SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT NAGPUR – 440013

An Autonomous College affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME

2022-2023

B.TECH. (ELECTRONICS AND COMPUTER SCIENCE)

Teaching Scheme for B. Tech. Electronics and Computer Science

SEMESTER-I												
Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	BSC	PHT156	Semiconductor Physics	3	1	0	4	40	60	100	3
2	BSC	PHP156	Semiconductor Physics Lab	0	0	3	1.5	25	25	50	-
3	BSC	MAT153	Mathematics - I	3	0	0	3	40	60	100	3
4	BSC	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	-
5	ESC	ECST101	Programming for Problem Solving	3	0	0	3	40	60	100	3
6	ESC	ECSP101	Programming for Problem Solving Lab	0	0	2	1	25	25	50	-
7	ESC	ECSP102	Electronics and Computer Workshop Lab	0	0	2	1	25	25	50	-
8	HSMC	HUT151	English	2	0	0	2	40	60	100	3
9	HSMC	HUP151	English Lab	0	0	2	1	25	25	50	-
10	ESC	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1	20	30	50	1.5
11	MC	PEP151	Yoga / Sports	0	0	2	0				-
TOTAL				**12**	**1**	**13**	**18.5**				
				26 Hrs.							

Teaching Scheme for B. Tech. Electronics and Computer Science

SEMESTER- II											
Sr. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
1	BSC	CHT152	Chemistry	3	1	0	4	40	60	100	3
2	BSC	CHP152	Chemistry Lab	0	0	3	1.5	25	25	50	-
3	BSC	MAT154	Mathematics - II	4	0	0	4	40	60	100	3
4	ESC	ECST103	Network Circuits	3	0	0	3	40	60	100	3
5	ESC	ECST104	Digital Circuits	3	0	0	3	40	60	100	3
6	ESC	ECSP104	Digital Circuits Lab	0	0	2	1	25	25	50	-
7	ESC	ECST105	Object Oriented Programming	3	0	0	3	40	60	100	3
8	ESC	ECSP105	Object Oriented Programming Lab	0	0	2	1	25	25	50	-
9	MC	HUT152	Constitution of India	2	0	0	0				-
TOTAL				**18**	**1**	**7**	**20.5**				
				26 Hrs.							

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester III											
Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	ESC	ECST201	Electronic Devices and Circuits	3	1	0	4	40	60	100	3
2	ESC	ECSP201	Electronic Devices and Circuits lab	0	0	2	1	50		50	-
3	PCC	ECST202	Data Structures	3	1	0	4	40	60	100	3
4	PCC	ECSP202	Data Structures Lab	0	0	2	1	50		50	-
5	PCC	ECST203	Digital System Design	3	0	0	3	40	60	100	3
6	PCC	ECSP203	Digital System Design Lab	0	0	2	1	50		50	-
7	PCC	ECST204	Discrete Signals and Systems	3	0	0	3	40	60	100	3
8	PCC	ECSP204	Discrete Signals and Systems Lab	0	0	2	1	50		50	-
9	BSC	MAT 277	Linear Algebra	2	0	0	2	40	60	100	3
10	MC	CHT251	Environmental Sciences	2	0	0	0				
TOTAL				**16**	**2**	**8**	**20**				
				26 Hrs.							

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester IV												
Sr. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
1	PCC	ECST206	Discrete Mathematics	3	1	0	4	40	60	100	3
2	PCC	ECST207	Software Engineering	3	0	0	3	40	60	100	3
3	PCC	ECSP207	Software Engineering Lab	0	0	2	1	50		50	-
4	PCC	ECST208	Computer Architecture and Organization	3	1	0	4	40	60	100	3
5	PCC	ECST209	Embedded System Design	3	1	0	4	40	60	100	3
6	PCC	ECSP210	Hardware System Design Lab	0	0	2	1	50		50	-
7	PCC	ECSP211	Software Lab-I	0	0	2	1	50		50	-
8	PCC	ECST212	Statistics for Data Analytics	3	0	0	3	40	60	100	3
9	OEC		Open Elective I	3	0	0	3	40	60	100	3
TOTAL				**18**	**3**	**6**	**24**				
				27 Hrs.							

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester V												
Sr. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
1	PCC	ECST301	Operating System	3	0	0	3	40	60	100	3
2	PCC	ECSP301	Operating System Lab	0	0	2	1	50		50	-
3	PCC	ECST302	Design and Analysis of Algorithms	3	1	0	4	40	60	100	3
4	PCC	ECST303	Machine Learning	3	0	0	3	40	60	100	3
5	PCC	ECSP303	Machine Learning Lab	0	0	2	1	50		50	-
6	PCC	ECSP304	Software Lab -II	0	0	2	1	50		50	-
7	PEC	ECST305	Programme Elective - I	3	0	0	3	40	60	100	3
8	PEC	ECSP305	Programme Elective- I Lab	0	0	2	1	50		50	-
9	HSMC	MBT	Business Management and Entrepreneurship	3	0	0	3	40	60	100	3
10	OEC		Open Elective II	3	0	0	3	40	60	100	3
TOTAL				**18**	**1**	**8**	**23**				
				27 Hrs.							

Programme Elective – I (V Semester)	
ECST305-1 / ECSP305-1	VLSI Signal Processing
ECST305-2 / ECSP305-2	Elements of IoT
ECST305-3 / ECSP305-3	Image Processing
ECST305-4 / ECSP305-4	Cloud Computing

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester VI											
Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	ECST306	Database ManagementSystem	3	0	0	3	40	60	100	3
2	PCC	ECSP306	Database ManagementSystem Lab	0	0	2	1	50		50	-
3	PCC	ECST307	Computer Networks	3	0	0	3	40	60	100	3
4	PCC	ECSP307	Computer NetworksLab	0	0	2	1	50		50	
5	PCC	ECST308	Digital VLSI Design	3	0	0	3	40	60	100	3
6	PCC	ECSP308	Digital VLSI Design Lab	0	0	2	1	50		50	
7	PEC	ECST309	Programme Elective II	3	0	0	3	40	60	100	3
8	PEC	ECSP309	Programme Elective IILab	0	0	2	1	50		50	-
9	PROJ	ECSP310	Project I	0	0	6	3	25	25	50	-
10	OEC		Open Elective III	3	0	0	3	40	60	100	3
TOTAL				**15**	**0**	**14**	**22**				
				29 Hrs.							

Program Elective – II (VI Semester)	
ECST 309-1 / ECSP 309-1	System Verilog for Verification
ECST 309-2 / ECSP 309-2	IoT Sensors and Devices
ECST 309-3 / ECSP 309-3	Deep Learning -I
ECST 309-4 / ECSP 309-4	Data Mining and Warehousing

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester VII												
Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PEC	ECST401	Programme Elective III	3	0	0	3	40	60	100	3
2	PEC	ECST402	Programme Elective IV	3	0	0	3	40	60	100	3
3	PCC	ECST403	Information Security and Cryptography	3	0	0	3	40	60	100	3
4	MC	ECST404	Cyber Laws and Ethics	2	0	0	2	40	60	100	3
5	PROJ	ECSP405	Project II	0	0	12	6	50	50	100	-
6	PROJ	ECSP406	Industry Internship Evaluation (6-8 weeks)	0	0	2	0		-		-
7	OEC		Open Elective IV	3	0	0	3	40	60	100	3
TOTAL				**14**	**0**	**14**	**20**				
				28 Hrs.							

Program Elective – III (VII Semester)		**Program Elective - IV (VII Semester)**	
ECST 401-1	VLSI Testing	ECST 402-1	SoC Design
ECST 401-2	IoT Networks and Protocols	ECST 402-2	IoT Programming and Big Data
ECST 401-3	Deep Learning -II	ECST 402-3	Natural Language Processing
ECST 401-4	System Design	ECST 402-4	Block Chain

Teaching Scheme for B. Tech. Electronics and Computer Science

Semester VIII												
Sr. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
1	PEC	ECST407	Programme Elective V	3	0	0	3	40	60	100	3
2	PEC	ECST408	Programme Elective VI	3	0	0	3	40	60	100	3
3	PROJ	ECSP409	Project III	0	0	12	6	50	50	100	-
TOTAL				**6**	**0**	**12**	**12**				
				18 Hrs.							
OR											
1	PROJ	ECSP410	Internship (Six Months)	0	0	24	**12**	150	150	300	-

Program Elective- V (VIII Semester)		**Program Elective- VI (VIII Semester)**	
ECST 407-1	Physical Design	ECST 408-1	Nano electronics
ECST 407-2	Cyber security and Privacy in IoT	ECST 408-2	Autonomous Vehicle
ECST 407-3	Generative Adversarial Network	ECST 408-3	Reinforcement Learning
ECST 407-4	Big data web intelligence	ECST 408-4	Bioinformatics

Open Electives			
IV semester	**V semester**	**VI semester**	**VII semester**
ECST299-1: Linux for Beginners	ECST398-1: Designing with Arduino	ECST399-1: Designing with Raspberry Pi	ECST498-1: Drone Technology

Teaching Scheme for B. Tech. Electronics and Computer Science

HONORS Specialization in Electronics and Computer Science

Sr. No.	Semester	Course Code	Course Title	Hours/ week			Credits	Maximum Marks			ESE Duration (Hrs.)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	III	ECSTH301	Edge for AI fundamentals	3	0	0	3	40	60	100	3
2	IV	ECSTH401	Embedded Machine Learning	3	0	0	3	40	60	100	3
3	V	ECSTH501	Computer Vision with Embedded Machine Learning	3	1	0	4	40	60	100	3
4	VI	ECSTH601	Business Considerations for Edge Computing	3	1	0	4	40	60	100	3
5	VII	ECSPH701	Project	0	0	8	4	50	50	100	-
				12	**2**	**8**	**18**				

MINOR Specialization in Electronics and Computer Science

Sr. No.	Semester	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
								Continuous Evaluation	EndSem Exam	Total	
1	III	ECSTM301	IoT fundamentals	3	0	0	3	40	60	100	3
2	IV	ECSTM401	Sensor Interfacing with Arduino and ESP 8266	3	0	0	3	40	60	100	3
3	V	ECSTM501	Cloud Computing Using Raspberry Pi	3	1	0	4	40	60	100	3
4	VI	ECSTM601	Data Management and Analytics for IoT	3	1	0	4	40	60	100	3
5	VII	ECSPM701	Project	0	0	8	4	50	50	100	-
			Total	**12**	**2**	**8**	**18**				

Syllabus of Semester I B.Tech.

Department of Electronics and Computer Science

Course Code	PHT156				
Category	Basic Science Course				
Course Title	Semiconductor Physics				
Scheme & Credits	L	T	P	Credits	Semester I
	3	1	0	4	

Course Outcomes:

After successful completion of the course students will be able to

1. Apply fundamental knowledge of quantum mechanics to examine electrons behaviour in solids at the quantum level.
2. Classify materials on the basis of band theory and its importance for semiconductors.
3. Outline the difference between intrinsic/extrinsic semiconductors and their carrier transport phenomena in semiconductor.
4. Analyze the process of generation and recombination of excess charge carriers in semiconductors along with working principle of P-N junction and Metal- Semiconductor junction diode
5. Illustrate the working and design aspects for the various photonic devices like LEDs, solar-cells and LASER diodes.

