



# RBU

RAMDEOBABA UNIVERSITY, NAGPUR  
Formerly Shri Ramdeobaba College of Engineering & Management (RCOEM) Est. 1984

## **RAMDEOBABA UNIVERSITY, NAGPUR-440013**

Established by the Maharashtra Private Universities (Establishment and Regulation) Act 2023 (Mah. Act No VIII of 2024)

Formerly, Shri Ramdeobaba College of Engineering and Management, Nagpur 440013

### **School of Electrical and Electronics Engineering**

### **Department of (Electronics Engineering)**

### **PROGRAMME SCHEME & SYLLABI**

**of First Year as per National Education Policy (NEP)**

**(With effect from Academic Year 2024-25)**

## **B.Tech. ELECTRONICS AND COMPUTER SCIENCE**

**Semester I**

S N	Course Type	Code	Course	Hours/week			Maximum marks			ESE Durati on (Hrs.)
				L	P	C	Continuo us Evaluati on	End Sem/ Intern al Eval	Tota l	
1	ESC	24EE0 1TH01 01	Basic Electronics and Computer Fundamentals	3	0	3	50	50	100	3
2	BSC	24HS0 3TH01 02	Calculus and Linear Algebra	3	0	3	50	50	100	3
3	ESC	24EE0 1TH01 02	Digital Logic Design	3	0	3	50	50	100	3
4	ESC	24EE0 1PR01 02	Digital Logic Design	0	2	1	25	25	50	-
5	ESC	24EE0 1TH01 03	Fundamentals of Programming	3	0	3	50	50	100	3
6	ESC	24EE0 1PR01 03	Fundamentals of Programming	0	2	1	25	25	50	-
7	VSEC	24EE0 1PR01 04	Computer workshop-I	0	2	1	25	25	50	-
8	VSEC	24EE0 1PR01 05	Prompt Engineering	0	2	1	25	25	50	-
9	CCA	24HS0 4PR01 01	Sports-Yoga-Recreation	0	2	1	25	25	50	-
10	CCA	24HS0 2PR01 05	Liberal/Performing Art Lab	0	2	1	25	25	50	-
11	VSEC	24EE0 1TH01 06	Creativity Innovation and Design Thinking	1	0	1	50	-	50	-
12	VSEC	24EE0 1PR01 06	Creativity Innovation and Design Thinking	0	2	1	25	25	50	-
			<b>TOTAL</b>	<b>13</b>	<b>14</b>	<b>20</b>				

**Semester II**

S N	Cour se Typ e	Code	Course	Hours / week		C	Maximum marks			ESE Durat ion (Hrs.)
				L	P		Continuo us Evaluati on	End Sem/ Intern al Eval	Total	
1	PCC	24EE01T H0201	CMOS Digital Circuit Design	3	0	3	50	50	100	3
2	PCC	24EE01P R0201	CMOS Digital Circuit Design	0	2	1	25	25	50	-
3	BSC	24HS03T H0212	Probability and Statistics	3	0	3	50	50	100	3
4	PCC	24EE01T H0202	Digital System Design	3	0	3	50	50	100	3
5	PCC	24EE01P R0202	Digital System Design	0	2	1	25	25	50	-
6	ESC	24EE01T H0203	Elements of Internet of Things	3	0	3	50	50	100	3
7	ESC	24EE01P R0203	Elements of Internet of Things	0	2	1	25	25	50	-
8	PCC	24EE01T H0204	Object Oriented Programming	3	0	3	50	50	100	3
9	PCC	24EE01P R0204	Object Oriented Programming	0	2	1	25	25	50	-
10	VSE C	24EE01P R0205	Computer workshop -II	0	2	1	25	25	50	-
11	AEC	24HS02T H0201	English for Professional Communication	2	0	2	50	50	100	2
12	AEC	24HS02P R0201	English for Professional Communication	0	2	1	25	25	50	-
13	IKS	24HS02T H0205	Foundational Literature of Indian Civilization	1	0	1	50	50	100	-
			<b>TOTAL</b>	<b>18</b>	<b>12</b>	<b>24</b>				

