Jacobian, Singularity, and Statics, Denavit–Hartenberg parameters, Concept of Dynamic Modeling such as Forward and inverse dynamics, Equations of motion by using Euler-Lagrange formulation and Newton Euler formulation.
[8L]

Module 3: Robotic Sensors and Actuators:
Robotic Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, calibration techniques, Geometry of the Image formation, Different transforms such as Euclidean or Projective transformations, Different types of vision applications in robotics.
Actuators: Electric, Pneumatic and Hydraulic actuators, Parameters for selection of actuators, Transmission Gears, Timing Belts and Bearings. [5L]

Module 4: Robot Control:

Basics of control: open loop and closed loop, Definition of transfer functions, Control mechanisms, P, PD, PID, Linear and Non-linear controls. [7L]

Module 5: Embedded Systems for Robotics and control hardware interfacing mechanisms: Embedded Systems, Microprocessors and Microcontroller Architecture and interfacing with robotic sensors, actuators and other components, Programming techniques for Industrial robot. [6L]

Module 6: Artificial Intelligence in Robotics
Applications in unmanned systems, examples: defense, medical, industries, etc. Robotics and Automation for Industrial benefits, Robot safety and social robotics [4L]

Text Books:
1. Introduction to Robotics: J. Craig, Pearson
2. Robot Dynamics and Control, Spong&Vidyasagar, McGraw Hill
3. Robotics Engineering: R. Klafter, PHI
4. Robotics: Subir K Saha, McGrawHill
5. Industrial Robotics: M. P. Groover, AshishDutta, McGraw Hill

Reference Book:

1. Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981

2. Robert Shilling, Fundamentals of Robotics, Prentice-Hall , 2003
3. Laxmidhar Behera and Indrani Kar, "Intelligent Systems and Control", Oxford University Press, Nov 2009.
4. M. Felix Orlando, Laxmidhar Behera, Tomayo Tamei, Tomohiro Shibata, Ashish Dutta and Anupam Saxena," On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in CooperativeObject Translation," Robotica, vol. 35, pp. 1992-2017, 2016.

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	3	1	3	2	1	2	1	2	3	2	1	2
CO2	1	2	2	3	2	1	3	2	4	2	1	2	2	2	2
CO3	1	2	2	1	2	2	3	3	2	3	2	2	3	1	2
CO4	1	3	2	1	3	2	1	3	3	3	2	3	2	2	3

Course Name: Cyber Security & Cryptography
Course Code: CS(ECS)605A
Contact (L: T: P): 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

1. Knowledge of Computer Networks and Operating Systems fundamentals
2. Understanding of Discreet Mathematics concepts

Course Objectives:

1. To understand basics of Cyber Security & Cryptography.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data
4. To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes:

After attending the course students should be able to

CO1 Understand cryptography and network security concepts and application.
CO2 Apply security principles to system design.
CO3 Identify and investigate network security threat
CO4 Analyze and design network security protocols.
CO5 Conduct research in network security.

Course Contents

Module-1 [7L]

Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model [1L]
Classical Encryption techniques (Symmetric cipher model, substitution techniques, trans techniques, steganography) [3L]
Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm [1L]

Polynomial Arithmetic, Prime numbers, Fermat's and Euler's theorem [1L]
Testing for primality -The Chinese remainder theorem - Discrete logarithms [1L]

Module-2 [9L]

Data Encryption Standard- Block cipher principles, block cipher modes of operation [2L]
Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm [3L]
Public key cryptography: Principles of public key cryptosystems, The RSA algorithm [2L]
Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography [2L]

Module-3 [6L]

Authentication requirement, Authentication function, MAC, Hash function [2L]
Security of hash function and MAC, MD5, SHA, HMAC, CMAC [2L]
Digital signature and authentication protocols, DSS, ElGamal, Schnorr [2L]

Module-4 [7L]

Authentication applications, Kerberos, X.509 [1L]
Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles [1L]
SET for E-Commerce Transactions [1L]
Intruder, Intrusion detection system [1L]
Virus and related threats, Countermeasures [1L]
Trusted systems, Practical implementation of cryptography and security [2L]

Module-5 [7L]

E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source [1L]
Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME [2L]
IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP) [1L]
Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding) [1L]
Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication [1L]
PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction [1L]

Textbooks

1. Kahate, A. (2013). Cryptography and network security. Tata McGraw-Hill Education.
2. Forouzan, B. A., & Mukhopadhyay, D. (2015). Cryptography and network security. New York, NY: Mc Graw Hill Education (India) Private Limited.

Reference Books

1. Stallings, W. (2006). Cryptography and network security, 4/E. Pearson Education India.
2. Daras, N. J., & Rassias, M. T. (Eds.). (2015). Computation, cryptography, and network security (pp. 253- 287), Springer.
3. Kumar, A., & Bose, S. (2017). Cryptography and network security. Pearson Education India.

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2	2
CO3	2	2	2	2	3	-	-	-	-	-	-	-	3	2	2
CO4	3	3	2	2	3	-	-	-	-	-	-	-	3	2	3

Course Name: Soft Computing
Course Code: CS(ECS)605B
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36L

Prerequisite:
Knowledge of set theory, nervous system, and biological evolution

Course Objective:

1. To make the learners understand the advantages of soft computing techniques
2. To make the learners understand the different aspects of fuzzy logic and fuzzy reasoning
3. To make the learners understand the different aspects of artificial neural networks
4. To make the learners understand the different aspects of genetic algorithm

Course Outcomes

After the completion of the course, earner will be able to:
CO1: justify the use of fuzzy logic for decision making in presence of uncertainty
CO2: design a fuzzy logic control system for a continuous-time plant with single i/p-single o/p **CO3:** compare the supervised and unsupervised learning techniques in artificial neural networks**CO4:** explain the operation of genetic algorithm-based optimization technique

Course Contents:

Module1: Soft Computing and Fuzzy logic
Soft-computing-definition, advantage over conventional computing, areas of application Fuzzy Sets,membership function and membership value, linguistic variable

Fuzzy operators, T- Norms and S- Norms
Fuzzy relations, implications, cylindrical extensions, projection Fuzzification and defuzzification
[10L]

Module2: Fuzzy reasoning and fuzzy logic control
Fuzzy extension principle, compositional rule of inference, approximate reasoning (fuzzy

reasoning)Different Fuzzy models-Mamdani's model, Sugeno's model (T-S-K model) Fuzzy logic control system, fuzzy PID controller [12L]

Module 3: Genetic algorithm

Genetic Algorithm (GA)- basic concept, components-chromosome and gene, GA operators, methodsof selection, elitism
Fuzzy-GA system [5L]

Module 4: Artificial neural networks

Artificial neural network (ANN)- basic concept, areas of application, McCulloch and Pitts model, perceptron, realization of logic gates, training of ANN, Supervised and unsupervised learning- techniques and comparison Neuro-fuzzy system [9L]

Text Books:

1. D.Dirankov, H. Hellendoorn, and M.Reinfrank, An Introduction to Fuzzy logic control,Narosa
2. S.Rajasekaran and G.A.V. Pai, Neural Networks, Fuzzy logic and Genetic Algorithm:Synthesys and Applications, Pearson Education
3. J.S.R.Jang, C.T. Sun and, E.Mizutani, Neuro-fuzzy and soft Computing, Pearson Education
4. T.J.Ross, Fuzzy Logic with Engineering Applications, Wiley (India)

Reference Book:

1. Simon Haykin, Neural Networks- A Comprehensive Foundation, Prentice Hall
2. B.Yegnanarayana, Artificial Neural Networks, PHI

Mapping of COs with POs and PSOs:(Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	2	1	1	1	-	-	-	-	-	2	3	3	3
CO2	3	-	3	1	3	2	-	-	-	-	-	2	3	2	2
CO3	3	-	1	2	1	3	-	-	-	-	-	2	3	2	2
CO4	3	-	1	2	1	2	-	-	-	-	-	2	3	2	3

Course Name: Mobile Computing
Course Code: CS(ECS)605C
Contact (L: T: P): 3:0:0
Credits: 3
Total Contact Hours: 36
Prerequisite:

1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objectives:

Students taking this course will develop an understanding of the ways that mobile technologies can be used

for
teaching and learning. They will also consider the impact of mobile computing on the field of education.

Course Outcomes:
On completion of this course, students will be capable of
CO1: Illustrate the concepts and working of modern communication technologies.
CO2: Demonstrate the various routing algorithms for both infrastructures based and ad hoc networks
CO3: Develop mobility and bandwidth management in cellular network
CO4: Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
CO5: Predict the technical issues related to recent mobile computing environment.

Course Contents:
Module 1: Introduction [6L]:
Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.
Module 2: Mobile Data Communication [5L]
Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.
Module 3: Mobility Management in Cellular Networks [4L]
Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, Brownian, map-based, group-based.
Module 4: Bandwidth Management in Cellular Mobile networks [3L]
Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth, Genetic algorithms for channel assignment- concept of critical block in a hexagonal cellular network, coalesced CAP, fast near-minimal channel assignment algorithm.

Module 5: Localization of Nodes in a Mobile Network [4L]
Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements, selection of beacon nodes; Location region identification- computational geometric technique.
Module 6: Message Communication in Ad Hoc Networks [6L]
Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP
Module 7: Energy-efficient Communication [3L]
Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.
Module 8: Secure Wireless Communication [4L]
Introduction-different types of attacks, internal attacks, external attacks; measures against attacks

(authentication, intrusion detection, encryption); RC4 algorithm, Lightweight cryptographic algorithms; antigambling techniques.

Text books:

1. K. Sinha, S.Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press: New York, 2015.
2. J. Schiller, Mobile Communication, Pearson
3. Yi-Bing Lin & Imrich Chlamtac, Wireless and Mobile Networks Architectures, John Wiley & Sons, 2001
4. Raj Pandya, Mobile and Personal Communication systems and services, Prentice Hall of India, 2001
5. XiangYang Li, Wireless Adhoc and Sensor Networks, Cambridge University Press.