Syllabus:

Module I: Quantum Mechanics Introduction Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling, One electron atom, periodic table, Quantum confinement effects in nanosystems.

Module II: Electronic Materials Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap-based classification of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

Module III: Intrinsic and Extrinsic Semiconductors Intrinsic and extrinsic semiconductors, Dependence ofFermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift Programme.

Module IV: Non-Equilibrium Semiconductors Carrier generation and recombination, Continuity equation, Ambipolar transport equation, QuasiFermi Energy levels, Excess Carrier Lifetime, Qualitative introduction to recombination mechanisms, Shorkley-Read-Hall Recombination, Surface Recombination.

Module V: Junction Physics p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non- rectifying barrier, tunneling barrier, Heterojunctions, Nanostructures, Energy band diagram, two- dimensional electron gas.

Module VI: Light - Semiconductors Interaction Optical absorption in semiconductors, Light emitting diodes, Principles, Device Structures, Materials, High Intensity LEDs, Characteristics, LASERS, Stimulated emission and photon amplification, Einstein Coefficients, Laser oscillation conditions, Laser diode, Solar Energy Spectrum, photovoltaic device principles, Solar Cells.

Text Book:

Modules 1-5 1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.

References:

1. Physics of Semiconductor Devices, S. M. Sze, 2nd Edition, Willey-Interscience Publication1986
Modules 6 1. Online course: Semiconductor Optoelectronics by M. R. Shenoy on NPTEL

2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall 2001

Syllabus of Semester I B.Tech.

Department of Electronics and Computer Science

Course Code	PHP156				
Category	Basic Science Course				
Course Title	Semiconductor Physics Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	3	1.5	

Course Outcomes:

The Physics Lab course consists of experiments illustrating the principles of physics relevant to the study of science and engineering.

At the end of the Course the students will learn to:

1. Develop skills required for experimentation and verification of physics laws.
2. Analyse the results obtained through proper graph plotting and Error analysis.
3. Conduct experiments to validate physical behaviour of materials/components.
4. Analyse the behaviour and characteristics of P-N Junction, Zener-Diode and other semiconductor devices.
5. Prepare laboratory reports on interpretation of experimental results.

In addition to the General physics experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

General Physics

1. Error analysis and graph plotting
2. Newton's law of cooling
3. Simple Pendulum
4. Magnetic flux using deflection magnetometer
5. Dispersive power and determination of Cauchy's constants
6. Data analysis using Mathematica.
7. Cathode Ray Oscilloscope

Semiconductor Physics and Devices

1. Energy gap of semiconductor/ thermistor
2. Study of Hall Effect
3. Parameter extraction from I-V characteristics of a PN junction diode
4. Parameter extraction from I-V characteristics of a zener diode 12
5. Study of diode rectification
6. Parameter extraction from I-V characteristics of a transistor in common-emitter configuration.
7. V-I Characteristics of Light Emitting Diodes
8. Study of a photodiode
9. Solar Cell (Photovoltaic cell)
10. Resistivity measurement by Four Probe method

A minimum of 8 experiments to be performed from the following list of experiments

Syllabus of Semester I B.Tech.

Department of Electronics and Computer Science

Course Code	MAT 153				
Category	Basic Science Course				
Course Title	Mathematics - I				
Scheme & Credits	L	T	P	Credits	Semester I
	3	0	0	3	

Course Outcomes:

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus:

Module I: First order ordinary differential equations (7 Hrs)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut'stype.

Module II: Ordinary differential equations of higher orders (8 Hrs)
Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module III: Basic Statistics: (7 Hrs)
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 Hrs)
Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 Hrs)
Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning:
Applications of Differential Equations.

Textbooks/References:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.

3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Codington, An Introduction to Ordinary Differential Equations, Prentice HallIndia, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.
7. Theory and Problems of probability and statistics: 2nded :*J. R. Spiegal ,Schaum series*
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus of Semester I B.Tech.

Department of Electronics and Computer Science

Course Code	MAP151				
Category	Basic Science Course				
Course Title	Computational Mathematics Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes:

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyse the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Reference:

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	ECST101				
Category	Engineering Science Course				
Course Title	Programming for Problem Solving				
Scheme & Credits	L	T	P	Credits	Semester I
	3	0	0	3	

Course Outcomes:

On successful completion of course student will be able to:

1. Develop the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs, test and execute the programs and correct syntax and logical errors.
3. Use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. Apply programming concepts to solve matrix addition, multiplication problems and searching & sorting problems.
5. Implement iterations and recursions, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.

Syllabus:

Module I: Introduction to Programming
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart /Pseudo code with examples. Arithmetic expressions and precedence.

Module II: C Programming Language
Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Pre-processor Directives, Decision Control Statement-if, if-else, nested if-else statement, switch case, Loops and Writing and evaluation of conditionals and consequent branching.

Module III: Arrays and Basic Algorithms
Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module IV: Functions and Recursion
User defined and Library Functions, Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module V: Pointers and Structures
Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Module VI: File handling
Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush ().

Text Books:

1. Programming in ANSI C: E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books:

2. Programming with C: Byron Gottfried, Schaums Outline Series.
3. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	ECSP102				
Category	Engineering Science Course				
Course Title	Electronics and Computer Workshop Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes:

Upon the completion of this course, students will demonstrate the ability to:

1. Inspect techniques to identify and test different Electronic components and Integrated Circuits.
2. Comprehend different EDA tools required for designing of Electronic and computer related circuits.
3. Classify mounting and troubleshooting practices and OS installation and Imaging.

Practical's based on:

1. Acquaintance with basic electronic components, reading of data sheets and Integrated circuits.
2. Introduction to electronic test and measurement equipment's (multimeter CRO, DSO, Function generator, power supply, etc.)
3. Test and measurement of resistor, capacitor, inductor, P-N junction Diode using Multimeter and DSO.
4. Introduction to EDA tools.
5. Circuit implementation and testing on breadboard
6. Component mounting and soldering on PCB.
7. Assembling and disassembling CPU and identification of peripherals.
8. Processor mounting and troubleshooting practices.
9. USB, Ethernet, HDMI, thunderbolt port variants (peripherals).
10. Types of OS and OS installation, OS imaging.

Text Books:

1. K.A. Navas; Electronics lab Manual; Fifth Edition; PHI learning; 2015
2. N. Kumar, T. H. Sheikh; PC Assembly and Installation; Books clinic Publishing; 2020

Reference books:

1. C. Bhargava; Digital Electronics: A Comprehensive Lab Manual; BS Publication; 2019
2. C. Zacker; PC Hardware: The Complete Reference; First Edition; McGraw Hill Education; 2017

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	HUT151				
Category	Basic Science Course				
Course Title	English				
Scheme & Credits	L	T	P	Credits	Semester I
	2	0	0	2	

Course Outcomes:

Upon the completion of this course, students will be able to:

CO1. Demonstrate correct use of word power in written as well as oral communication.
CO2. Apply the principles of functional grammar in everyday as well as professional communication.
CO3. Create precise and accurate written communication products.
CO4. Objectively apply various writing styles.
CO5. Effectively implement the comprehensive principles of written communication.
CO6. Employ techniques of listening and reading comprehension in professional communication.

Syllabus:

Module I: Vocabulary Building The concept of Word Formation, Techniques to develop word power: root words from foreign language, affixes, games, etc. Commonly used power verbs, adjectives and adverbs. Synonyms, antonyms, phrases & idioms, one word substitutions and standard abbreviations

Module II: Identifying Common Errors in Writing Articles, prepositions, modifiers, modal auxiliaries, Tenses Subject-verb agreement, noun-pronoun agreement Active – passive voice

Module III: Basic Writing Skills

Sentence Structures
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

Module IV: Nature and Style of sensible Writing

Describing
Defining
Classifying
Providing examples or evidence

Module V: Writing Practices

Précis Writing
Essay Writing
Email Writing
Note Making (with reference to GD, Meetings, Presentations, and Feedback)

Module VI: Reading and Listening Comprehension

Reading Comprehension: purpose, types, strategies and practice
Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, barriers in listening, and practice

Textbooks/References:

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	HUP151				
Category	Basic Science Course				
Course Title	English Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes:

Upon the completion of this course, students will:

CO1: Apply effective listening and speaking skills.
CO2: Demonstrate the techniques of effective Presentation Skills.
CO3: Analyze and apply effective strategies for Personal Interviews.
CO4: Evaluate and apply effective strategies for Group Discussions.
CO5: Implement essential language skills- listening, speaking, reading, and writing.

List of Practicals :

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	IDT151				
Category	Multidisciplinary Course				
Course Title	Creativity, Innovation & Design Thinking				
Scheme & Credits	L	T	P	Credits	Semester I
	1	0	0	1	

Course Outcomes:

1: Be familiar with processes and methods of creative problem solving
2: Enhance their creative and innovative thinking skills
3: Practice thinking creatively and innovative design and development

Syllabus:

Module I: Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

Module II: Pattern Breaking: Thinking differently, Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brain- writing, The SCAMPER methods, Metaphoric thinking, Outrageous thinking, Mapping thoughts, Other (new approaches)

Module III: Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

Module IV: Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats, Ethical considerations

Module V: Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

Module VI: Intellectual Property: Introduction to intellectual property: Patents, Copyrights,Trademarks, Trade Secret, Unfair Competition.

Text Book and Reference Books:

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. CambridgeUniversity Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka PuzzleBusters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie/game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus of Semester I B. Tech.

Department of Electronics and Computer Science

Course Code	PEP151				
Category	Basic Science Course				
Course Title	Yoga/Sports				
Scheme & Credits	L	T	P	Credits	Semester II
	0	0	2	0	

Course Outcome:

On successful completion of the course, students will be able to:

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes:

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students, which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so also recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline:

- **Sports:**
  1. Introduction to sports, offered by the department.
  2. Health and safety issues related to sports; knowledge, recognition and ability todeal with injuries and illness associated with sports.
  3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
  4. Conduction of small recreational games and activities.
- **Yoga:** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.
- **Physical Efficiency Tests:** This includes 6 health related physical fitness test

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	CHT152				
Category	Basic Science Course				
Course Title	Chemistry				
Scheme & Credits	L	T	P	Credits	Semester II
	3	1	0	4	

Course Outcomes:

After the successful completion of the course, students shall be able to

1. Predict the properties and interactions of chemical substances at the atomic level.
2. Interpret the unique properties of nano-materials to solve challenges in life.
3. Explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing.
4. Examine the chemical kinetics using concepts of computational chemistry.
5. Discuss how spectroscopic methods are used for qualitative and quantitative analyses.
6. Understand the importance of biomaterials.

Syllabus :

Module I: Chemical Bonding (7 Hrs)

Bondings in atoms: Primary bonding: ionic, covalent, metallic. Secondary bonding: dipole-dipole, induced dipole-induced dipole, London dispersion/van der Waals, hydrogen. LCAO-MO Electronic material: Band theory: metals, insulators, and semiconductors. Band gaps, doping.Silicon wafer production. Integrated circuits, Light Emitting Diodes.