Recommended books:

1. Research articles published on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping) published in leading journals.
2. Mark Ciampa, Guide to Designing and Implementing wireless LANs, Thomson learning, Vikas Publishing
   House, 2001.
3. P. Stavronlakis, Third Generation Mobile Telecommunication systems, Springer Publishers.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	1	1	-	-	-	-	-	3	2	3
CO2	3	2	2	1	2	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	1	1	-	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	2	1	1	-	-	-	-	-	3	2	3
CO5	3	2	1	1	3	1	-	-	-	-	-	-	3	2	3

Course Name: Computer Networking Lab
Course Code: ECS691
Contact: 0:0:3
Credits: 1.5

Prerequisite: Require the Basic Linux commands and little bit programming languages concepts likeC, Java.

Course Objectives:

1. Familiarization with Network devices, cables and other tools.
2. To implement Different protocols of Transport Layer like UDP, TCP.
3. Implementing different Routing protocols of Network Layer.
4. To interpret different congestion control Algorithms
5. To analyze the functions of each layer and gain knowledge in different applications that usecomputer networks.
6. To emphasize the hand-on experience of network topology in a laboratory environment

Course Outcomes:

CO1: Installation of different Network devices, simulators, hardware connection using cables andother tools.
CO2: Demonstrate TCP & UDP using socket program.
CO3: Develop the code for Data link layer protocol simulation.
CO4: Examine the performances of Routing protocol with congestion control algorithm usingnetwork simulator

List of Experiment:

1. Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping.Internetworking Operating Systems – Configurations
2. Implementation of flow control mechanisms
3. Socket Programming using TCP and UDP
4. Implementing routing protocols such as RIP, OSPF.
5. Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOSServer Configuration: only web server (If time permit. instructor can do more than that)

Text Book:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) "– TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

Reference Book:

1. Kurose and Rose – "Computer Networking -A top down approach featuring the internet" – PearsonEducation
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	1	2	1	1	-	-	-	-	2	-	-	1	2	2	3
CO2	-	2	1	-	-	-	2	-	3	-	1	1	2	2	3
CO3	1	3	-	2	2	-	1	-	2	-	1	-	2	2	3
CO4	2	2	-	-	3	2	-	-	2	1	-	1	1	2	3
CO5	1	2	1	1	-	-	-	-	2	-	-	1	3	2	3

Course Name: Control System Engineering Lab

Course Code: ECS692

Contact: 0:0:3

Credits: 1.5

Prerequisite: Student should have the knowledge of MATLAB with SIMULINK

Course Objective:

1. Will have a strong knowledge on MATLAB software.
2. They get the basic knowledge on practical control system.
3. To get the Design applications of control system.
4. They get the knowledge of stability analysis of different control systems.

Course Outcome:

The students will be able to:
CO1: Apply formulate transfer function for given control system problems. **CO2:** Demonstrate an understanding of the fundamentals of control systems. **CO3:** Determine time response of given control system model.
CO4: Analyze the system behavior through Root Locus, Bode plots & Nyquist plot fora given controlsystem model.

List of Experiments*:*

1. Familiarization with MATLAB & SIMULINK control system toolbox.
2. Study of impulse, step, ramp & sinusoidal response for first and second order system with unity feedback and calculation of parameters for different system designs.
4. Modelling of a first order system and its response analysis.
5. Modelling of a second order system and its response analysis.
6. Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB.

7. Determination of root-locus, using MATLAB toolbox for a given second order transferfunction and analysis of result.
8. Bode plot, using MATLAB toolbox for a given second order transfer function and analysisof result.
9. Nyquist plot using MATLAB toolbox for a given second order transfer function and analysisof result.
10. Study of position control system (AC/DC).
11. Innovative Experiment

Text Books:

1: B. C. Kuo "Automatic Control Systems" 8th edition– by 2003– John wiley and son's., 2: I. J. Nagrath and M. Gopal, "Control Systems Engineering" New Age International (P)Limited, Publishers, 2nd edition.

Reference Books:

1. Katsuhiko Ogata "Modern Control Engineering" Prentice Hall of India Pvt. Ltd., 3rdEdition, 1998.
2. N.K.Sinha, "Control Systems" New Age International (P) Limited Publishers, 3rdEdition, 1998.
3.NISE "Control Systems Engg." 5th Edition – John wiley
4. Narciso F. Macia George J.
Thaler, "Modeling & Control of Dynamic Systems" Thomson Publishers

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	-	-	-	-	-	2	3	3	2	3
CO2	1	3	1	3	2	-	-	-	-	-	1	2	3	2	3
CO3	2	2	3	1	2	-	-	-	-	-	3	1	2	2	3
CO4	3	3	1	2	1	-	-	-	-	-	2	2	1	2	3
CO5	2	2	3	1	2	-	-	-	-	-	2	3	3	2	3

Course Name: Artificial Intelligence Lab
Couse Code: ECS693
Contact: 0:0:3
Credits: 1.5

Perquisite: Knowledge of programming languages.

Course Objective*:*

Apply knowledge of computing and mathematics appropriate to the discipline. Analyze a problem, and identify and define the computing requirements appropriate to its solution. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs Understand current techniques, skills, and tools necessary for computing practice.

Course Outcome:

After completion of this course student will be able to:

CO1: Understand and recognize various AI search algorithms and AI tools.

CO2: Apply the fundamentals of knowledge representation, inference and theoremproving using

CO3: Analyze working knowledge of reasoning in the presence of incompleteand/or uncertain information.

CO4: Evaluate and create knowledge representation, reasoning, and machine learningtechniques for the solutions of real-world problems.

List of Experiments*:*

A. Write the following programs using PROLOG

1. Study of PROLOG facts and rules.
2. Write a program to compute factorial of a number.
3. Write a program to compute GCD of two numbers.
4. Write a program to represent facts and rules.
5. Write a program to represent a family tree.
6. Write a program to diagnosis intelligently.
7. Write a program to check whether a given line segment is vertical or horizontal.
8. Write a program for list processing.

B. Write the following programs using PROLOG

1. Write a program to solve 8 queens problem
2. Solve any problem using depth first search.
3. Solve any problem using best first search.
3. Solve 8-puzzle problem using best first search
4. Solve Robot (traversal) problem using means End Analysis

6. Solve traveling salesman problem.

C. Write some programs on recent trend in AI (It may be recent real world problems)Jupyter Notebook(iPython): Medical diagnosis. Design an Expert System

Projects assigned by instructor to model and solve real world problems.

Text Books*:*

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

Reference Book:

3. Prolog Programming for Artificial Intelligence Paperback by Ivan Bratko
4. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	-	-	-	-	1	2	2	3	2	3
CO2	3	3	2	2	1	-	-	-	-	2	2	2	3	3	3
CO3	1	2	3	1	1	-	-	-	-	1	1	1	2	1	3
CO4	3	3	2	2	1	-	-	-	-	1	1	1	1	1	3
CO5	2	3	3	2	2	-	-	-	-	1	2	2	3	2	3

Course Name: Industrial Automation
Course Code: ECS701
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36
Prerequisite: knowledge of I/O in computer-based systems, knowledge of network

Course objectives:

1. To make the learner understand the benefits of using industrial automation systems
2. To make the learner acquainted with the features of PLC, DCS, and SCADA (basicarchitectures, networking principles, programming, I/O systems)
3. To make the learner able to program a PLC
4. To make the learner able to compare the strengths of PLC, DCS, and SCADA

Course Outcomes:

After completion of this course student will be able to:
CO1: appreciate the advantages of automated manufacturing systems

CO2: identify the uniqueness of PLC, DCS, and SCADA

CO3: select a suitable PLC or DCS or SCADA system for an automation solution, based on thetype and size of the production facility

CO4: program a PLC for a given automation problem

Course Contents:

Module I: PLC [8L]

Introduction to Programmable Logic Controllers (PLCs) – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; Ladder diagram Programming, Scan time; Applications of PLC

Module II: DCS [12L]

DCS – basic components and their functions.

HMI – operator & engineering interface, functions and requirements.

Communication – ISO/OSI reference model; data highway and Fieldbus ;

HARTNetwork access protocols – TDMA, CSMA/CD, token passing, Master

– Slave Transmission media – twisted pair, co-axial, optical fiber ;

Network topology – mesh, ring, star, bus;
Redundancy – processor, bus and input-output level

Module III: Plant Automation [10L]

Plant Automation System network Elements of Plant Automation System (PAS) : Smart Sensors, Sensor networks, Intelligent actuators, SCADA systems, Introduction, Different Generations, I/OModules (wired and wireless), MTU and RTU, AS-Interface.

Safety Interlocks, Sequence Controls PAS network and typical system architecture

Module IV: Case studies [6L]

Case studies- rolling mill control (system with time delay), pH control (nonlinear system),temperature control and pressure control of a boiler

Text Books:

1. R.G. Jamkar, Industrial Automation Using PLC, SCADA, and DCS, Global Education Ltd,2018
2. R. Mehra and V. Vij, PLC and SCADA- Theory and Practice, Laxmi Publications Pvt Ltd,2017

Reference Books:

1. M. Elshafei, Modern Distributed Control System, Amazon Digital Services, 2016
2. B.G. Liptak (ed.), Instrument Engineers' Handbook (vol.2), CRC Press, 2014

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	2	1	1	1	1	1	2	2	3
CO2	3	2	2	2	3	1	1	1	1	1	2	1	3	3	3
CO3	3	3	3	3	3	1	2	2	2	2	2	1	2	1	3
CO4	3	3	3	2	3	1	2	1	2	2	2	2	1	2	3
CO5	3	3	2	2	3	2	2	1	1	1	1	1	3	2	3

Course Name: Machine Learning
Course Code: ECS702A
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36L

Prerequisites:
Probability, Linear Algebra, Multivariable Calculus, Programming

Course Objectives:

1. This introductory course gives an overview of many concepts, techniques, and algorithms inmachine learning related to classification and regression problems.
2. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work.
3. The underlying theme in the course is statistical inference as it provides the foundation for mostof the methods covered.
4. Make use of Data sets in implementing the machine learning algorithms

Course Outcome:

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

CO1: Recognize the characteristics of machine learning that make it useful to real-world problems.
CO2: Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.