Module II: Nano-materials (7 Hrs)

Basics of Nanochemistry: Definition of Nano, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical, optical properties.

Application of Nanomaterials: Molecular electronics and nanoelectronics, Nanotechnology for waste reduction and improved energy efficiency, Carbon Nanotubes for energy storage, Hydrogen Storage in Carbon Nanotubes.

Module III: Advanced Materials: (7 Hrs)

Introduction to Composites, their classification Ceramic, Carbon–Carbon Composites, Fiber-Reinforced Composites and Applications.

Reinforcements: Kevlar, silicon carbide, boron carbide.

Industrial Polymer: Thermoplastics, Thermosetting Plastics, Polymers used in electronic industries, Polymers in optical media data storage devices.

Module IV: Computational Chemistry (6 Hrs)

Rate of the reaction, Order and Molecularity of the reaction, Rate expression for Zero Order, First Order and Second Order Reactions, Effect of the temperature, Use of computational tools for determining rate of the reaction, etc.

Module V: Material Characterization using different Spectroscopic Techniques (7 Hrs)

Fundamentals of spectroscopy, Infrared Spectroscopy, Electronic Spectroscopy, Nuclear Magnetic Resonance Spectroscopy. Fundamentals of X-Ray Diffraction (XRD).

Module VI: Biomaterials (8 Hours)

Introduction, metallic biomaterials like stainless steel, CoCr alloy, Corrosion of metallic implants, Ceramic biomaterials like calcium phosphate, bioactive or surface reactive biomaterials, biodegradable polymers, biocompatibility.

Text Books:

1. Shikha Agrawal, Engineering Chemistry: Fundamentals and Applications, Cambridge University Press.
2. Dr. Rajshree Khare, A Textbook of Engineering Chemistry(AICTE), S.K. Kataria &Sons
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.

Reference Books:

1. J. Michael Hollas, Modern Spectroscopy, Fourth Edition, John Wiley and Sons, 2004.
2. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
3. Bradley D. Fahlman, Materials Chemistry, Third Edition, Springer Nature, 2018.
4. Brian W. Pfennig, Principles of Inorganic Chemistry, John Wiley and Sons, 2015.
5. Steven S. Zumdahl, Donald J. DeCoste, Chemical Principles, Eighth Edition, Cengage Learning,2017.
6. Catherine E. Housecroft and Edwin C. Constable, Chemistry: An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition, Pearson Education Limited, 2006.
7. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Fifth Edition, John Wiley and Sons, 2006.
8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James R. Vyvyan, Introduction to Spectroscopy, Fifth Edition, Cengage Learning, 2009.
9. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004.
10. P. C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publication.
11. J. D. Lee, Concise Inorganic Chemistry, Fourth Edition, Chapman and Hall Publications.
12. Joon B. Park and Joseph d. Bronzino " Biomaterials : Principles and Applications, CRCPress
13. C. Mouli Agrawal, Joo L Ong, Mark R. Appeleford and Gopinath Mani: Introduction to biomaterials.
14. U Sattyanarayana, U Chakrapani: Biochemistry, Elsevier publications.

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	CHP152				
Category	Basic Science Course				
Course Title	Chemistry Lab				
Scheme & Credits	L	T	P	Credits	Semester II
	0	0	3	1.5	

Course Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Estimate the amount of different impurities in water/ waste water samples.
   Measure molecular system properties of liquids/oils such as surface tension, viscosity, acid value and saponification number.
2. Estimate the rate constants of reactions and order of the reaction and/or to validate adsorption isotherms.
3. Understand the basics of synthesis of nanomaterial/ polymer or drug molecule and use of spectroscopic techniques for determination of properties.

List of Experiments: [Any Eight from the List]

[1] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.

[2] To find out types of alkalinity and estimation of their extent in the water sample.

[3] Estimation of temporary, permanent and total hardness present in the water sample using complexometric titration method.

[4] Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software.

[5] To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find outorder of the reaction and analysis of experimental data using Computational Software.

[6] Study the optical property of Nano-materials.

[7] Determination of relative and kinematic viscosities of aqueous solutions of Poly-ethylene glycol (Polymeric Liquid) using Redwood Viscometer (type I or II) at different temperatures and analysis using computational tools.

[8] To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non- electrolyte solute (Soap) in the solution through Surface Tension Determination.

[9] Study of ion-exchange column for removal of hardness in the water sample.

[10] Prediction of IR/NMR spectra of materials using open source tools.

[11] Demonstration of in-organic spectral techniques: XRD, XRF.

[12] Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert- Beer's Law.

[13] Acid base titration and data analysis using computational tools.

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	MAT154				
Category	Basic Science Course				
Course Title	Mathematics- II				
Scheme & Credits	L	T	P	Credits	Semester II
	4	0	0	4	

Course Outcomes:

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus:

Module I: Differential Calculus: (12 Hrs)
Taylor's and Maclaurin's series expansions ;radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, EulersTheorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module II: Integral Calculus: (6 Hrs)
Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module III: Sequences and series: (7 Hrs)
Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module IV: **Multiple Integrals (10 Hrs)**
Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module V: Vector Calculus (10 Hrs)
Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration, Theorems of Green, Gauss and Stokes and their applications.

Topics for self-learning

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line), Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks / References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Warlike, A text book of Applied Mathematics Volume I & II, Pune VidhyarthiGriha Prakashan, Pune-411030 (India).

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	ECST103				
Category	Engineering Science Course				
Course Title	Network Circuits				
Scheme & Credits	L	T	P	Credits	Semester II
	3	0	0	3	

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Understand basic electrical circuits with node and mesh analysis.
2. Apply network theorems for the analysis of electrical circuits.
3. Appreciate the importance of Laplace Transform for steady state and transient analysis.
4. Analyze two port network circuit with different interconnections.

Syllabus

Module I (7 Hrs)

Circuit Analysis: KVL- KCL- circuit elements (R, L &C) in series and parallel- voltage and current divider rule-source transformation technique-duals and duality- mesh analysis-super mesh analysis-nodal analysis-super nodal analysis.

Module II (7 Hrs)

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power Transfer theorem, reciprocity theorem, as applied to DC and AC. Circuits.

Module III (7 Hrs)

Electrical Circuit Analysis: Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, partial fractions, singularity functions, Analysis of electrical circuits using Laplace transform for standard inputs, convolution integral, inverse Laplace transform, evaluation of initial conditions. Transformed network with initial conditions

Module IV (7 Hrs)

S Domain Analysis: Analysis of RC, RL, and RLC networks with and without initial conditions using Laplace transform, transient behavior, evaluation of initial conditions, Waveform synthesis.

Module V (7 Hrs)

Two Port Network: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, inter connections of two port networks.

Text Books:

1. M. E. Van Valkenburg, " Network Analysis", Prentice Hall, 2006.
2. Roy Choudhury, "Networks and Systems," New Age International Publications, 1998.3.W. H Hayt and J. E. Kemmerly," Engineering Circuit Analysis", McGraw Hill Education, 2013.

Reference Books:

1. Sudhakar, A., Shyammohan, S. P., " Circuits and Network", Tata McGraw Hill New Delhi,1994.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	ECST104				
Category	Engineering Science Course				
Course Title	Digital Circuits				
Scheme & Credits	L	T	P	Credits	Semester II
	3	0	0	3	

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Apply various optimization techniques to minimize digital circuits.
2. Design combinational logic circuits.
3. Analyze and design asynchronous and synchronous sequential circuits.
4. Discuss x86 architecture

Syllabus

Module I (6 Hrs)

Basics of Digital Electronics: Motivation for digital systems: Number Systems and arithmetic's, Logic and Boolean algebra, logic gates & truth tables, SOP, POS, Minimization of combinational circuits using Karnaugh-maps.

Module II (6 Hrs)

Combinational Circuit Design: Multiplexers, De-multiplexers, Encoders, Decoders, Code Converters, Adders, Subtractor (Half, Full), BCD Adder/ Subtractor, ripple and carry look-ahead addition, Unsigned Multiplier.

Module III (6 Hrs)

Sequential circuit Design-I: Storage elements, Flip-flops and latches: D, T, J/K, S/R flip-flops: level triggered, edge triggered, Master Slave flip-flop, flip flop conversion, timing analysis.

Module IV (6 Hrs)

Sequential circuit Design-II: Design of asynchronous and synchronous counters, Registers & Shift registers, Application of shift register: ring counter, Johnson counter, sequence generator and detector, serial adder; Linear feedback shift register (LFSR)

Module V(6 Hrs)

Design of synchronous sequential circuit using Mealy model and Moore model: state transition diagram, algorithm state machine (ASM) chart

Module-VI (5Hr)

Introduction to X86 architecture.

Text Books:

1. Donald P. Leach, Albert P. Malvino and Goutam Saha, "Digital Principles & Applications 8e", McGraw Hill
2. Douglas V. Hall "Microprocessors and Interfacing" Tata McGraw Hill Education Private Limited, 2005

Reference Books:

1. Thomas L Floyd, "Digital Fundamentals 9e", Pearson
2. M. Morris Mano and Michael D. Ciletti, "Digital Design 5e", Pearson
3. Taub and Shilling, "Digital Integrated Electronics", McGraw Hill
4. A Anand Kumar, "Fundamentals of Digital Circuits" Fourth Edition, PHI
5. Kip R. Irvine, "Assembly Language for x86 Processors" Seventh Edition, Pearson Education

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	ECST105				
Category	Engineering Science Course				
Course Title	Object Oriented Programming				
Scheme & Credits	L	T	P	Credits	Semester II
	3	0	0	3	

Course Outcomes:

On successful completion of the course, students will be able to demonstrate

1. Understand the principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Apply the concepts of generics and implement collection classes and develop reusable programs using the concepts of OOP.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free Codes for solving classic synchronization problems.
4. Create design Pattern in Software design process.

Syllabus:

Module I:(6 Hrs)

Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding. Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading and overriding.

Module II :(6 Hrs)

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

Module III :(5 Hrs)

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, file handling in Java, Serialization.

Module IV:(6 Hrs)

Generics, generic class with two type parameter, bounded generics. Collection classes: Array list, Linked List, Hashset, Treeset.

Module V:(6 Hrs)

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, InterThread communications.

Module VI: (6 Hrs)

Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, and Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioural Patterns.

Text Books:

1. Herbert Schildt; JAVA, the Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. Design Patterns by Erich Gamma, Pearson Education.

Reference Books:

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press 2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; TataMcGraw- Hill Education Private Ltd 2013.

Syllabus of Semester II B.Tech.

Department of Electronics and Computer Science

Course Code	HUT152				
Category	Basic Science Course				
Course Title	Constitution of India				
Scheme & Credits	L	T	P	Credits	Semester II
	2	0	0	0	

Course outcomes:

On successful completion of the course, students will:

1. Understand the role of constitution in democratic India
2. Act responsibly as citizens of India by knowing their fundamental rights and duties
3. Analyze the working of a democratic government and constructively participate in all the democratic functions that are expected from the citizens.
4. Interpret the implementations of constitutional and other laws in the federal structure established by the constitution.

Course content:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and theStates
8. Parliamentary Form of Government in India – The constitution powers and status of thePresident of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy and social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Text Book:

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, Lexis Nexis.

Syllabus of Semester III B.Tech.

Department of Electronics and Computer Science

Course Code	ECST201				
Category	Engineering Science Course				
Course Title	Electronic Devices and Circuits				
Scheme & Credits	L	T	P	Credits	Semester III
	3	1	1	5	

Course Outcomes

Upon the completion of this course, students will be able to:

1. Identify the region of operation of PN Junction Diode and MOSFET.

2. Design rectifier, Clipper, clamper, and voltage regulator using diodes

3. Apply the mathematical models of MOS transistors for circuits and systems design

4. Examine the effect of negative feedback on gain, bandwidth, input and output impedance and the stability of the amplifier.

5. Design, test and analyze operational amplifier-based circuits/systems

Syllabus

Module I: (7 Hrs)

Diode Models and Circuits: Terminal Characteristics of Junction Diodes, Models of P-N Junction Diode, Small-Signal Model. Operation in the Reverse Breakdown Region—Zener Diodes, Zener as a Shunt Regulator, Applications of PN junction diode ─ Rectifier, Clipper, Clamper, DC power supply, Diode Logic Gates

Module II: (8 Hrs)

Two Terminal MOS Capacitor: MOS capacitor, Accumulation, Depletion and Inversion region of operation, Charge Distribution, Depletion Layer Thickness, Flat-Band Voltage, Threshold Voltage. Capacitance-Voltage characteristics: Ideal C-V Characteristics, Frequency Effects, Fixed Oxide and interface Charge Effects

Module III: (8 Hrs):

MOS Field Effect Transistor: Device structure and physical operation, Current –Voltage Characteristics, MOSFET circuits at DC, MOSFET in Amplifier Design: The Voltage-Transfer Characteristic (VTC), biasing the MOSFET to Obtain Linear Amplification, Small-Signal Voltage Gain, Small-Signal Operation and Model.

Module IV: (8 Hrs)

Feedback amplifier and Op-amp fundamentals: General Feedback amplifier Structure, Properties of Negative Feedback, Characteristics of operational amplifier, open loop Op-amp, basic inverting and non-inverting Op-amp amplifiers with negative feedback, Op-amp parameters & their analysis.

Module V: (7 Hrs)

Op-amp linear and nonlinear applications: Voltage follower, summing amplifiers, integrators and differentiators, difference amplifiers & instrumentation amplifiers, Comparators, Schmitt trigger circuits, Sample/Hold circuits, Digital to analog converters, Analog to digital converters.

Module VI: (7 Hrs)

Oscillators and Active filters design: Precision rectifiers, oscillators: basic concept, Op-amp based sinusoidal oscillators, design of Active filters.

Textbook:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar: Microelectronic Circuits: Theory and Applications: Seventh Edition, Oxford University Press, 2017.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits” Fourth Edition, McGraw-Hill Education, 2014.

Reference Books:

1. Donald Neamen “Electronic Circuits: Analysis and Design” Third Edition, McGraw-Hill Publication, 2006.
2. Ramakant Gayakwad, ” OP-AMPS and linear integrated circuits” 4th Edition, PHI
3. Jacob Millman, Christos Halkias, Chetan Parikh: “Millman's Integrated Electronics” Second edition, McGraw Hill Education, 2017.
4. Coughlin Driscoll, “Operational Amplifiers and Linear Integrated Circuits” 4th Edition: PHI.
5. D. Roy Choudhary, Shail Jain “Linear Integrated Circuits”, 4th Edition, New Age International

Syllabus of Semester III B. Tech.
Department of Electronics and Computer Science

Course Code	ECST202				
Category	Programme Core Course				
Course Title	Data Structures				
Scheme & Credits	L	T	P	Credits	Semester III
	3	1	1	5	

Course Outcomes

Upon the completion of this course, students will be able to:

1. Understand the concepts of data structures.
2. Apply the concepts of linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
3. Implement different searching and sorting techniques.
4. Demonstrate the use and applicability of data conversion techniques
5. Devise algorithms for solving real-world problems.

Syllabus

Module I:(5 Hrs)

Understanding data structures and algorithms, Python for data, Variables and expressions, Flow control and iteration, Overview of data types, objects and python modules, Types of Data Structures- User defined, Built in data types:List, Set, Dictionary, tuple

Module II:(5 Hrs)

Linear Data Structure Arrays, Pointer structures, Nodes, Representation of arrays, Applications of arrays, sparse matrix and its representation

Module III:(6 Hrs)

Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Queue: Representation Of Queue, Operations On Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.

Module IV:(7 Hrs)

Nonlinear Data Structure: Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (In order, postorder, preorder), Binary search trees, Representation of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree.

Module V:(6 Hrs)

SORTING And SEARCHING Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting On Several Keys, List and Table Sort, Linear Search, Binary Search.

Module VI:(6 Hrs)

Hashing and Symbol Tables, Perfect hashing functions, Putting elements, Getting elements, Testing the hash table, Non-string keys, Growing a hash table, Open addressing

Text Book:

Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley, 2013**.**

Reference Books:

Gowrishankar S, Veena A, “Introduction to Python Programming”, 1st Edition, CRC Press/Taylor & Francis, 2019. ISBN-13: 978-0-8153-9437-2. 2.

Benjamin Baka, “Python Data Structures and Algorithms” Published by Packt Publishing Ltd., 2017.

Syllabus of Semester III B. Tech.
Department of Electronics and Computer Science

Course Code	ECST203				
Category	Programme Core Course				
Course Title	Digital System Design				
Scheme & Credits	L	T	P	Credits	Semester III
	3	0	1	4	

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:
1. Realize the digital systems using HDL
2. Apply the testing strategies using HDL
3. Write a synthesizable HDL code for EDA tools
4. Analyze the timing issues in digital systems
5. Implement the digital systems on FPGA platforms.

Syllabus

Module I (6 Hrs)
Digital System Design Flow, FPGA Architecture, Introduction to FPGA Development Board, Introduction to HDL, Basic Language Elements, Syntax and Semantics of HDL

Module II (5 Hrs)
Gate level, Dataflow and Behavioral Modeling for combinational circuits like Multiplexer, De-multiplexer, Encoder-Decoder, Flip-Flop, Counter, Writing Test Benches and Handling Text files to test the Circuits.

Module III (6 Hrs)
Design and Analysis of Standard Combinational Blocks, Algorithm to Architectural Translation for Arithmetic Circuits-Adders, Subtractor, Multiplier, Divider, Shifter, ALU and Comparator

Module IV (6 Hrs)
Design and analysis of standard sequential blocks, Finite State Machine Design.

Module V (6 Hrs)
Design of Data Path and Control unit with Case Studies.

Module VI (6 Hrs)
Logic Synthesis and Optimization Techniques for Area, Power and Delay, Timing analysis-Setup and Hold Violations, Synthesis of HDL code on FPGA platforms, Concepts of Critical Path Delay

Text Book:

1. Verilog HDL: A Guide to Digital Design and Synthesis; Samir Palnitkar, Prentice Hall PTR; 2nd Edition
2. Fundamentals of Digital Logic with Verilog; Stephen Brown and ZvonkoVranesic; McGraw Hill, 2nd Edition

Reference Books:

1. Digital Systems Design Using Verilog ; Charles Roth, Lizy K. John, Byeong Kil Lee ; Cengage Learning 2nd Edition
2. A Verilog HDL Primer: J Bhaskar; Star Galaxy Publishing; 2^{nd} Edition.

Syllabus of Semester III B. Tech.
Department of Electronics and Computer Science

Course Code	ECST204				
Category	Programme Core Course				
Course Title	Discrete Signals and Systems				
Scheme & Credits	L	T	P	Credits	Semester III
	3	0	1	4	

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Classify and find the response of the discrete time systems
2. Analyze the discrete time systems in Z Domain
3. Find the frequency response of signals
4. Design the digital filters
5. Apply signal processing techniques on DSP applications

Module I (6 Hrs)
Elementary continuous & discrete time signals and systems, basic operations on signals, classification of signals and systems, Properties: causality, correlation, stability, step response, impulse response, sampling theorem, aliasing error

Module II (5 Hrs):
Mathematical Overview: Fourier Series, Fourier Transform, Discrete time Fourier Transform, Laplace Transforms and Z transform. Relationship of Fourier, Laplace and Z transform, Region of Convergence and stability analysis

Module III (6 Hrs):
Discrete Fourier Transform, Fast Fourier transform algorithms (Decimation in Time/ Frequency)

Module IV (5 Hrs):
Realization of FIR and IIR System: Direct Form I, Direct form II, Cascade and Parallel Structures

Module V (8 Hrs):
Filter (FIR & IIR) Design: Fourier Series, Windowing, Frequency sampling, Butterworth and Chebyshev techniques

Module VI (5 Hrs):
Practical Case Studies on Image, ECG, EEG, Sound signal processing

Text Book:

1. Digital Signal Processing, A Nagoor Kani, 2nd Edition Mc-Graw Hill

Reference Books:

1. Digital Signal Processing: Principles, Algorithms & Applications, Proakis & Monalkis, 4^{th} Edition PHI
2. Digital Signal Processing A Computer based Approach, Mitra S, 4^{th} Edition Mc-Graw Hill
3. Discrete Time Signal Processing, Oppenheim & Schafer, 2^{nd} Edition PHI

Syllabus of Semester III B. Tech.
Department of Electronics and Computer Science

Course Code	MAT277				
Category	Basic Science Course				
Course Title	Linear Algebra				
Scheme & Credits	L	T	P	Credits	Semester III
	2	0	0	2	

Course Outcomes

On successful completion of the course, the students will learn:

1. Understand basic concepts such as vector spaces, linear dependence / independence of vectors, basis and linear maps, rank nullity of a matrix / linear map.
2. Apply Gram-Schmidt process on inner product spaces, diagonalize special matrices.
3. Apply concepts of SVD to various applications including real life problems.

Syllabus:

Module I (8 Hrs):

Vector Space; Subspaces; Linear Dependence and Independence; Basis; Dimension; Linear transformation; Range Space and Rank; Null Space and Nullity; Rank nullity theorem, Matrix Representation of a linear transformation; Linear Operators on R^n and their representation as square matrices; Invertible linear operators**.**

Module II (8 Hrs):

Linear Operators on R^n and their representation as square matrices; Invertible linear operators **.**Eigenvalues and Eigenvectors of a linear operator; Inner Product Spaces, Norm; Orthonormal Sets, Gram Schmidt orthogonalization process; projections.

Module III (8 Hrs):

Positive definite matrices, and Singular Value Decomposition. Properties and application of SVD, Least square approximation, QR decomposition.