CO3: Be able to use support vector machines.
CO4: Understand the learning algorithm for hidden Markov model with latent variables.

Course Contents:

Module1: Basics of Linear Algebra:

Introduction to Machine Learning, linear classification, perceptron update rule, Perceptron convergence, generalization, Maximum margin classification, Classification errors, regularization.

[8L]

Module2: Logistic regression

Linear regression, estimator bias and variance, active learning, Active learning, non-linear predictions, Regression/Classification Basic methods: Distance-based methods, Nearest Neighbors, Decision Trees, Kernel regression, kernel optimization, Model selection criteria, Description length, feature selection, expectation maximization

[9L]

Module 3: Classification

Classification problems; decision boundaries; nearest neighbor methods, Probability and classification, Naive Bayes, Bayes' Rule and Naive Bayes Model, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Logistic regression, online gradient descent,neural network, support vector machine (SVM), kernel ridge regression. [10L]

Module 4: Introduction to Deep Learning
Definition, Need of Deep Learning, Different Techniques: ANN, CNN, Recursive Neural DeepModel, Framework: Tensorflow, Tensorflow light [9L]

Text Books
1. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Reference Books:

1. Simon Haykin, Neural Networks and Learning Machines Third Edition, Pearson Publisher.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning (InformationScience andStatistics), Springer, 2006.
3. Pattern Classification. Richard Duda, Peter Hart and David Stock. SecondEdition Wiley Interscience.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	2	-	-	-	-	-	2	2	3
CO2	3	3	3	2	2	-	-	-	-	-	3	-	2	3	3
CO3	2	-	-	2	3	-	-	-	2	-	2	-	2	1	3

CO4	**1**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**3**
CO5	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

Course Name: Digital Image Processing
Course Code: ECS702B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:

To become familiar with:

1. Digital image fundamentals
2. Transform of Digital Images and its applications
3. Simple image enhancement techniques in both spatial and frequency domains.
4. Image compression, recognition, restoration segmentation and representation techniques
5. The Edge detection & Security in Digital Image Processing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

CO1: Mathematically represent the various types of images and analyze them.
CO2: Process these images for the enhancement of certain properties or for optimized use of theresources.
CO3: Develop algorithms for image compression and coding

CO4: Explaining the Edge detection & Security in Digital Image Processing & Demonstrate the basicsteps of Video processing

Module 1: (5L)
Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, imagesampling
and quantization, basic relationships between pixels - neighborhood, adjacency, connectivity,distance measures.

Module 2: (6L)
Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications,
pixel-domain smoothing filters - linear and order-statistics, pixel-domain sharpening filters - first and second derivative, two-dimensional DFT and its inverse, frequency domain filters - low-pass and high-pass.
Color Image Processing-Color models-RGB, YUV, HSI; Color transformations- formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; ColorSegmentation.

Module 3: (7L)
Image Segmentation- Detection of discontinuities, edge linking and boundary detection,

thresholding –global and adaptive, region-based segmentation.
Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform,

Module 4: (7L)
Time frequency localization, continuous wavelet transforms, wavelet bases and multi-resolutionanalysis, wavelets and Sub band filter banks, wavelet packets.
Image Compression-Redundancy-inter-pixel and psycho-visual; Lossless compression - predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still imagecompression standards-JPEG and JPEG-2000.

Module 5: (6L)
Fundamentals of Video Coding-Inter-frame redundancy, motion estimation techniques - full-search, fast search strategies, forward and backward motion prediction, frame classification - I, P and B; Videosequence Hierarchy-Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards - MPEG and H.26X.

Module 6: (5L)
Video Segmentation-Temporal segmentation-shot boundary detection, hard-cuts and soft-cuts; spatialsegmentation-motion-based; Video object detection and tracking.

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rdedition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	-	-	-	3	-	3	1	2	2	3
CO2	3	1	3	2	1	-	-	-	2	-	2	-	3	3	3
CO3	2	2	2	1	2	-	-	-	2	-	1	3	2	1	1
CO4	3	2	2	1	-	-	-	-	1	-	1	2	1	2	3
CO5	3	1	2	1	2	-	-	-	3	-	3	1	3	2	3

Course Name: Embedded System Design
Course Code: ECS702C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre-Requisite: Knowledge of Microprocessor and Microcontroller.

Course Objectives:

1. An ability to design a system, component, or process to meet desired needs within realisticconstraints.
2. Ability to understand microcontroller, microcomputer, embedded system.
3. Understand different components of a micro-controller and their interactions.
4. To become familiar with the programming environment used to develop embedded systems.
5. Understand key concepts of embedded systems like IO, timers, interrupts, interaction withperipheral devices
6. Learn debugging techniques for an embedded system

Course Outcomes:

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

CO1: Understand the architecture and classifications of different embedded systems and therelated programming knowledge.

CO2: Understand the concepts of embedded systems like I/O, timers, interrupts, interactionwith peripheral devices

CO3: Choose case-specific debugging technique for an embedded

system. **CO4**: Design various real time systems using embedded

systems

Course Contents:

Module1:

Introduction to the Embedded System: Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of

embedded processor and microcontrollers, CISC vs. RISC, ASIC. [5L]

Module 2:

Serial and parallel communication: devices and protocols, wireless communication: devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth. [9L]

Module 3:

Program Modeling Concepts ; 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 [5L]

Module 4:

Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS [5L]

Module 5:

PIC microcontroller: introduction, architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, assembly language programming, addressing modes, instruction set, interfacing with various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming, embedded architecture
[12L]

Text Books:

1. Introduction to Embedded Systems: Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (JohnWiley)
3. Embedded Systems: Raj kamal (TMH)
4. Embedded Systems: L. B. Das (Pearson)

Reference Books:

2. Embedded System design: S. Heath (Elsevier)
3. Embedded microcontroller and processor design: G. Osborn (Pearson)
4. Programming PIC microcontrollers with PIC basic by chuck helebuyck
5. PIC microcontrollers-programming in basic by Milan verle

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	1	2	-	-	-	2	-	3	1	3	2	3
CO2	2	1	3	2	1	-	-	-	1	-	2	-	3	3	3
CO3	2	2	3	1	1	-	-	-	1	-	1	3	2	1	1
CO4	3	2	2	-	-	-	-	-	-	-	1	2	1	2	3
CO5	3	-	2	1	2	-	-	-	2	-	3	1	3	2	3

Course Name: Computer Graphics
Course Code: ECS703A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Fundamental mathematics, Coordinate geometry, Principle of Computer Programming

Course Objective:
To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.

Course Outcomes
On successful completion of the learning sessions of the course, the learner will be able:

CO1: Understand the basic computer graphics and Identify different media representations of different multimedia data and data formats, windows, clipping and view-ports object representation
CO2: Comprehend the concept of geometric, mathematical and algorithmic concepts necessary for programming computer graphics.
CO3: Differentiate windows, clipping and view-ports object representation in relation to images displayed on screen.
CO4: Distinguish different coding technique and software tools for solving real world problems related to graphics and multimedia.

Course Contents:

Module I: [6L]
Introduction to computer graphics, Importance and applications of computer graphics, Basic Terminologies in Graphics, lookup table, 3D viewing devices, I/O devices, Active & Passive graphics, Computer graphics software. Display: Light & Color models, Raster Scan and Random scan displays, CRT basics, video basics, Flat panel displays

Module II: [6L]
Scan conversion: Points & lines, Line drawing algorithms: DDA algorithm, Bresenham's line algorithm, Circle drawing algorithm: Bresenham's circle drawing algorithm, Mid-point circle drawing algorithm, Scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm

Module III: [8L]
2D and 3D Transformation Basic transformations: translation, rotation, scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, Composite transformation, Pivot point transformation, reflection shear, 3D transformations: translation, rotation, scaling.

Module IV: [8L]
2D-Viewing & Clipping: Viewing pipeline, Window to viewport co-ordinate transformation. World co-ordinate, Device co-ordinate, Normalized co-ordinate, Point clipping, line clipping (Cohen Sutherland line clipping algorithm, Mid-point sub division line clipping algorithm), Polygon Clipping (Sutherland Hodgman Polygon Clipping algorithm, Weiler Atherton Polygon clipping algorithm)

Module V: [4L]
Projection: Basic concepts, Parallel Projection, Perspective Projection
Curves: Bezier curves, B-spline curves.

Module VI: [4L]
Hidden Surface Removal: Basic concepts, Z-buffer algorithm, Back face detection, BSP tree method, Painter's Algorithm

Text books:
1. Computer Graphics C Version by Donald Hearn, M. Pauline Baker, Pearson education.
2. Computer Graphics by Samit Bhattacharya, Oxford University Press.

Reference books:

1. Schaum's outlines Computer Graphics (2nd Ed.) by Ray A. Plastock, Gordon Kalley, McGraw-Hill Inc.
2. Mathematical Elements for Computer Graphics by David Rogers, J. Alan Adams,McGraw Hill Education.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2							2	2	3
CO2	3	2	2	-	3	2	-	-	1	-	2	-	3	3	3
CO3	3	-	3	-	2	-	-	-	-	-	-	-	2	1	1
CO4	3	3	3	3	3	2	-	-	-	-	1	2	1	2	3
CO5	2	2	2	2	3	2							3	2	3

Course Name: Software Engineering
Course Code: ECS703B
Contact: 3:0:0
Total contact Hours: 36
Credits: 3

Prerequisites:
Mathematics, Data Structure and Basic Computations

Course Objectives:
In this course, students will gain a broad understanding of the discipline of software engineering and its application to the development of and management of software systems. Knowledge of basic software engineering methods and practices and their appropriate application.

Course Outcomes:
After completion of this course student will be able to
CO1: Ability to analysis and design of complex systems and meet ethical standards, legal Responsibilities.
CO2: Ability to apply software engineering principles, techniques and develop, maintain, Evaluate large-scale software systems.
CO3: To produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis.
CO4: Ability to work as an effective member or leader of software engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals.