Text Books:

1. Hoffman and Kunze : Linear Algebra, Prentice Hall of India, New Delhi
2. Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007)

Reference Books:

1. Seymour Lipschutz et al: Linear Algebra, 3rded: Schaum outlineseries.
2. V. Krishnamoorthy et al: An introduction to linear algebra, Affiliated East West Press, New Delhi P.G. Bhattacharya, S.K. Jain and S.R.
3. Nagpaul : First course in Linear Algebra, Wiley Eastern Ltd., New Delhi
4. K.B.Datta : Matrix and Linear Algebra, Prentice Hall of India, New Delhi

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECST206				
Category	Programme Core Course				
Course Title	Discrete Mathematics				
Scheme & Credits	L	T	P	Credits	Semester
	3	1	0	4	IV

Course Outcomes

On successful completion of the course, students will be able to

1. Internalize logical notations to define fundamental mathematical concepts to derive logical inference and solve problems related to recurrence relations, linear congruences, coding theory, etc. in cryptography.
2. Understand a given problem of graph network and solve with techniques of graph theory.
3. Realize the lattice as algebraic structure and use it for pattern recognition in cryptography.
4. Apply groups and fields in coding theory.

Syllabus

Module I Mathematical Logic
Statement and notations, connectives, Negation, conjunction, disjunction, conditional & bi-conditional, statement formulas & truth tables. Tautologies, equivalence of formulas, Duality law, Tautological implications.

Module II Modular Arithmetic
Modular Arithmetic, Euclid's Algorithm, Primes, Fermat's Algorithm, Euler's Theorem, Diophantine equations, Linear Congruences, Chinese Remainder Theorem, Application to Cryptography.

Module III Graph Theory
Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub-Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Perfect Graph.

Module IV Combinatorics
Addition and multiplication rules in combinatories, Linear and circular permutation, Combination, Inclusion and Exclusion Principle, recurrence relations, generating function, examples using ordinary power series and exponential generating functions.

Module V Lattice theory
Lattices as partially ordered set, Definitions and Examples, some properties of Lattices, Lattices as algebraic system, sub lattices, direct product, homomorphism, some special Lattices.

Module VI Groups and Fields
Group definitions and examples, cyclic group, permutation groups, subgroups and homomorphism, co-sets, Lagrange's theorem, Finite field, Galois field.

Text Books

1. J. P.Tremblay and R. Manohar; Discrete Mathematical Structures with Applications to Computer Science; Tata McGraw-hill Publication.
2. Babu Ram; Discrete Mathematics; Pearson Education.
3. C.L. Liu and D.P. Mohapatra, Combinatorial Mathematics, 3rd edition Tata Mc Graw Hill.

Reference Books

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 8^{th} edition Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw –Hill.

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECST207				
Category	Programme Core Course				
Course Title	Software Engineering				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand generic processes of software development and learn different techniques and methodologies used in development of software systems.

2. Apply learned concepts to effectively use software testing methodologies in various software development scenarios.

3. Develop comprehensive plans for resource allocation and project monitoring and apply quality management techniques to ensure process and product quality in software development.

Syllabus

Module I
Introduction to Software Engineering, Exploratory style versus Software Engineering, Shortcoming of exploratory style, Basic principles to hadle complexity, Some basic issues: Types of software projects, software services, Emergence of software engineering principles, Evolution of design techniques.

Module II
Software Process Models, Basic concepts of classical Waterfall Model, Stages of Waterfall Model, Iterative Waterfall Model, V-Model and Prototyping Model, Incremental Model, Evolutionary Model, Agile Model, Extreme Programming and Scrum, Scrum Life Cycle Model, Case Study on software development life cycle (SDLC)

Module III
Basic testing concepts, levels of testing, Errors, Faults and Failure, Unit, Integration and System Testing, Test data, Test cases, and Test Suite, Pesticide effect, Validation Testing, System Testing, Debugging. Software Testing fundamentals, Black Box Testing, White Box Testing, Web Testing, Test case design, building, execution, Automated Testing. Path Testing, Case Study on Software Testing Life Cycle (STLC)

Module IV
Software Project management- Plans, Methods and Methodology, The Business Case, Project Success and Failure, Project Evaluation, Cost-benefit evaluation technique, Project Planning-stepwise project Planning, Software Effort Estimation-Albrecht Function Point Analysis, COSMIC Function Point, Cost Estimation, Project Scheduling.

Module V
Resource allocation: Introduction, Nature of Resources, Identifying Resource Requirement, scheduling Resourses, Project Monitoring and Control, Project Control Cycle, Configuration Management, Process, Configuration Management Tool, Project Management Tools. Contract Management: Managing Contracts, Types of Contracts, stages in contract placement, contract

checklist. Project Close out, Reasons of Project Closure, Project Closure process and report.

Module VI

Software Quality Management: Introduction to Software Quality, Evolution of quality systems, Quality Control, Quality Assurance, Total Quality Management, Process Improvement, Process and Product Quality, CMM (Capability Maturity Model), Personal Software Process (PSP) Software Reliability, Software Testing. Risk management

Text Books

1. Software Engineering-A Practitioner's Approach; Roger Pressman; Sixth Edition, MaGraw Hill,2010
2. Project Management by Clifford F. Gray, Erik W. Larson, McGraw Hill

Reference Books

1. Software Engineering; Ian Somerville; Seventh Edition; Pearson Education. 2008.
2. Ethics in Information Technology, George W. Reynalds, 4th Edition, Cengage Leraning Publication
3. Software Engineering;David Gustafsan, Schaum's Series,Tata McGraw Hill,2002
4. Software Project Management, Sanjay Mohapatra; First Edition, Cengage Learning, 2011.
5. Software Project Management,Rajib Mall, 5th Edition, McGrawHill

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP207				
Category	Programme Core Course				
Course Title	Software Engineering Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Experiment List:

[1] a. Explore the perspectives and notations of the Unified Modeling Language (UML) in Star UML.
b. Study the IEEE SRS standard and prepare SRS for the conceptualization of the identified systems.

[2] Create a Use-Case diagram to depict the user's perspective of the system, demonstrating user interactions and system functionalities.

[3] Develop a Class Diagram to articulate the structural aspects of the system

[4] Construct Component Diagram and Deployment Diagram to depict the structural view of the system.

[5] Construct a Sequence Diagram to represent the dynamic view or behavior of the system, illustrating the chronological flow of interactions among different components or entities within the system.

[6] Create an Activity Diagram and a Statechart Diagram to illustrate the system's behavioural perspective.

[7] Perform White-Box Testing to test the functionalities using JUnit testing tool.

[8] Mini Project: Based on real-time modeling of software on a testbed and in a production environment, with case studies on SDLC and STLC

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECST208				
Category	Programme Core Course				
Course Title	Computer Architecture and Organization				
Scheme & Credits	L	T	P	Credits	Semester
	3	1	0	4	IV

Course Outcomes

Upon completion of this course, students will demonstrate the ability to:
1. Understand common principles of computer organization and multiprocessing
2. Apply the concept of cache and virtual memory management in computer system.
3. Analyse different arithmetic algorithms, control unit and processor datapath with and without pipelining.
4. Use Field Programmable Gate Arrays for investigating algorithms, datapath, I/O and memory for computing system.

Syllabus

Module I
Introduction to computer system and its sub modules, Introduction to RISC and CISC paradigm, Performance Equation, Common Principles of Computer organization: Amdahl's Law, Principle of Locality.

Module II
Processor organization, instruction set (MIPS), instruction formats, Arithmetic for Computers: Addition and Subtraction, Multiplication, Division, IEEE 754 floating point format.

Module III
Processor Design-Introduction, Datapath and control unit design, Performance Considerations, Multi-cycle design, Micro Programmed control design, Exception Handling.

Module IV
Motivation for Pipelining, Clock period and CPI, Pipelined data path, graphical representation, Pipelining Hazards.

Module V
Memory organization, concepts of semiconductor memory, memory management, concept of cache and associative memories, virtual memory.

Module VI
Parallel processing concepts, multiprocessors and its characteristics, Input/Output Subsystem:- Interfaces and BUS, I/O Operations, Designing I/O Systems, Case study: Application of RISC and CISC as Data Centers perspective.

Text Books

1. Computer Organization and Design - The Hardware/Software Interface, David A. Patterson, John L. Hennessy, Fifth

Edition, 2014.

Reference Books

1.Computer Architecture and Organization; J. P. Hayes; Third Edition (Fifth Reprint), McGraw Hill, 2012.

2. Computer Architecture And Parallel Processing; Kai Hawang, Faye A. Briggs, McGraw Hill, 2012

3.Computer Organization; Safwat G. Zaky, Zvonko G. Vranesic, Carl Hammacher ; Fifth Edition, McGraw Hill, 2002.

4. Structured Computer Organization; Andrew. S. Tanenbum; Fifth Edition, Pearson, 2005.

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECST209				
Category	Programme Core Course				
Course Title	Embedded System Design				
Scheme & Credits	L	T	P	Credits	Semester
	3	1	0	4	IV

Course Outcomes

1. Understand the architecture and organization of Cortex microcontroller and its programming.
2. Acquire the knowledge, techniques and skill to integrate microcontroller hardware and software.
3. Analyse the concept of real time operating system architecture.
4. Apply microcontroller-based Embedded system knowledge to real world application.

Module I
Introduction to embedded System, RISC Principles, ARM Processor Families, AMBA Bus Architecture.

Module II
The Cortex - M processor: Simplified view block diagram, programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence, Instruction Set, Pipeline, Bus, Priority, Vector Tables, Interrupt Inputs and Pending behavior, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller.

Module III
Introduction to the Cortex microcontroller software interface standard (CMSIS), Interfacing of GPIOs, Timers, ADC, PWM.

Module IV
Communication Protocols: I2C, SPI, UART, MODBUS, USB and its Interfacing with Cortex - M Microcontrollers.

Module V
RTOS Concepts-Critical section, Shared Resources, Context Switching, Pre-emptive and non-pre-emptive Schedulers, Priority Inversion, Mutual exclusion, Synchronization, Inter task communication mechanisms.

Module VI
Structure of µCOS-II: Introduction to µCOS-II-, kernel structure, Task States, Inter task communication, Task Scheduling, Task Synchronization, Critical section, Shared Resources, Context Switching, Priority Inversion, Mutual exclusion. Introduction to embedded Linux.

Text books:

1. The Definitive Guide to the ARM Cortex-M0: Joseph Yiu, Elsevier, (1/E) 2011.

Reference Books:

1. Freescale ARM Cortex-M Embedded Programming, Mazidi and Naimi ARM
2. An embedded software primer: David E Simon, Pearson education Asia, 2001
3. Micro C/OS II The Real Time Kernel: Jean J. Labrosse, CMPBooks,(2/E) 2002
4. Embedded Linux Primer: christopher Hallinan, Pearson (1/E) 2007

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECST299-1				
Category	Open Elective				
Course Title	Linux for Beginners				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes:

1) Acquire a working knowledge of Linux fundamentals and Linux distributions.

2) Apply knowledge to comprehend system configurations and Linux graphical interfaces.

3) Independently perform fundamental command line operations in Linux.