Course Content:

Module 1:

Introduction: Definition of Software Engineering, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs. Software Engineering, Human cognition mechanism, Software Engineering principle- abstraction and decomposition

Software Development Life Cycle (SDLC) models: Water fall model, V-shape Model, PrototypingModel, Spiral Model, RAD Agile Model, Verification and Validation. [6L]

Module 2:

Software Project Management: Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning

Requirement analysis and specification: SRS, Requirement gathering and specification, Functionalrequirement, Traceability. [10L]

Module 3:

Software Design: Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements. Object oriented design- class and relationship, UML diagrams. Coding and Testing: Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclometric Complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing. [15L]

Module 4:

Software Reliability and Quality Management: Reliability, Hazard, MTTF, Repair and Availability, Software quality, Software reliability and fault-tolerance, six-sigma.

Computer-aided software engineering: Computer-aided software engineering (CASE)-environment and benefit. Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001. [5L]

Text Books:

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition.

Reference Books Edition.:

2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

4. Software Engineering: Iyan Somarville, 7th

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	1	-	-	1	1	2	2	3
CO2	-	3	1	2	2	-	-	1	-	-	1	1	2	3	3
CO3	2	1	3	-	1	-	-	1	-	-	-	1	2	1	1
CO4	-	-	2	3	3	-	-	1	-	-	-	1	2	2	3
CO5	3	2	1	1	-	-	-	1	-	-	1	1	3	2	3

Course Name: Cloud Computing
Course Code: ECS703C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite

1. Should have the basic knowledge of Operating Systems.
2. Should be aware of the fundamental concepts of Networking.
3. Should have knowledge of heterogeneous systems and resource management.

Course Objective(s):

- To learn the workflow of cloud business model and optimized resource allocation.
- To gain knowledge of cloud service and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service deliverymodel.
- To learn virtualization techniques, load balancing, and work strategy of different cloudinfrastructure.
- To know the security and privacy issues in cloud infrastructure

Course Outcome(s):

CO1: To articulate the business model concepts, architecture and infrastructure of cloud computing,including cloud service models and deployment models.

CO2: To apply and design suitable Virtualization concept, Cloud Resource Management and designscheduling algorithms.

CO3: To explore some important cloud computing driven commercial systems such as Google Apps,Microsoft Azure and Amazon Web Services and other businesses cloud applications.

CO4: To analyze the core issues of cloud computing such as security, privacy, interoperability, andits impact on cloud application.

Course Contents:

Module 1: Definition of Cloud Computing and its Basics [8L]

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing [3]
Cloud Architecture: Cloud Infrastructure, Architecture of each component, Virtualization versusTraditional Approach, Virtualization Model for Cloud Computing. [2]
Services and Applications by Type [3]
IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations,silos.
PaaS – Basic concept, tools and development environment with examples
SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platformIdentity as a Service (IDaaS) Compliance as a Service (CaaS)

Module 2: Use of Platforms in Cloud Computing [6L]

Concepts of Abstraction and Virtualization [2L]

Virtualization technologies: Types of virtualizations, Load Balancing and Virtualization: BasicConcepts,

Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational- Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) [2L]
Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application applianceConcepts of Platform as a Service [2L]
Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development. Use of PaaS Application frameworks.

Module 3: Cloud Service Models [6L]

Use of Google Web Services [2L]
Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), majorfeatures of Google App Engine service.
Use of Amazon Web Services [2L]
Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service
Use of Microsoft Cloud Services [2L]
Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure [10L]

Types of services required in implementation – Consulting, Configuration, Customization and SupportCloud Management [3L]
An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

Live Migration of Virtual Machines: [2L]
Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and SecurityIssues during live migration.

Concepts of Cloud Security [3L]
Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management.
Auditing and Compliance in Cloud Environment: [2L]
Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

Module 5: Concepts of Services and Applications [6L]

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for anSOA
architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6]

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and CloudAPIs [2]

Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1]
Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail,Yahoo mail, concepts of Syndication services [1]

Text books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGrawHill Education (India)PrivateLimited,2013

2. Fundamentals of Cloud Computing by P. K. Pattnaik, S. Pal, M. R. Kabat, Vikas Publications, 2014.

Reference Books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013

2. Cloud Computing: A Practical Approach, Anthony T. Velte, Tata Mcgraw-Hill

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	-	-	1	1	2	-	2	2	2	3
CO2	3	3	2	2	1	-	1	2	2	2	-	2	3	3	3
CO3	2	2	-	1	3	-	2	1	1	-	-	1	1	1	1
CO4	-	1	-	3	2	-	2	-	-	1	-	-	2	2	3
CO5	2	3	1	1	-	-	-	1	1	2	-	2	3	2	3

Course Name: Information Theory and Coding

Course Code: EC(ECS)704A

Contact: 3:0:0

Credits: 3

Total Contact Hours: 36

Prerequisite: Probability & Statistics

Course Outcomes:

After completion of the course students will be able to

CO1: Understand the basic concept of information and apply this knowledge in designing solution forreal life engineering problem.
CO2: Understand the basic concept of coding theory and use this knowledge for designing and implementing mathematical and engineering problem leading to lifelong learning.
CO3: Understand the concept of channel models to determine the mutual information in the channels. **CO4:** Outline the concept of error detection techniques and design a model for building a new solutionas a professional engineering practice as a team.
CO5: Understand how convolutional theory works and develop an approach to solve it by means of existing and new methods as a team work.

Course Content:

Module 1:
Information Theory:
Introduction, Measure of Information, Average Information Content (Entropy) of a Zero MemorySource, Extension of Zero Memory Source, Entropy of a Source with Memory
[4L]

Module 2:
Source Coding
Introduction, Types of Codes, Prefix Codes, Source Coding Theorem, Shannon's Encoding Theorem, Huffman Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run Length Encoding, An Overview onSpeech and Image Compression. [9L]

Module 3:
Information Channels

Introduction, Channel Models, System Entropies, Mutual Information (Trans information), ChannelCapacity, Capacity of Channels, Continuous Channels [4L]

Module 4:

Error Control Coding

Introduction, Need for Error Control Coding, Types of Codes, Coding Gain, Codes , Linear Block Codes, The Hamming Codes, Cyclic Codes, Golay Codes, Shortened Cyclic, Probability of an Undetected Error Pattern for an LBC over a BSC, Equivalent Codes, CRC Code [8L]

Module 5:

Burst Error Correcting Codes

Introduction, Burst Errors, Interleaved Codes, Product Codes, Fire Codes, BCH Codes, Non-BinaryBCH Codes, Reed-Solomon Code [6L]

Module 6:

Convolution Codes

Introduction, Convolution Encoder, Representation of Convolution Code, Transfer Function of a Convolution Code, Distance Properties of Convolution Codes, Decoding of Convolution Codes, StackAlgorithm, Known Good Convolution Codes [5L]

Text books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.

Reference Books:

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

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	2	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	1	1	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	2	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

Course Name: Fiber Optics Communication
Course Code: EC(ECS)704B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3
Prerequisite: Basic concepts of Solid-State Devices

Course Outcomes:

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

CO1: Know the classification and working of optical fiber with different modes of signal propagation

CO2: Understand the transmission characteristics and losses in optical fiber

CO3: Describe the constructional features and the characteristics of optical sources and detectors

CO4: Describe the performance of optical amplifiers

CO5: Know the concept of WDM, FSO and LiFi

Module 1:

Optical fiber Communications: The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity

Fibres: Types and refractive index profiles, Step index fibers, Graded index fibers, Single mode fibers, Cut off wavelength, Mode field diameter, effective refractive index. Fibre materials, photonic crystal fibre,

index guiding PCF, photonic band-gap fibres, fibre cables.

Module 2:

Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.

Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers.

Module 3:

Optical sources: LEDs and LDs, structures, characteristics, modulators using LEDs and LDs.

coupling with fibres, noise in Laser diodes, Amplified Spontaneous Emission noise, effects of Laser diode noise in fibre communications

Optical detectors: Types and characteristics, structure and working of PIN and AP, noise in detectors, comparison of performance. Optical receivers, Ideal photo receiver and quantum limit of detection.

Module 4:

Optical Amplifiers: basic concept, applications, types, doped fibre amplifiers, EDFA, basic theory, structure and working, Semiconductor laser amplifier, Raman amplifiers, TDFA, amplifier configurations, performance comparison.

Module 5:

The WDM concept, WDM standards, WDM components, couplers, splitters, Add/ Drop multiplexers, gratings,

tunable filters. Introduction to free space optics, LiFi technology and VLC.

Optical Time Domain Reflectometer (OTDR) – fault detection length and refractive index measurements.

Text Books

1. Gerd Keiser, Optical Fiber Communications, 5/e, McGraw Hill, 2013.
2. Mishra and Ugale, Fibre optic Communication, Wiley, 2013.

Reference Books

1. Chakrabarthi, Optical Fibre Communication, McGraw Hill, 2015.
2. Hebbar, Optical fibre communication, Elsevier, 2014
3. John M Senior- Optical communications, 3/e, Pearson, 2009.
4. Joseph C. Palais, Fibre Optic Communications, 5/e Pearson, 2013.
5. Keiser, Optical Communication Essentials (SIE), 1/e McGraw Hill Education New Delhi, 2008.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1		
CO1	3	3	1	1	1	-	-	-	-	-	-	1	2	1	1
CO2	3	3	2	1	1	-	-	-	-	-	-	1	1	1	1

CO3	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
CO4	**3**	**3**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
CO5	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**

Course Name: Wireless Sensor Network
Course Code: EC(ECS)704C
Contact: 3:0:0
Total Contact Hours:
36Credits: 3

Prerequisite: The candidates should have the basic knowledge of communication and networks.

Course Objective:

The objective of this course is to provide:

1. the concept of various types of Wireless Sensors and their applications
2. the concept of sensor networks and the challenges

Course Outcome:

After successful completion of this course, students should be able to:

CO1: Understand the fundamentals of wireless sensor networks and its application.

CO2: Study the various protocols at various layers and its differences with traditional protocols.

CO3: Realize the issues pertaining to sensor networks and the challenges.

CO4: Employ appropriate sensors to perform engineering tasks and scientific researches

Course Content:

Module I [6L]: Introduction:

Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques,wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Module II [8L]: **Introduction to adhoc/sensor networks*:***

Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wirelessnetworks,
issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Module III [8L]: **MAC Protocols:**

Issues in designing MAC protocols for adhoc wireless networks, design goals,

classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, otherissues, S-MAC, IEEE 802.15.4.

Module IV [8L]: Routing Protocols:

Issues in designing a routing protocol, classification of necessary routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical and power aware routing protocols

Module V [6L]: **QoS and Energy Management:**

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmissionpower, and system power management schemes.

Text Books:

1. C. Siva Ram Murthy&B. S. Manoj, "AdHoc Wireless networks ", Pearson Education

2. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication

Reference Books:

1. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition

2. William Stallings, "Wireless Communications and Networks ", Pearson Education

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	2	1	2	2	2	1	1	1	2	2	3
CO2	3	2	1	2	2	3	2	1	2	1	2	2	3	3	3
CO3	2	3	2	3	1	2	1	2	2	2	2	1	2	1	1
CO4	1	1	1	2	1	1	-	-	3	1	1	1	2	2	3
CO5	3	1	2	3	2	1	2	2	2	1	1	1	3	2	3

Course Name: Industrial Automation Lab
Course Code: ECS791
Contact: 0:0:3
Credits: 1.5

Course Outcome:

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

CO1: Recognize & explain basic elements of an automated process (controller, actuator, final control element) viahands on experiment.

CO2: Control different process variable (flow, pressure, level & temperature) using DCS

CO3: Develop and test ladder diagram for different application

CO4: Use SCADA for an automated process

Experiments:

1. Study of an automatic control system
2. Monitoring and control of Temperature Control Loop using DCS
3. Monitoring and control of Pressure Control Loop using DCS
4. Monitoring and control of Flow Control Loop using DCS
5. Monitoring and control of Level Control Loop using DCS
6. Study of PLC field device interface modules (AI,AO,DI,DO modules) and software
7. Programming Logic Gates Function in PLC Ladder Logic
8. Develop /Execute a ladder program for the given application using following: - timer, counter, comparison,logical, arithmetic instruction.
9. Develop/ test ladder program to blink LED/lamp.
10. Develop Ladder Logic for Traffic Light Control System and test it through PLC using Ton instruction.
11. Logic for counting the objects
12. Use various functions of SCADA simulation editors to develop simple project.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1	2	1	2	1	2	1	2	2	3
CO2	3	3	3	3	3	1	2	2	2	1	3	1	2	3	3
CO3	3	3	3	3	3	1	2	2	2	1	3	2	2	2	1
CO4	3	3	2	3	3	1	2	2	1	1	3	2	2	2	3
CO5	3	3	2	2	3	1	2	1	2	1	2	1	3	2	3

Course Name: Machine Learning Lab
Course Code: EI792A
Contact: 0:0:3
Total Contact Hours: 36
Credits: 1.5

Course Objective:

1. Make use of Data sets in implementing the machine learning algorithms

2. Implement the machine learning concepts and algorithms in any suitable language of choice

Course Outcome:

After completion of the course students will be able to:

CO1. Understand the implementation procedures for the machine learning algorithms.
CO2. Design Java/Python programs for various Learning algorithms.
CO3. Apply appropriate data sets to the Machine Learning algorithms.
CO4. Identify and apply Machine Learning algorithms to solve real world problems.

List of Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/ API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	4	4	-	-	-	-	-	-	-	3	-
CO2	-	4	4	3	4	3	-	-	-	-	-	-
CO3	-	3	-	3	3	3	-	-	-	-	-	-
CO4	3	4	-	4	-	3	-	-	-	-	-	-

Course Name: Digital Image Processing Lab

Course Code: ECS792B

Contact: 0:0:3

Credits: 1.5

Prerequisite: Applied Mathematics

Course Outcome:

Learner will be able to:

CO1: Acquire the fundamental concepts of a digital image processing system such as image acquisition, enhancement, segmentation, transforms compression, morphology, representation anddescription.

CO2: Analyze images in the spatial domain.

CO3: Analyze images in the frequency domain through the Fourier transform.

CO4: Design and implement with MATLAB/C/Labview algorithms for digital image processing operations such as point processing, histogram processing, spatial and frequency domain filtering,

denoising, transforms, compression, and morphological processing.

List of Laboratory Experiments:

1. Point Processing techniques (At least 4 experiments).
2. Spatial domain Filtering.
3. Histogram Processing (Histogram Stretching and Equalization).
4. Frequency Domain Filtering (Plotting 2D-DFT, Low pass and High Pass- Ideal, Butterworthand Gaussian Filters).
5. Segmentation-Gradient operators.
6. Transforms-DCT.
7. Morphology-Dilation Erosion.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	-	3	-	-	-	2	3	3	2	3
CO2	3	3	2	2	3	-	3	3	3	1	3	3	2	3	3
CO3	2	3	1	3	3	-	3	-	-	-	2	3	2	2	3
CO4	2	3	3	2	3	-	3	3	3	1	3	3	2	2	3

Course Name: Embedded System Design Lab
Course Code: ECS791A
Contact: 0:0:3
Credits: 1.5

Prerequisites: Concept of Digital Electronics Lab, Microprocessor and Microcontroller Lab.

Course Outcomes:

CO1. Familiarization with PIC Microcontroller, ARM Microcontroller,FPGA and their interfacing.
CO2. Design of different types real time projects with digital controllers.
CO3. Program ARM microcontroller to perform various tasks.
CO4. Understand the key concepts of embedded systems such as I/O,timers, interrupts and interaction with peripheral devices.

Experiments:

1. PIC based experiment (Any Five)
   a) Familiarization of PIC kit.
   b) Interface and control a LED, LCD, Keyboard, ADC& DAC using PIC.
   c) Connect two PIC kit and transfer data serially.
   d) Design a Digital watch based on PIC.
   e) Control a stepper motor and display temperature from a temperaturesensor on a LCD.
2. ARM based experiment (Any Four)
   a) Familiarization with ARM evaluation system
   b) Familiarization with Raspberry Pi
   c) Interfacing with a real time clock using a serial port to display time.
   d) Interface a Keyboard and display the keystrokes on a LCD, LED.
   e) Familiarization of image processing using ARM
3. FPGA based experiment
   a) Design a 3 to 8 decoder circuit.
   b) Design an UP/DOWN counter and display the count on a 7-segment display.
   c) Designing an ALU and verify with mathematical operations.
   d) Innovative Project.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	3	-	-	-	2	3	2	2	3
CO2	3	3	3	2	3	1	3	3	3	1	3	3	2	3	3
CO3	3	3	3	3	3	-	3	-	-	-	2	3	2	2	3
CO4	3	3	3	2	3	2	3	3	3	2	3	3	2	2	3

Course Name: Computer Graphics Lab
Couse Code: ECS793A
Contact: 0:0:2
Credits: 1

Prerequisite: Computer Programming, Mathematics

Course Objective:

The objective of the course is to become familiar with graphics programming and expertise in text, image, audio, video enhancement and manipulation using different software/tools through projects.

Course Outcome:

After completion of this course students will be able to

CO1: Apply 3D graphical scenes using open graphics library suits.

CO2: Analyze the effects of scale and use on both presentation and lower-level requirements.

CO3: Compare interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

CO4: Implement image manipulation, enhancement, and basic transformations on objects and clipping algorithm on lines.

Course Contents:

IMPLEMENT THE EXERCISES USING C /C++/ OPENGL / JAVA

1. Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes, Circle (Midpoint)
2. 2D Geometric transformations – Translation, Rotation Scaling, Reflection Shear, Window-Viewport
3. Composite 2DTransformations
4. Line Clipping
5. 3D Transformations - Translation, Rotation, Scaling.
6. 3D Projections – Parallel, Perspective.
7. Creating 3DScenes.
8. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image Optimization.
9. 2D Animation – To create Interactive animation using any authoring tool.
10. VLC and Video Streaming
11. HTML 5 and media publishing with Projects based learning.
12. Web document creation using Dreamweaver
13. Creating Animation using Flash.

Text books:

1. Hearn Baker Carithers, - "Computer Graphics with Open GL", Pearson New International Edition

Reference books:

1. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007
2. P. K and Kiran Thakrar, ―Multimedia Systems and Design‖, PHI,2003.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1		
CO1	3	3	2	1	3	2	2	-	-	-	-	3	2	2	3

CO2	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**3**
CO3	**3**	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**3**
CO4	**3**	**2**	**3**	**-**	**2**	**3**	**1**	**1**	**2**	**-**	**-**	**3**	**2**	**2**	**3**

Course Name: Software Engineering Lab
Course Code: ECS793B
Contact: 0:0:2
Credits: 1

Course Objective:
Demonstrate the UML diagrams with ATM system descriptions, Demonstrate the working of softwaretesting tools with c language, Understanding Project Planning Tools.

Course Outcome:

CO1: Ability to analysis and design of complex systems and meet ethical standards, legal responsibilities

CO2: Ability to apply software engineering principles, techniques and develop, maintain, evaluate large-scale software systems.

CO3: To produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis.

CO4: Ability to work as an effective member or leader of software engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals.

List of Experiments:

1. Identifying the Requirements from Problem Statements
2. Requirements, Characteristics of Requirements, Categorization of Requirements, FunctionalRequirements, Identifying Functional Requirements
3. Estimation of Project Metrics
4. Project Estimation Techniques -COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
5. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
6. Use case diagrams, Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include Relationship, Extend Relationship, Generalization Relationship, Identifying Actors, Identifying Use cases, Guidelines for drawing Use Case diagrams
7. Identifying Domain Classes from the Problem Statements
8. Introduction to selenium tool for software testing.
9. JUnit, Static analysis, Junit Framework
10. Prepare a SRS document in line with the IEEE recommended standards
11. Draw the use case diagram and specify the role of each of the actors. Also state the pre condition,post condition and function of each use case.