4) Effectively employ common Linux applications for specific tasks and functionalities.

Syllabus

Module I: The Linux Foundation: Linux Philosophy and Concepts, Linux Basics and System Startup.

Module II: Graphical Interface, System Configuration from the Graphical Interface, Common Applications, Command Line Operations, Finding Linux Documentation.

Module III: Processes, File Operations, Text Editors, User Environment, Manipulating Text, Network Operations.

Module IV: The Bash Shell and bash Scripting, Introduction, Features and Capabilities, Syntax, Constructs.

Module V: Printing, Local Security Principles, Understanding Linux Security, root Privileges, sudo, Process Isolation, Limiting Hardware Access and Keeping Systems Current, Working with Passwords, Securing the Boot Process and Hardware Resources.

Module VI: Remote access and managing processes through remote login

Text books:

1) Linux BIBLE, Christopher Negus, Tenth Edition, Wiley 2020.

2) Linux for Beginners: An Introduction to the Linux Operating System and Command Line, Jason Cannon, O'Reilly, 2014.

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECSTH401				
Category	Programme Core Course				
Course Title	Embedded Machine Learning				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes:

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

1. Understand the key design considerations for efficient DNN processing
2. Understand tradeoffs between various hardware architectures and platforms
3. Develop and analyze the architecture of DNN accelerators using software framework
4. Review the performance using case studies

Syllabus

Module I

Introduction to Machine learning, background, overview and its limitations, Machine learning on embedded systems and computer interfaces.

Module II:

Background and overview on Deep Neural Networks, Training versus Inference, Applications of DNNs, Key Metrics: Accuracy, Throughput and Latency, Energy Efficiency and Power Consumption, Hardware Cost, Flexibility, Scalability, Interplay Between Different Metrics.

Module II: (Introduction to processors included in detail)

Processors- Graphics Processing Unit (GPU), Central Processing Unit (CPU), Neural Processing Unit (NPU), Embedded AI devices, Embedded versus Cloud

Module III: Introduction to Software Framework: Pytorch, TinyML

Module IV: Operation mapping on specialized hardware, Audio classification on embedded systems, Precision reduction, Quantization, Sparsity

Module V:

Case Study: Real world machine learning application and implementation.

Text Book

1. Efficient Processing of Deep Neural Networks, Vivienne Sze, Yu-Hsin Chen, Tien-Ju Yang, and Joel S. Emer, Morgan &cLaypool publishers (2020)
2. Practical Deep Learning for Cloud, Mobile and Edge: Real-World AI & Computer-Vision Projects Using Python, Keras & Tensorflow by Anirudh Koul, Siddha Ganju, Mehere Kasam, O Reilly; Illustrated edition (2019)

Reference Book

1. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition, by Perry Lea, Packt Publishing Limited; 2nd Revised edition
2. Hardware Architectures for Deep Learning, by Masoud Daneshtalab , Mehdi Modarressi, Institution of Engineering and Technology
3. Recent Research Papers from Reputed Journals and Conferences such as CVPR, ICLR, NIPS, ICML, PAMI etc.

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECSTM401				
Category	Programme Core Course				
Course Title	Sensor Interfacing with Arduino and ESP8266				
Scheme &Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

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

1. Code in Arduino IDE that works with open source hardware platforms like Arduino and ESP
2. Measure physical parameters using sensors and control various actuators
3. Interface devices with serial communication protocols

Syllabus
Module I:
Introduction to Arduino Prototyping Platform: Arduino IDE, Arduino C, Setting up the Arduino board, creating sketches, using Libraries, using example codes, Debugging using the Serial Monitor.

Module II:
Sensor interfacing with Arduino: Analog and digital sensors, Temperature sensors, Humidity sensors, Proximity sensors, Ultrasonic sensor, Accelerometer and gyro, etc.

Module III:
Serial Communication in Arduino: Serial and parallel communication, Serial communication protocols, UART, I2C, SPI, Wired and Wireless communication, Interfacing Communication Modules with Arduino.

Module IV:
Interfacing Displays and Actuators: 16x2 LCD, Graphical LCD, Graphical OLED, Relay, Speed and direction control of DC, Servo and, Stepper Motor.

Module V:
Introduction to ESP8266: ESP8266 development board, Programming ESP8266 through Arduino IDE, connecting to the internet, sending and receiving data on internet.

Module VI:
Interfacing sensors and actuators with ESP8266: LDR, Temperature sensor, Humidity sensor, RGB LED, Relay, etc.

Text Book

1. Arduino Cookbookby Michael Margolis, O’Reilly Media, Inc., 1st edition
2. Beginning C for Arduino By Jack Purdum (ebook)
3. Arduino for Beginners: Essential Skills Every Maker Needs, John Baichtal, Pearson Education, Inc., 1st edition

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP211				
Category	Engineering Core Course				
Course Title	Software Lab-I				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Course Outcomes

Upon completion of this course, students will be able to:

1) Understand Processes, Tools, and Methodologies in Software Development Lifecycle.
2) Implement Agile Software Development Life Cycle.
3) Integrate Software Development and its Operations.
4) Use Cloud Environment and its Services

Syllabus

Labs Based on following Course Contents

1. Introduction to Dev Ops.
2. Version Control System (Git and Git Hub).
3. Integration, Deployment and Building (Jenkins).
4. Resource Management and Configuration (Puppet and Chef).
5. Containerization (Docker).
6. Working with Nagios Monitoring Tool.
7. Cloud services and DevOps.

Reference Books

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by by Gene Kim, Patrick Debois, John Willis, Jez Humble, 2016.

2. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis.

3. Python for DevOps: Learn Ruthlessly Effective Automation by Noah Gift , Kennedy Behrman, Alfredo Deza, Grig Gheorghiu.

4. Building Microservices: Designing Fine-Grained Systems by Sam Newman.

5. Effective DevOps with AWS: Ship faster, scale better, and deliver incredible productivity by Nathaniel Felsen

Syllabus of Semester IV B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP210				
Category	Programme Core Course				
Course Title	Hardware System Design Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Experiment List:

1. Familiarization with BUS Structure and debugging tool for the CPU
2. Test the instruction memory and data Memory of a Single Cycle CPU on the FPGA board.
3. Test the register files of a Single Cycle CPU on the FPGA board.
4. Test the ALU operations of a Single Cycle CPU on the FPGA board.
5. Test the data & control path of a Single cycle CPU on the FPGA board.
6. Create Fibonnacci Series and write an assembly language program.
7. Sort the numbers in descending order using assembly language program.
8. Implement the given equation using assembly language program.
9. Interfacing of Switch and LEDs with Cortex M0 processor using GPIO pins.
10. Interfacing of LCD with Cortex M0 processor for displaying key status on LCD.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST301				
Category	Programme Core Course				
Course Title	Operating System				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

Course Outcomes

On successful completion of the course, the student will be able to:

1. Understand the fundamental concepts and functions of operating systems.
2. Analyze process management, scheduling algorithms, and thread synchronization techniques.
3. Evaluate memory management strategies, including virtual memory and memory protection.
4. Implement file systems, disk scheduling algorithms, and device management techniques.
5. Students will gain proficiency in Linux system administration tasks, including booting Linux on hardware platforms, kernel administration, device management, and networking, with a focus on practical applications using the Raspberry Pi platform.

Syllabus

Module I : Introduction to Operating Systems: Overview of operating systems, Role and functions of operating systems, Types of operating systems, Historical perspective, Operating system structure and components.

Module II: Process Management, Scheduling Algorithms, Process Synchronization, Threads and Deadlocks: Process concept and management, Process states and transitions, Process scheduling algorithms, CPU scheduling, Process synchronization and concurrency, Inter-process communication, Deadlock detection and prevention, Resource allocation and management, Multiprogramming and multitasking.

Module III: Memory Management:Memory hierarchy, Memory allocation strategies, Virtual memory concept, Paging and segmentation, Memory protection and addressing, Memory management unit (MMU).

Module IV: File Systems and I/O Management:File system organization and structure, File system implementation techniques, File system operations, Disk scheduling algorithms, Device management and drivers, Input/output operations and buffering.

Module V: System Security :Basics of system security, Access control and authentication, Threats and vulnerabilities, Security mechanisms and policies.

Text Books

3. Operating Systems: Internals and Design Principles, William Stallings, Pearson Education, 9th edition, 2018
4. Operating Systems Foundations with Linux on the Raspberry Pi" by Jeremy Singer and WimVanderbauwhede, ARM Education media, 2019.

Reference Books

6. Linux system programming: talking directly to the kernel and C library, Robert Love, O'Reilly Media, 2ndedition, 2013.
7. Operating Systems Design and Implementation, Andrew S. Tanenbaum and Albert S. Woodhull, PHI, 3rd edition, 2003.
8. Operating Systems: Three Easy Pieces, RemziArpaci-Dusseau, Andrea Arpaci-Dusseau, Arpaci-Dusseau Books,2023

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP301				
Category	Programme Core Course				
Course Title	Operating System Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	V

List of Experiments

1) Study of Linux commands – System Information, Files and Directories, Process, Text Processing and Scripting, Programming.

2) Shell scripting (I/O, decision making, looping)

3) Installing Raspbian on the Raspberry Pi 3, Setting up SSH under Raspbian, and Writing a kernel module.

4) Create a cyclic executive with three tasks where each task creates a continuous waveform: task 1creates a sine; task 2, a block wave; and task 3, a triangle; each with a different period. Print either the values of the waveforms or a text-based graph on the terminal. Make your cyclic executive preemptive. Share a resource between the three tasks. This can be a simple shared variable with read and write access.

5) Create a round-robin scheduler. Create a FIFO scheduler

6) Calculate the size of your Raspberry Pi system's virtual address space in megabytes by writing a short C program.

7). Implement a solution to the dining philosophers problem in C using the POSIX threads API.

8) Create a system of N threads that communicate via static arrays of size N defined in each thread, using condition variables and mutexes.

9) Write a data-parallel program that produces the sum of the squares of all values in an array, using p threads and using OpenMP

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST302				
Category	Programme Core Course				
Course Title	Design and Analysis of Algorithms				
Scheme & Credits	L	T	P	Credits	Semester
	4	0	0	4	V

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

1. Understand mathematical formulation, complexity analysis and methodologies to solve the recurrence relations for algorithms.
2. Apply Divide and Conquer algorithms and use them in examples
3. Formulate Greedy Methodology and use them in real life examples.
4. Design Dynamic programming and Backtracking Paradigms to solve real-life problems.
5. Design solutions using standard approaches comprehending NP class problems.

Syllabus

Module I
Mathematical foundations for arithmetic and geometric series, Principles of designing algorithms and complexity calculation, Asymptotic notations for analysis of algorithms, worst case and average case analysis, amortized analysis and its applications.

Module II
Divide and Conquer- basic strategy, Quick sort, Merge sort, Strassen's matrix multiplication, Maximum sub-array problem, Closest pair of points problems, Convex hull problem.