12. Draw the sequence diagram for any two scenarios.
13. Draw the collaboration diagram.
14. Draw the state chart diagram & component diagram.
15. Draw the deployment diagram.

Text Book

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", SeventhEdition, McGraw-Hill International Edition

Reference Book

2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.SoftwareEngineering: Iyan Somarville, 7th Edition

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	2	-	-	1	1	3	2	3
CO2	1	3	-	1	2	-	-	1	-	-	1	2	2	3	3
CO3	1	2	3	2	-	-	-	1	-	-	-	-	2	2	3
CO4	1	2	1	2	-	-	-	1	-	-	2	2	3	2	3

Course Name: Cloud Computing Lab
Couse Code: ECS793C
Contact: 0:0:2
Credits: 1

Prerequisites:
Networking, Operating System, Web Technology.

Course Objectives:
The objective of the course is to learn and apply the concept of cloud computing in realworld application

Course Outcome:

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

CO1 Apply the concept to solve practical application
CO2 Analyzing different service in cloud computing

CO3 Evaluate different available service with Amazon and Azure
CO4 Design Cloud based application

Course Content:

Module 1: Virtual Machine:

Creation of vpc, vnet, virtual machine, Private and Public IP configuration

Module 2: Application Development*:*

Implementation of SOAP Web services in JAVA Applications. Use Azure to launch the web applications. Test Simple Application

Module 3: Security*:*

Identity and access management, Multifactor Authentication.

Module 4: Bot and AI service*:*

Test AWS and AZURE Bot and AI services

Text Books

1. Cloud Computing: Principles, Systems and Applications, Editors: NikosAntonopoulos, LeeGillam, Springer, 2012

Reference Books*:*

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg,Andrzej M. Goscinski, Wile, 2011
2. https://aws.amazon.com/
3. https://azure.microsoft.com/en-us/

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-		-	1	-	-	-	-	1	3	2	2	3
CO2	3	3	3	2	2	2	-	-	-	-	2	2	2	3	3
CO3	3	3	3	2	3	2	-	-	-	-	1	1	2	2	3
CO4	3	3	3	4	2	-	-	-	-	-	1	1	3	2	3

Course Name: Business Communication
Course Code: HU(ECS)791
Contact: 0:0:2
Credits: 1

Prerequisites:
A basic knowledge of the forms, formats, discourses and channels of interpersonal workplace communication.

Course Objectives:

- to acquaint students with procedures, templates and strategies of organizational communication in globalized business.
- to facilitate students in achieving gender-neutral and culturally neutral communication across various cultural contexts.
- to enable students to become more empowered communicators in business speech and writing, using ICT and interactive tools in digital era communication.

Course Outcomes:
After completion of this course the students will be able to
CO1: Select, compare, classify and correlate between modes and modalities of communication in the globalized workplace.
CO2: Develop, apply and make use of interpersonal business strategies, team dynamics, writing templates a nd workplace procedures.
CO3: Apply, infer, test and develop behavioral and interpersonal skills like problem-solving, decision making and negotiation using workplace situations and case studies.
CO4: Develop, elaborate and justify procedures and modes of interface in globalized business and client partnerships.

Module 1: Intrapersonal and Interpersonal Workplace Communication
1.1The Skills of Interpersonal Communication (Content, Voice, Tone, Register)
1.2Interface with Customers/Clients—Business Telephony (Taxonomy and courtesies of calls, Call Procedures
and Phrases, Managing Customer Relations)
1.3 Achieving Global Partnerships in Business (Culture sensitivity and achieving culturally neutral communication)
1.4 Achieving Gender-Sensitive Communication (Avoiding Gender Bias, Gender Neutral titles and interface in everyday workplace communication)

Module 2: People Skills in Business
2.1 Understanding Interpersonal and Team Dynamics—Participating/Engaging in Team Efforts—Projects, Meetings, Presentations and Team Huddles.
2.2 Problem-Solving in Teams—Dealing with Problems, Adopting and Testing Solution Strategies, Team-Based
Case Studies.
Negotiation Strategies in Client Interactions and Meetings—Negotiation Basics, A Win-Win/Win-Lose and
2.3 Other Strategic Parameters, Negotiation Examples and Case Studies.
Decision-Making in Business—Basics of Business Decision-Making, Factors involved, Implementing
2.4 Decisions and Follow-up, Examples and Case Studies.

Module 3: Business Etiquette and Behavioral Norms
3.1 Presenting Oneself in the Business Environment—Corporate Dressing, Grooming and Mannerisms
3.2 Etiquette relating to Formal/Informal Social Occasions—Dining and Table Etiquette.
3.3 Meeting and Netiquette—Examples and Activities.

Module 4: Procedural Interpersonal Interfaces

4.1 Preparing for an Interview/Presentation—Attention-Grabbing Techniques, Using Audio-Visual aids and Rhetorical Techniques.
4.2 Presentation Skills—Giving Informational and Persuasive Presentations (Sales and Product Performance Review presentations)
4.3 Speaking in an Interview (Assessment parameters—body language, courtesy, voice, tone, attitude)—Interview Case Studies and Mock-Interviews.

Textbooks:

1.Peter Hartley, *Interpersonal Communication*. London: Routledge, 1993.
2. Adrian Pilbeam and Nina O'Driscoll, *Meetings and Discussions*. 2nd ed. London: Longman, 1992.
3. Andrew Littlejohn, *Company to Company*. Cambridge: Cambridge University Press, 2005.

Reference Books:

1.Fiona Moore, *Transnational Business Cultures: Life and Work in a Multinational Corporation*. London: Routledge, 2005.
2.Jeanette S. Martin and Lillian H. Chaney, *Global Business Etiquette: A Guide to International Communication and Customs*. Praegar, 2012.
3. Michael Maginn, *Making Teams Work: 24 Lessons for Working Together Successfully*. Mc Graw-Hill, 2004.
4. Eli Mina, *The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making*, Amacom, 2002.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	-	-	1	1	-	2	3	-	2	-	2	1
CO2	-	-	2	2	-	3	3	-	2	3	-	3	-	1	1
CO3	-	-	2	2	-	3	3	2	2	3	-	3	-	2	1
CO4	-	-	-	-	-	3	3	2	2	3	-	3	-	2	1

Course Name: Real Time System
Course Code: ECS801A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Concepts of Operating systems and Algorithm.
2. Knowledge of Distributed System basics.

Course Objective(s):

- To understand the real-time systems
- Obtain a broad understanding of the technologies and applications for emerging and

excitingdomain of real-time systems.
- Get in-depth hands-on experience in designing and developing a real time system.

Course Outcome(s):

CO1: Understand the concepts of Real-Time systems
CO2: Recognize the characteristics of a real-time system
CO3: Understand and develop document on an architectural design of a real-time system.
CO4: Develop and document Task scheduling, resource management, real-time operating systemsand fault tolerance applications of real-time systems.

Course Contents:

Module-1: Introduction

Definition, Typical Real Time Applications: Digital control, High Level Controls, Signal processing etc., Release Times, Deadline period and time constraints, Hard and soft real time systems, Reference models for RTOS: Processors and Resources, Temporal parameters of Real-time workload, Periodic Task Model, Precedence Constraints and Data Dependency.**[8L]**

Module-2: Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective- Deadline-First (EDF) and Least-Stack-Time-First (LST) algorithms, Rate Monotonic algorithm, Offline versus Online Scheduling

[8L]

Module-3: Resources Sharing

Effect of Resource Contention and Resource Access Control (RAC), Non-pre-emptive Critical Sections, Basic Priority- Inheritance and Priority-Ceiling Protocols, stack based Priority Ceiling Protocol, Use of Priority Ceiling Protocol in Dynamic priority systems, Pre-emption Ceiling Protocol, Access control in Multiple Module Resources, Controlling Concurrent Accesses to Data Objects.

[8L]

Module-4: Real Time Communication.

Basic Concepts of Real time Communication, Soft and Hard real-time Communication systems, Modelof Real-time Communication, Priority based service and Weighted Round Robin Service disciplines for switched Networks, Medium Access control protocols for broadcast networks, Internet and resource reservation protocols **[6L**]

Module-5: Real Time Operating Systems and Databases.

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of temporal data, temporal consistency, on-currency Control, and Overview of Commercial Real Time databases.

6L]

Text Books

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication

Reference Books

1. Real Time Systems – Mall Rajiv, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2	-	-	-	-	-	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	2	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-

Course Name: MEMS Technology
Course Code: ECS801B
Contact: 3:0:0
Total Contact Hours: 36Credits: 3

Course Objective(s):

- Introduction to MEMS and microfabrication
- To study the essential material properties
- To study various sensing and transduction technique
- To know various fabrication and machining process of MEMS
- To know about the polymer and optical MEMS

Course Outcome(s):

At the end of the course students will be able to:
CO1: Be familiar with the important concepts applicable to MEMS
CO2: Be familiar with the important concepts MEMS fabrication.
CO3: Be fluent with the design, analysis and testing of MEMS.
CO4: Apply the MEMS for different applications.

Module 1: Introduction to MEMS and microfabrication

History of MEMS Development, Characteristics of MEMS-miniaturization - microelectronics integration - Mass fabrication with precision. Micro fabrication - microelectronics fabrication process- silicon based MEMS processes- new material and fabrication processing- points of consideration for processing.

Module 2: Electrical and mechanical properties of MEMS materials

Conductivity of semiconductors, crystal plane and orientation, stress and stain – definition – relationship between tensile stress and stain- mechanical properties of silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- deflection of beam-longitudinal stain under pure bending- spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

Module 3: Sensing and Actuation

Electrostatic sensing and actuation-parallel plate capacitor – Application-Inertial, pressure and tactile sensor- parallel plate actuator- comb drive.
Thermal sensing and Actuations-thermal sensors-Actuators- Applications- Inertial, Flow and Infrared sensors.
Piezoresistive sensors- piezoresistive sensor material- stress in flexural cantilever and membrane- Application-Inertial, pressure, flow and tactile sensor.
Piezoelectric sensing and actuation- piezoelectric material properties-quartz-PZT-PVDF –ZnO-Application-Inertial, Acoustic, tactile, flow-surface elastic waves
Magnetic actuation- Micro magnetic actuation principle- deposition of magnetic materials-Design and fabrication of magnetic coil.