Module III
Greedy method – basic strategy, fractional knapsack problem, Minimum cost spanning trees, Huffman Coding, activity selection problem,find maximum sum possible equal to sum of three stacks, K Centres Problem.

Module IV
Dynamic Programming -basic strategy, Bellmen ford algorithm, all pairs shortest path, multistage graphs, optimal binary search trees, traveling salesman problem, String Editing, Longest Common Subsequence problem and its variations.

Module V
Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, sum of subset problem, Introduction to Approximation algorithm.

Module VI

NP-hard and NP-complete problems - basic concepts, non-deterministic algorithms, NP hard and NP complete decision and optimization problems, polynomial reduction graph-based problems on NP Principle, vertex cover problem, clique cover problem

Text Books

1. Thomas H. Cormen et.al; "Introduction to Algorithms"; 3 Edition; Prentice Hall, 2009.
2. Horowitz, Sahani and Rajasekaram; "Computer Algorithms", Silicon Press, 2008.
3. Brassard and Bratley; "Fundamentals of Algorithms", 1 Edition; Prentice Hall, 1995.
4. Richard Johnsonbaugh, "Algorithms", Pearson Publication, 2003.

Reference Books

1. Parag Himanshu Dave, Balchandra Dave, "Design and Analysis of Algorithms" Pearson Education, O'relly publication
2. Richard Johnson baugh, "Algorithms", Pearson Publication, 2003.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST303				
Category	Programme Core Course				
Course Title	Machine Learning				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

Course Outcomes

On successful completion of the course, students will be able to:

1. Compare and contrast different paradigms of machine-learning techniques and to get an insight of when to apply a particular machine learning approach.
2. Integrate multiple facets of practical machine learning in a single system: data preprocessing, learning, regularization and model selection.
3. Employ probability theory, calculus, linear algebra, and optimization in order to develop predictive models or learning methods.
4. Implement and analyze existing learning algorithms, including well-studied methods for classification, regression, and clustering and test them with benchmark data sets.
5. Evaluate and interpret the results of the machine-learning algorithms.

Syllabus

Module I: (4Hrs)
Foundations for ML: Review of Linear algebra and Optimization, introduction to machine learning and its types, parametric vs non-parametric models, machine Learning pipeline and MLOPs.

Module II:(7Hrs)
Supervised learning algorithms: Linear and Logistic Regression – Bias/Variance Trade-off, overfitting and under fitting, Regularization, Multivariate and polynomial Regression, Variants of Gradient Descent algorithm.Decision Trees, Basic decision trees learning algorithm, Random Forests.

Module III:(7Hrs)
Support Vector Machines, and Kernel functions in SVM, K-Nearest Neighbors. Feature selection techniques: Filter Method, Wrapper Method,Feature scaling, Evaluation and Model Selection: ROC and AUC Curves, Evaluation Measures, Cross-Validation techniques.

Module IV: (5Hrs)
Probabilistic Machine Learning: Bayesian learning and Bayesian networks, Naive Bayes classifier; Bayes optimal classifiers, Maximum Likelihood Estimation, MAP; Gaussian Discriminant Analysis.

Module V:(6Hrs)
Unsupervised learning algorithms: K-means clustering, Hierarchical Clustering, Dimensionality Reductiontechniques: PCA, LDA;

Module VI:(6Hrs)
Unsupervised learning algorithms: Hidden Markov Models, GaussianMixture Modeling, EM-algorithms, Anomaly

detection, Recommender System.

Text Book:

1. Machine learning, by Mitchell Tom, First edition, McGraw Hill, 1997.
2. Pattern Recognition and Machine Learning by Christopher M. Bishop, First edition, Springer, 2006.

Reference Books:

1. The Elements of Statistical Learning Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second Edition, Springer, 2009.
2. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy, Francis Bach; MIT Press, 2012.
3. Understanding Machine Learning: From Theory toAlgorithms by Shai Shale-Shwartz, and Shai Ben-David, Cambridge University Press, 2014.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP303				
Category	Programme Core Course				
Course Title	Machine Learning Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	V

List of Experiments:

Lab-01: **Implement data preprocessing techniques on the given dataset.**

a) Perform Exploratory Data Analysis (EDA)
b) Decide on strategies for handling missing data (e.g., imputation, deletion, interpolation).
c) Identify and remove duplicate entries from the dataset if any.
d) Detect outliers and decide on appropriate treatment methods (e.g., removal, transformation, binning).
e) Convert categorical variables into numerical representations suitable for machine learning algorithms (E.g. one-hot encoding, label encoding, and target encoding).
f) Standardize or normalize numerical features to ensure they have a similar scale, preventing certain features from dominating the learning process.
g) Create new features from existing ones or transform existing features to improve model performance (E.g. polynomial features, interaction terms, or domain-specific transformations)
h) Use techniques like filter methods (e.g., correlation analysis), wrapper methods (e.g., recursive feature elimination) for feature selection.
i) Divide the dataset into training and testing sets to evaluate the performance of the machine-learning model.
j) Visualize the dataset to gain insights into its distribution, relationships between features, and potential patterns.
k) Explore summary statistics, histograms, scatter plots, and correlation matrices to understand the data's characteristics and inform preprocessing decisions.

Lab-02: Implement linear regression algorithm (Single, Multiple variable and polynomial) using benchmark datasets and evaluate the performance of linear regression using evaluation measures like MAE, MSE, RMSE, Coefficient of Determination (R^2), and **Adjusted R-squared.**

Lab-03: Implement **the following algorithms to perform the task of classification on** the benchmark datasets and evaluate the performance of algorithms using evaluation measures like Accuracy, Precision, Recall, F1 score, ROC curves, AUC, and cross-validation techniques.

a) Logistic Regression
b) Decision Tree
c) Random Forest
d) K-nearest Neighbor

Lab-04: Build and implement **an image classifier using Support Vector machine (SVM) algorithm** and evaluate the performance of the trained model algorithms using k-fold cross-validation.

Lab-05: Build and develop a model for document classification using probabilistic machine learning algorithms.

Lab-06: Implement the K-means clustering algorithm to perform image segmentation and compare its performance with different numbers of clusters (k) using various evaluation metrics such as silhouette score, Davies-Bouldin index, and within-cluster sum of squares (WCSS).

Lab-07: Perform Dimensionality Reduction using Principal Components Analysis (PCA) and do the following task:

a) Use PCA in order to **visualize** a high-dimensional problem in 2-dimensions.
b) Use PCA in order **to improve model-training time and understand the speed-accuracy trade-off.**
c) **Evaluate the trade-offs between preserving global structure and local relationships in the data space.**
d) **Discuss when to use PCA and when not to use it.**

Lab-08: Implement **Gaussian Mixture Model (GMM) Clustering** to model complex data distributions and visualize the resulting cluster assignments and probability contours.

Lab-09: Investigate the effectiveness of Isolation Forest for identifying outliers and to detect anomalous behavior in server computers.

Lab-10: Build a simple recommender system using collaborative filtering or matrix factorization techniques and assess its performance using metrics like Mean Absolute Error (MAE) or Root Mean Squared Error (RMSE).

Lab-11: Perform the comparative analysis of ensemble learning techniques on classification tasks.

Lab-12: A Capstone Project**:**Students are required to utilize the knowledge and competencies gained throughout the course to address a practical real-world challenge or investigate a substantial research query within the realm of machine learning.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP304				
Category	Engineering Core Course				
Course Title	Software Lab – 2				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	V

Course Outcomes

On successful completion of the course, the student will be able to:

1) Understand Syntex commands and deployment using Jankins.
2) Implement Automation using Ansible.
3) Understanding Kubernetes and deployment using Docker.
4) Understanding continuous monitoring tools using Nagios and Portainer
5) Use Cloud Environment and its Services

Syllabus

List of Experiments

1 **Jenkins**

i. Introduction to Jenkins
ii. Setup and installation of Jenkins
iii. Jenkin syntaxes and commands
iv. Basic example
v. Integration, Deployment and Building

2 **Ansible**

i. Introduction to Ansible
ii. Exploring Ansible concepts
iii. Automating with Ansible
iv. Creating play book and building inventory

3 **Kubernetes**

i. Install and configure Kubernetes
ii. Run stateless and stateful applications on Kubernetes
iii. Install and use Kubeless to run functions (Serverless) on Kubernetes
iv. Use Docker Client (with Kubernetes)

4 Nagios Monitoring Tool: Continuous Monitoring with Nagios.
5 GitLab and Bitbucket: Repository Management, features and integrations.
6 Working with Portainer: Container Management across cloud, data center, network edge, and Industrial IoT devices.
7 Cloud services and DevOps.
8 Mini Project

Reference Books

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by by Gene Kim, Patrick Debois, John Willis, Jez Humble, 2016.
2. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis.
3. Python for DevOps: Learn Ruthlessly Effective Automation by Noah Gift , Kennedy Behrman, Alfredo Deza, Grig Gheorghiu.
4. Building Micro services: Designing Fine-Grained Systems by Sam Newman.
5. Effective DevOps with AWS: Ship faster, scale better, and deliver incredible productivity by Nathaniel Felsen

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST305-1				
Category	Programme Elective				
Course Title	VLSI Signal Processing				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

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

1. Explain the basic understanding of discrete signals and systems
2. Apply the pipelining and parallel processing techniques
3. Re-design the DSP systems for the given constraints using retiming techniques
4. Fold and unfold the DSP systems.
5. Analyze data flow in systolic architectures

Syllabus

Module I: Introduction to Digital Signal Processing (DSP) systems, sampling theorem, discrete time signal & systems, representation of discrete systems in Z domain, basic DSP algorithms and its mathematical representation, representation of DSP algorithms using block diagram, data flow graph, dependence graph, signal flow graph, Loop bound and Iteration bound algorithms, difference between recursive (IIR) and non-recursive (FIR) systems

Module II: Basics of pipelining and parallel processing, cut-set theory, data broadcast structure and transpose structure of FIR systems, fine-grain and course-grain pipelining techniques, realizing a parallel architecture for FIR systems, pipelining and parallel processing for low power.

Module III: Retiming algorithm for IIR systems, cut set retiming and pipelining, retiming for clock period minimization, retiming for register minimization.

Module IV: Unfolding algorithms, properties, unfolding for sample period reduction, word level processing, bit level processing, register minimization techniques using folding transformation.

Module V: Folding algorithms, properties, register minimization techniques using folding transformation.

Module VI: Systolic architecture design, block diagram, space representation, edge mapping table, low level implementations, space time representation for systolic arrays.

Text book:

1) VLSI Digital Signal Processing Systems, Keshab K. Parhi, A Wiley-Interscience Publication, 1999

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP305-1				
Category	Programme Elective				
Course Title	VLSI Signal Processing Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	V

List of Experiments:

1. Model a recursive and non-recursive DSP filter using Verilog HDL and test its functionality.

2. Apply the cut set theory on 3-Tap FIR filter architecture to design a pipelined FIR system. Demonstrate the increase in the speed of operation. Compare the power results, if the speed of operation is kept same as that of the non pipelined FIR filter.

3. Apply the parallel processing technique on a 3-tap FIR filter architecture to design a 3-parallel FIR system. Demonstrate the increase in the speed of operation.