Module 4: Bulk and surface micromachining

Anisotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), Isotropic wet etching, Basic surface micromachining process- structural and sacrificial material, stiction and antistiction methods, Foundry process.

Module 5: **Polymer and optical mems**

Polymers in MEMS- polymide-SU-8 liquid crystal polymer(LCP)-PDMS-PMMA-Parylene-Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

Text book(s):

[1].Chang Liu, “Foundations of MEMS”, Pearson International Edition, 2006.
[2].Gaberiel M.Rebiz, “RF MEMS Theory,Design and Technology”, John Wiley & Sons,2003

Reference Book(s):

[1].Charles P.Poole, Frank J.Owens, “Introduction to nanotechnology” John Wiley & sons, 2003.
[2]Sunipa Roy, Chandan Kr Saha, “MEMS and Nanotechnology for gas sensors”, Taylor & Francis eBooks,2017
[4].Julian W.Gardner, Vijay K Varadhan, “Microsensors, MEMS and Smart devices”, John Wiley & sons,2001.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-
CO3	3	2	1	2	2	-	-	-	-	-	-	-
CO4	3	2	1	3	2	-	-	-	-	-	-	-

Course Name: Multimedia and Virtual Reality

Course Code: ECS801C

Contact: 3:0:0

Total Contact Hours:

36Credits: 3

Prerequisites: Computer Programming, Mathematics

Course Objectives:

The objective of the course is to provide comprehensive introduction about computer graphics system, design algorithms and two-dimensional transformations; to make the students familiar with techniques of clipping, three-dimensional graphics and three-dimensional transformations and become familiar with various software programs used in the creation and implementation of multimedia and to gain knowledge about hardware devices and software used.

Course Outcome:

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

CO1: Understand the basic computer graphics and Identify different media representations of different multimedia data and data formats, windows, clipping and view-ports object representation.

CO2: Analyze geometric, mathematical and algorithmic concepts necessary forprogramming computer graphics.

CO3: Apply different coding technique for solving real world problems.

CO4: Evaluate the software utilized in constructing computer graphics and multimedia applications.

Course Content:

Module1: Overview of Computing Paradigm

Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business dr adopting cloud computing. [3L]

Module2: TWO-DIMENSIONAL GRAPHICS

Module 3: ILLUMINATION AND COLOR MODELS

Height sources, basic illumination models, halftone patterns and dithering techniques, Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model, colour selection. Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms, Pixel addressing and object geometry [7L]

Module 4: THREE-DIMENSIONAL GRAPHICS

Three dimensional concepts, Three dimensional object representations, Polygon surfaces, Polygon tables, Plane equations, Polygon meshes, Curved Lines and surfaces, Spline representations, Bezier curves and surfaces, B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modelling transformations, Translation, Rotation, Scaling; Three- dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping [7L]

Module 5: MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING

Multimedia basics, Multimedia applications, Multimedia system architecture, evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies [6L]

Module 6: HYPERMEDIA

Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems [6L]

Text Books

1. Hearn Baker Carithers, - "Computer Graphics with Open GL", Pearson New InternationalEdition
2. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007
3. Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design¦, PHI, 2003

Reference Books:

1. Judith Jeffcoate, ―Multimedia in practice: Technology and Applications, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice, 2ndEdition, Pearson Education, 2003.
3. Jeffrey McConnel, ―Computer Graphics: Theory into Practice, Jones and BartlettPublishers, 2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard,KelvinSung, and AK Peters, ―Fundamentals of Computer Graphics, CRC Press, 2010.
6. William M. Newman and Robert F.Sproul, ― Principles of Interactive Computer Graphics,Mc Graw Hill 1978.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	1	2	1	1	-	-	-	-
CO2	2	2	1	1	3	1	2	1	-	-	-	-
CO3	2	2	3	3	1	1	1	1	-	-	-	-
CO4	3	1	2	2	2	1	1	1	-	-	-	-

Course Name: Mobile Communication
Course Code: EC(ECS)801A
Contact: 3:0:0
Total Contact Hours:
36Credits: 3
Prerequisite: Analog and Digital Communication System

Course Objective:

- To make students familiar with basics of mobile communication systems.
- To choose system (TDMA/FDMA/CDMA) according to the cost of installation, complexity, speed of propagation, channel properties etc.
- To compare between mobile communication and static communication.
- To identify the advantages, limitations and design techniques of 2G and 3Gwireless mobile communications.

Course Outcome:

CO1: By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems.
CO2: By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.
CO3: By the end of the course, the student will be able to realize all the applications of wireless protocols
CO4: By the end of the course, the student will be able to design the mobile networks.

Module 1 [3L]
Introduction: Vision of mobile communication. Historical perspective in the development of mobile communication - 1G to 4G and beyond (5G). Wireless standards.

Module 2 [9L]
Cellular system principle and planning: Cellular concepts - cell structure, frequency reuse, cell splitting and channel assignments, cellular network architecture. Location updating and Call setup. Hand off techniques and power control. Selection of uplink and downlink frequencies.

Module 3
Global System of Mobile communication (GSM): System overview, GSM architecture. Mobility management. Network signaling.

Module 4 [6L]

GSM system architecture and function partitioning. Introduction to Mobile System (MS). Base Station System (BSS). Home Location Register (HLR), Visiting Location Register (VLR), Equipment Identity Register (EIR).

Module 5 [6L]

GSM radio aspects: Wireless medium Access Control – FDMA, TDMA, CDMA, WCDMA. GSM radio standards. Frequency band and channel allocation.

Module 6 [4L]

Mobile data communication. Wireless LANS (WLANS). IEEE 802.11 Standards, Mobile IP

Module 7 [2L]

Introduction to GPS systems and its applications in real life.

Text Books:

1. Mobile Cellular Telecommunications – Analog & Digital Systems, William C. Y. Lee, McGrawHill, 1995
2. Mobile Communications Design Fundamentals, William C. Y. Lee, A Wiley-lnterscience Publication
3. Mobile. Communications, J. Schiller, Pearson Education

Reference Books:

1. Wireless Communications, T. S. Rappaport, Prentice Hall International, 2002.
2. Wireless Network Evolution, V. K. Garg - Pearson Ed

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	3	3	1	2	2	1	1
CO2	2	2	1	1	3	0	1	0	2	3	3	2
CO3	2	2	1	2	0	1	2	1	3	2	3	3
CO4	2	2	1	3	0	1	3	2	2	2	3	3

Course Name: Nanoelectronics
Course Code: EC(ECS)801B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

The candidates should have the basic knowledge of materials physics and charge transportphenomena in electronic devices.

Course Outcome:

After successful completion of this course, students should be able to:
CO1: develop a fundamental knowledge of nanomaterial
CO2: understand the recent trends of microelectronics and nano-Electronics.
CO3: know about the fabrication and analytical techniques of nanomaterials.
CO4: understand the quantum transport phenomena and working principles of nano-electronic devices.

Course Contents:

Module 1 **[8L]**
Introduction to nano-electronics, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics. Mesoscopic physics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence. Classification of Nano structures, Low dimensional structures: Quantum wells, wires and dots, Density of states and dimensionality. Basic properties of two-dimensional semiconductor nanostructures, carbon nano tube and graphene.

Module 2 ***[8L]***
Introduction to methods for fabrication of nano-layers, different approaches, physical vapor deposition, chemical vapor deposition. Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide- dry and wet oxidation methods. Fabrication of nano particle- grinding with iron balls, laser ablation, reduction methods, sol gel, self-assembly, precipitation of quantum dots. MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.

Module 3 ***[6L]***
Introduction to characterization of nanostructures, tools used for of nano materials' characterization, Microscope- optical and electron microscope. Principle of operation of Scanning Tunneling Microscope, Atomic Force Microscope, Scanning Electron microscope, Specimen interaction. Transmission Electron Microscope. X-Ray Diffraction analysis, UV-Vis spectroscopy, Particle size analyzer.

Module 4 ***[8L]***
Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezoresistivity, Piezoelectricity and thermoelectricity,

Module 5 **[6L]**
Introduction – Scaling of physical systems – Geometric scaling & Electrical system scaling. The Single- Electron Transistor: Single-Electron Transistor Logic, Other SET and FET Structures, CarbonNanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Coulomb Blockade in a Nanocapacitor, Hot electro transistors, Molecular SETs and Molecular Electronics

Text Books
1. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press
2. Marc Madou, Fundamentals of microfabrication & Nanofabrication.
3. T. Fukada & W.Mens, Micro Mechanical system Principle & Technology, Elsevier.
4. Julian W.Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices.

Reference Books

1. Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques byWR Fahrner – Springe
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; TataMc.Graw Hill.
3. Nanotechnology: Synthesis to Applications by Roy, Ghosh and Sarkar, CRC Press, 2017.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	1	1	-	-	-	1	2	1
CO2	3	2	2	1	1	-	2	1	1	1	1	2
CO3	2	3	1	2	1	1	1	2	-	-	1	1
CO4	2	3	3	2	2	2	1	-	2	2	-	-

Course Name: Biomedical Electronics
Course Code: EC(ECS)801C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Sensors & Transducers, Signal Processing

Course Objectives:

1. To understand the various systems of the human physiology and signals of biological originobtained from various systems,
2. To analyse various biosensors, transducers and bio-potential electrodes used to acquirevarious bio- potentials.
3. To understand various methods of measurement of blood pressure, blood flow, heart sounds andpacemaker
4. To familiarize with various amplifiers for measuring biopotentials.
5. To acquire knowledge about Electrical safety of medical devices and their protective measures.