4. Demonstrate a cut set retiming technique for FIR and IIR filters. Compare the delay and power values.

5. Demonstrate the use of unfolding if the longest node computation time is larger than iteration bound.

6. Demonstrate a folding transformation for DFG of DSP filter architecture.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST305-2				
Category	Programme Elective Course				
Course Title	Elements of IoT				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand the IoT reference Model and different element used in it.
2. Apply the understanding in identifying the element used in IoT
3. Analyse the role of different elements in IoT as a system in different use cases;
4. Propose a solution to a real-world problem using the IoT framework
5. Evaluate the engineering feasibility of the solutions'/ Use cases;

Syllabus

Module I [6 Hrs]: Introduction to Internet of Everything, IoT Reference Model, Different IoT models, Elements in IoT Infrastructure

Module II [6 Hrs]: IoT Infrastructure Elements and their roles at Different Layer in IoT Reference Model, Devices/ Function of elements in IoT Sensors, Controllers, Network, Cloud, User Applications and Data Analytics

Module III [6 Hrs]: Perception Layer, Network Layer, Application Layer Architecture in IoT system,

Module IV[6 Hrs]: Resources used at Perception Layer, Network Layer, Application Layer

Module V [6 Hrs]: Use cases of IoT Systems builds across SAMIoT/ Arduino / ESP32 / NodeMCU/ PI-PICO H/W variants etc,

Text Book

1. Internet of Things Principles and Paradigms, Rajkumar Buyya Amir Vahid Dastjerdi, Morgan Kaufman, Elsevier 2016 1st Edition

Reference Books

1. Internet of Things Principles, Paradigms and Application of IoT, Joseph Kofi Wireko, Kaml Hiran, BPB Publications 2020 1st Edition
2. Microchip SAMIoTApp;ication notes
3. Arduino NanoBLE/ Nano 33IoT Application notes
4. Espressif Application notes ESP32/ESP8266/Node MCU
5. Raspberry Pi- PICO application notes

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP305-2				
Category	Programme Elective Course				
Course Title	Elements of IoT Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	V

List of Experiments

1. Understand the IoT reference Model implementation on various use cases of IoT System in applications specific domains.
2. Identification of elements used in various use cases
3. Analyse the role and functions of different IoT elements used in different use cases
4. Proposing a solution based on the IoT reference frame work
5. Evaluating the engineering feasibility of the IoT solution on the basis of
    a. Hardware platform/ resource usage
    b. Communication mode used
    c. Uptime requirements
    d. Scale and volume of data
    e. Security and Maturity

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST305-3				
Category	Program Elective				
Course Title	Image Processing				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

Course Outcomes

On successful completion of the course, students will be able to:

1. Describe the foundational principles and terminology associated with digital image processing and computer vision.
2. Utilize fundamental image processing algorithms to enhance the visual quality of images, both subjectively and objectively.
3. Extract meaningful features from images for pattern classification and shape analysis,
4. Develop and implement algorithms for solving real life problems in digital image processing.
5. Demonstrate proficiency in implementing algorithms and techniques learned in the course through hands-on projects using tools like OpenCV, MATLAB, or Python libraries.

Syllabus

Module I:(5 Hours)

Fundamentals of Image processing: pixel, domain, size, resolution, and relationship between pixels. Fundamental Steps in Digital Image Processing. Elements of Visual Perception, Photometric image formation, the digital camera, 2D to 3D projections, and Camera Matrix;Motion models: rotation, translation, and affine, scaling, shearing, matrix representation, low rank transforms composition of transformation.

Module II:(8 Hours)

Image Enhancement in Spatial and Frequency Domain: Basic gray level transformations, Histogram equalization, Smoothing Spatial Filters, Order Statistic Filters, Sharpening Spatial Filters. Image smoothing and sharpening using frequency domain filters.

Module III: (7 Hours)

Image Restoration and Denoising: Model of mage degradation/restoration processes; Types of image blur, linear position-invariant degradation, estimation of degradation function, linear and nonlinear image restoration techniques, Inverse filtering, Wiener filtering, Constrained Least Squares Filtering.

Image Denoising: Noise Models, restoration in the presence of Noise only, Introduction to latestfiltering techniques: bilateral filtering, Non-local mean filter, PCA for image denoising.

Module IV:(08 Hours)

Image Transforms and Compression models:2D Orthogonal and Unitary Transforms, Discrete Fourier Transform, Discrete Cosine Transform, KL Transform, Wavelets and Multi resolution Processing: Multi resolution Expansions, Wavelet Transforms in 1D and 2D, The Fast Wavelet Transform.
Image Compression: lossless and lossy, JPEG for gray scale and color image compression, Huffman encoding and run length encoding in JPEG, Structure of Huffman encoder and decoder.

Module V: (6 Hours)

Image Segmentation: Detection of Discontinuities, Edge and Corner Detection, Edge linking and Boundary Detection, Hough Transform,Thresholding, Region-Based Segmentation, Graph-based segmentation, Segmentation by clustering, and normalized cuts.

Module VI:(6 Hours)

Feature Extraction and Applications of Image Processing: Boundary and region feature descriptors, SIFT, HOG feature descriptors, Face Recognition, and Image Pattern Classification, Image Compositing and matting.

Text Books

1. Digital Image Processing by R. C. Gonzalez & R. E. Woods, Pearson education, Fourth edition, 2018.
2. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer, second edition, 2022.

Reference Books

1. Anil K. Jain, "Fundamentals of Digital Image Processing," PHI Learning, Indian edition.
2. Digital Image Processing using MATLAB by R. C. Gonzalez, R. E. Woods & Steven Eddins, Pearson education, second edition, 2017.
3. Feature Extraction and Image Processing for Computer Vision by Alberto S. Aguado and Mark S. Nixon, Academic Press, 3 edition, 2012.
4. Image Processing, Analysis and Machine vision by Milan Sonka, Roger Boyle, and Vaclav Hlavac, Cengage India Private Limited, Fourth edition, 2017.
5. Pattern Classification by Richard Duda, Peter Hart, and David Stork,Wiley, Second edition, 2021.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP305-3				
Category	Program Elective				
Course Title	Image Processing Lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	V

List of Experiment

1. Fundamental operations on an image. (Such as reading, displaying, rotation, translation, and affine, scaling, shearing, image negative).
2. Image enhancement using point processing operations:
    a) Contrast stretching,
    b) Gray Level Slicing
    c) Histogram Equalization
3. Image enhancement using global processing operations:
    a) Spatial Filtering (Image smoothing and sharpening)
    b) Frequency Domain Filtering (Image smoothing and sharpening)
4. Image Restoration in the presence of Noise using global processing operations:
    a) Mean Filters
    b) Order-Statistic Filters
5. Image Deburring using :
    a) Inverse Filtering
    b) Minimum Mean Square Error (Wiener) Filtering
6. Computation of Image Transforms:
    a) Discrete Fourier Transform
    b) Discrete Cosine Transform
    c) KL Transform
7. Implement JPEG compression and decompression model from scratch for a gray scale image.
8. Detection of Edges and Corners in a given image using:
    a) Laplacian operator
    b) Canny edge detector
    c) Marr-Hildreth edge detector
    d) Harris corner detector
9. Performing image segmentation using:

a) Thresholding
b) Region Growing
c) K-means clustering
d) Graph-Based Segmentation

10. Develop an application for Face Detection using the fundamentals learned in the course.
11. Develop an application for Face Recognition using the fundamentals learned in the course.
12. Develop and application for Texture classification using :
    a) prototype matching,
    b) Optimal statistical formulation.
13. A Capstone Project.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST305-4				
Category	Engineering Science Course				
Course Title	Cloud Computing				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	

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

1. Understand network as recourse for cloud
2. Articulate the concepts of cloud computing
3. Implement the concept of virtualization and resource management.
4. Demonstrate the measures to be taken for handling fault tolerance and security.
5. Provide cloud computing solutions and recommendations for cloud programming and software environments-based applications.

Syllabus

Module I: Introduction
Introduction to computer network Basics, Computing Services, Servers, Data bases, Networking software, analytics and intelligence, interconnection of peering points, Autonomous systems.

Module II: Cloud formation
ubiquitous, convenient on demand network access of pooled resource creation, configuration, customization.

Module III: Models of Cloud:
Public, Private and Hybrid Clouds, and service models - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS)methods and technology used.

Module IV: Cloud virtualization:
Hardware /Software /Data servers, Networks infrastructure.

Module V: Service providers and their role
infrastructure creation/support, security and Administration

Module VI: Use cases and resource Provisioning
Oracle cloud infrastructure configuration and management

Text Books

1. Cloud Computing Principles and Paradigm, RajkumarBuyya, James Broberg, AndrzejGoscinski, Wiley Publishers.2011

Reference Books

1. Barrie Sosinsky, - Cloud Computing Bible|| John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, - Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009
3. Cloud Computing: A Practical Approach, Toby Velte, Anthony TVelte, Robert Elsenpeter, McGrawHill,2009
4. Application notes of AWS
5. Application notes of Azure

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECSP305-4				
Category	Engineering Science Course				
Course Title	Cloud Computing Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	

List of Experiments

Experiments will be based on following

1. Formation of cloud
2. Design an application in a cloud environment.
3. Demonstrate the use of cloud environment to access cloud storage.
4. Resource provisioning on cloud infrastructure.
5. Implement concepts of migration and load balancing.
6. Deploy security measures and administration.

Syllabus of Semester V B.Tech.
Department of Electronics and Computer Science

Course Code	ECST 398-1				
Category	Open Elective II				
Course Title	Designing with Arduino				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	V

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

1. Use the Arduino IDE for writing, testing and debugging of sketches.
2. Measure physical parameters using Arduino and sensors.
3. Interface devices with Arduino using UART, TWI and SPI protocols.
4. Control DC, stepper and servo motors with Arduino.

Syllabus

Module I
Arduino platform, Prototyping environment, electronic component overview, Arduino IDE, setting up the Arduino board, creating sketches, using Libraries, using example codes, Debugging using the Serial Monitor

Module II
Arduino C, Data types, Decision making, Loops, Functions, Pointers, Structures, writing sketches using C

Module III
Sensors, Digital and Analog signals, Temperature sensors, Humidity sensors, Obstacle sensors, Ultrasonic sensor, Accelerometer and gyroscope

Module IV
Wired and Wireless communication, Communication Protocols- UART, TWI, SPI, Interfacing Communication Modules with Arduino

Module V
Interfacing Nokia5110 GLCD and SSD1306 OLED displays, displaying text, drawing geometrical shapes, displaying bitmaps on displays

Module VI
Tone functions, melody generation, Motor interfacing - DC, Servo, Stepper motor with Arduino

Text Books

1. Arduino for Beginners: Essential Skills Every Maker Needs, John Baichtal, Pearson Education, Inc., 1st edition
2. Beginning C for Arduino by Jack Purdum (ebook)

Reference Books

1. Arduino Cookbook by Michael Margolis, O'Reilly Media, Inc., 1st edition

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