Course Outcome

After completion of this course, the students will be able to
CO1: Able to understand the detailed physiology of various human anatomical systems. CO2: Able to identify proper transducer for acquisition of a particular bioelectric potential. CO3: Able to analyse various biological conditions from the measured bioelectric potentials.
CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distance .

Module I: Physiology of various anatomical systems:

Introduction to the physiology of cardiac, nervous, muscular and respiratory

systems [6L]

Module II: Bioelectric potential and measuring transducers:

Bioelectric potentials: Definitions, types, range, basic characteristics. resting and action potentialDifferent types of transducers and electrodes: construction, selection for acquiring various bio- potentials [8L]

Module III: Measurements on cardiovascular and respiratory system

Blood pressure - characteristics of blood flow - Heart sounds - ECG - Measurement of blood pressure,blood flow, heart sounds and Cardiac pace-maker: types and its detail instrumentation [12L].

Module IV: Electrical activities in brain and muscles:

Electromyography and Electroencephalograph: characteristics, measurements and signal analysis.

[2L]

Module V: Medical Imaging Techniques

Ultrasound imaging and IR Imaging: image acquisition technique and analysis, MRI [4L]

Module VI: Biotelemetry

Transmission and Reception aspects of biological signals over long distances. [2L]

Module VII: Measurement Errors and safety issues

Errors in bio-potential measurement, types and methods to minimize errors
Electrical- Safety codes and standards, basic approaches to protection against shock, powerdistribution protection, equipment protection [2L]

Text Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Khandpur R.S., Hand book of Biomedical Instrumentation, Tata McGraw Hill
3. Webster J S – Medical Instrumentation – Application and Design
4. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
5. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	2	2	1	2	-	-	-	-	-
CO2	3	3	2	2	2	2	1	-	-	-	-	-
CO3	3	3	2	3	3	1	1	-	-	-	-	-
CO4	3	3	3	3	3	2	2	-	-	-	-	-

Course Name: Quantum Computing
Course Code: CS(ECS)801A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Discrete Structures

Course Objective(s):

The objective of this course is to provide:

1. the students an introduction to quantum computation.
2. Much of the background material related to the algebra of complex vector spacesand quantum mechanics is covered within the course.

Course Outcome(s):

After completion of the course students will be able to:

CO1 : Understand the basic idea of quantum computing including background of mathematics and physics required for developing and solving complex engineering problem in the domain of quantum computing possibly using modern engineering tools.

CO2 : Understand and explain the concept of quantum circuits using single and multiple qubit gates and also designing of quantum circuits for solving engineering problem including societal and environmental issues.

CO3: Compare between classical and quantum information theory and explain and apply Bell states, Quantum teleportation, Quantum Cryptography and no cloning theorem in solving engineering problem possibly in a team maintain proper ethics of professional collaboration.

CO4 : Understand, explain and apply different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also relate between quantum and classical complexity classes forsolving engineering problem.

CO5: Understand noise and error correction including graph states and codes, quantum error correction, fault-tolerant computation and apply it in designing and solving complex engineering problems leading to their lifelong learning.

Course Content*:*

Module1: Introduction to Quantum Computation: 8L

Quantum bits, Bloch sphere representation of a qubit, multiple qubits. Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Module2: Quantum Circuits: 6L
Single qubit gates, multiple qubit gates, design of quantum circuits.
Module3: Quantum Information and Cryptography: 6L
Comparison between classical and quantum information theory. Bell states. Quantum

teleportation.Quantum Cryptography, no cloning theorem.

Module4: Quantum Algorithms: 8L
Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Module5: Noise and error correction: 8L
Graph states and codes, Quantum error correction, fault-tolerant computation.

Text book:
1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge UniversityPress.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Reference Books:
1. P Kaye, R Laflamme and M Mosca, An Introduction to Quantum Computing.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientificand Engineering Computation)
3. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.
4. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd.
5. Scott Aaronson, "Quantum Computing since Democritus", Cambridge.
6. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	1	-	-	2
CO2	3	3	3	3	2	2	2	-	1	-	-	2
CO3	3	2	2	3	1	2	1	2	2	-	-	2
CO4	1	2	2	2	1	1	2	2	-	-	-	2
CO5	2	3	3	1	-	1	2	-	-	-	-	3

Course Name: Big Data Analytics
Course Code: CS(ECS)801B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics,Artificial Intelligence, Programming skills of Python

Course Objective(s):

- Comprehend the fundamental concepts of the Big Data Analytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various

types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework).

- Formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions
- Apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured data distributed across multiple locations.
- Excogitate and Implement ideas to address the challenging issues of Big Data Analytics.
- Analyze the effectiveness of various Big Data Analytics Frameworks.

Course Outcome(s):

After completion of the course students will be able to

CO1 : Understand and explain the fundamental concepts of the Big Data Analytics which are primarily explored for making automated decisions using machine learning strategies on analyzing large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework) underscoring the utilitarian importance in current technological context for furtherexploration leading towards lifelong learning.

CO2 : Identify and formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions within the scope of Big Data Analytics Frameworks.

CO3 : Explore relevant literature and apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured data using Map Reduce, Hadoop and advanced SQL Frameworks.

CO4 : Excogitated as for proposing solutions to the challenging problems of Big Data Analytics.

CO5 : Implement ideas of Big Data Analytics through developing feasible algorithms or frameworks and investigate their effectiveness in solving the relevant problems by analyzing the performances usingproper techniques.

Course Content:

Module – 1: Introduction to Basic Analytics [10L]

Introduction: Big data overview, Analyst's perspective on data repositories, Current analyticalarchitecture, Drivers of big data, Examples of big data analytics.

Life Cycle of Data Analytics: Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational.

Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.

Module - 2: Advanced Analytic Methods I [8L]

Clustering: Overview, K-means, Determining the number of clusters, Diagnostics.

Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application ofassociation rules, Validation and testing, Diagnostics.

Regression: Linear regression - model description, Logistic regression – model description, Otherregression models.

Classification: Decision trees – overview, General algorithm, Decision tree algorithms, Evaluating adecision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Dia of classifiers.

Module – 3: Advanced Analytic Methods II [8L]

Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, moving average model, ARMA and ARIMA model, Building and evaluating an ARIMA model.
Text Analysis: Steps in text analysis, collecting raw text, representing text, Term Frequency-InverseDocument Frequency (TFIDF), Categorizing documents by types, Determining sentiments.
Map Reduce and Hadoop: Analytics for unstructured data – map reduce, Apache Hadoop, HadoopEcosystem – Pig, Hive, Hbase, Mahout.

Module – 4: Advanced Analytic Methods III [10L]

Technology and Tools: SQL essentials - Join, Set, grouping extensions, Advanced SQL – Windowfunctions, User-defined functions, Ordered aggregates, MADlib, NoSQL.
Integration of Techniques: Communicating and operationalizing an analytic project.
Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details, Recommendations, Providing technical specifications and code.
Data visualization basics - Key points, evolution of a graph, common representation methods, how toclean up a graphic.

Text Books*:*

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons,2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

Reference Books:

1. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-timeData Systems. Manning Publications, 2015.
2. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	3	2	-	-	-	-	-
CO2	2	3	1	1	1	1	1	-	-	-	-	-
CO3	2	2	3	2	1	1	1	-	-	-	-	-
CO4	2	2	2	3	1	1	1	-	-	-	-	-
CO5	2	2	3	3	2	2	2	-	-	-	-	-

Course Name: Neural Network and Deep Learning
Course Code: CS(ECS)801C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
Mathematics. Having a good mathematical background, at least an undergraduate level will prove to be beyond helpful in grasping the neural network technology. A good amount of knowledge in Calculus, LinearAlgebra, Statistics and Probability will smoothen the process of learning the surface of the subject.

Course Outcome(s):

After completion of the course students will be able to
CO1: understand the concepts of Neural Networks
CO2: select the Learning Networks in modeling real world systems
CO3: use an efficient algorithm for Deep Models
CO4: apply optimization strategies for large scale application

Course Content:

Module 1: [6L]
Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

Module 2: [7L]
Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance TheoryNetworks. Special Networks- Introduction to various networks.

Module 3: [7L]
Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning,Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

Module 4: [8L]
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

Module 5: [8L]
Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second Order Methods, Optimization Strategies and Meta-Algorithms Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, NaturalLanguage Processing

Text book:

1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

Reference Books:

1. B. Yegnanarayana, "Artificial Neural Networks" Prentice Hall Publications.
2. Simon Haykin, "Artificial Neural Networks", Second Edition, Pearson Education.
3. Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications", Prentice Hallpublications.
4. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
5. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
6. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
7. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Mapping of COs with POs and PSOs: (Detailed: High:3; Medium:2; Low:1):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	2	-	-	-	-	-
CO2	3	3	3	2	2	2	2	-	1	1	-	3
CO3	3	2	3	3	1	2	2	-	-	-	-	2
CO4	3	2	1	2	1	1	-	-	3	-	-	1
CO5	3	3	1	3	-	-	-	-	3	2	-	1

Course name: Principles of Management
Course Code: HU(ECS)801
Credits: 1
No. of lectures: 12

Course Outcomes:

CO1: To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context

CO2: To understand and apply a variety of management and organizational theories in practice

CO3: To be able to mirror existing practices or to generate their own innovative management competencies required for today's complex and global workplace

CO4: To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organizations.

Course Content:

Module1: Introduction to Management and Organizations

Definition of Management – Science or Art – Manager Vs Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management. 8L

Module-2: Nature and purpose of planning – planning process – types of planning – objectives –

setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process. 4L

Text Books:

1. Koontz, H., and Weihrich, H., Essentials of Management: An International, Innovation and Leadership Perspective, McGraw Hill, 2015.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004

Reference Books:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson publication

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	1	1	2	-	-
CO2	-	-	-	-	-	1	1	2	1	2	3	-
CO3	-	-	-	-	-	3	2	-	-	1	-	-
CO4	-	-	-	-	-	3	2	-	-	1	-	-
CO5	-	-	-	-	-	-	2	1	1	-	-	-