Exit option: Award of UG Certificate with additional 8 credits

Exit Courses

1	IT Support Engineer	Online/Offline Certification Course	8
2	Web Designer		8
3	UI/UX Design		8

**Semester III**

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Durati on (Hrs.)
				L	P		Continuo us Evaluati on	End Sem/ Intern al Eval	Tota l	
1	PCC	24EE0 1TH03 01	Data Structures and Algorithms	3	0	3	50	50	100	3
2	PCC	24EE0 1PR03 01	Data Structures and Algorithms	0	2	1	25	25	50	-
3	PCC	24EE0 1TH03 02	Computer Architecture	3	0	3	50	50	100	3
4	PCC	24EE0 1PR03 02	Computer Architecture	0	2	1	25	25	50	-
5	BSC	24EE0 1TH03 03	Discrete Mathematics	3	0	3	50	50	100	3
6	PCC	24EE0 1TH03 04	Digital Signal Processing	3	0	3	50	50	100	3
7	PCC	24EE0 1PR03 04	Digital Signal Processing	0	2	1	25	25	50	-
8	MDM	24EE0 1TH03 05	MDM-1	3	0	3	50	50	100	3
9	OE	24EE0 EC01T H0306	Open Elective I / MOOC	2	0	2	50	50	100	2
10	BSC	24HS0 1TH03 01	Environmental Science	1	0	1	50	-	50	-
11	BSC	24HS0 1PR03 01	Environmental Science	0	2	1	25	25	50	-
12	VEC	24HS0 2TH02 04	Foundational course in Universal Human Value	1	0	1	50	-	50	-
			<b>TOTAL</b>	<b>19</b>	<b>8</b>	<b>23</b>				

**Semester IV**

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Durati on (Hrs.)
				L	P		Continuo us Evaluatio n	End Sem/ Intern al Eval	Tota l	
1	PCC	24EE01TH 0401	Embedded System Design	3	0	3	50	50	100	3
2	PCC	24EE01PR 0401	Embedded System Design	0	2	1	25	25	50	-
3	PCC	24EE01TH 0402	Operating System	3	0	3	50	50	100	3
4	PCC	24EE01PR 0402	Operating System	0	2	1	25	25	50	-
5	PCC	24EE01TH 0403	Design and Analysis of Algorithms	3	0	3	50	50	100	3
6	PCC	24EE01TH 0404	Fundamentals of AI and Machine Learning	3	0	3	50	50	100	3
7	PCC	24EE01PR 0404	Fundamentals of AI and Machine Learning	0	2	1	25	25	50	-
8	MDM	24EE01TH 0405	MDM-2	3	0	3	50	50	100	3
9	OE	24EE01TH 0406	Open Elective- II/MOOCs	2	0	2	50	50	100	2
10	VSEC	24EE01PR 0407	Software Laboratory Practice-I	0	2	1	50	-	50	-
11	AEC	24EE01PR 0408	Basic Competitive coding	0	2	1	50	50	100	-
12	HSSM	24SM01T H0401	Innovations and Entrepreneurship	1	0	1	50	0	50	-
	HSSM	24SM01PR 0401	Innovations and Entrepreneurship	0	2	1	25	25	50	-
			<b>TOTAL</b>	<b>18</b>	<b>12</b>	<b>24</b>				

Exit option: Award of UG Diploma with additional 8 credits			
Exit Course			
1	Android Application Development	Online/ Offline Certification Course	8
2	Python Programming		8
3	PCB Design		8

### Semester V

S N	Course Type	Code	Co ur se	Hours/week		C	Maximum marks			ESE Dura tion (Hrs. )
				L	P		Continuo us Evaluati on	End Sem /Intern al Eval	Tota l	
1	PCC	24EE01TH 0501	Computer Networks	3	0	3	50	50	100	3
2	PCC	24EE01PR 0501	Computer Networks	0	2	1	25	25	50	-
3	PCC	24EE01TH 0502	Digital Image Processing	3	0	3	50	50	100	3
4	PCC	24EE01PR 0502	Digital Image Processing	0	2	1	25	25	50	-
5	PCC	24EE01TH 0503	Deep Learning	3	0	3	50	50	100	3
6	PCC	24EE01PR 0503	Deep Learning	0	2	1	25	25	50	-
7	OE	24EEOEC0 1TH0504	Open Elective- III/MOOCs	2	0	2	50	50	100	2
8	MDM	24EE01TH 0505	MDM-3	3	0	3	50	50	100	3
9	PEC	24EE01TH 0506	Program Elective-I	3	0	3	50	50	100	3
10	PEC	24EE01PR 0506	Program Elective-I	0	2	1	25	25	50	-
11	AEC	26HS02TH 0501	Business Communication	1	0	1	50	0	50	-
12	AEC	26HS02PR 0501	Business Communication	0	2	1	25	25	50	
			<b>TOTAL</b>	<b>18</b>	<b>10</b>	<b>23</b>				

### Semester VI

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Durati on (Hrs)
				L	P		Continuo us Evaluati on	End Sem/ Intern al Eval	Tota l	
1	PCC	24EE0 1TH06 01	Database Management System	3	0	3	50	50	100	3
2	PCC	24EE0 1PR06 01	Database Management System	0	2	1	25	25	50	-
3	PCC	24EE0 1TH06 02	Software Engineering	3	0	3	50	50	100	3
4	PEC	24EE0 1TH06 03	Programme Elective-II	3	0	3	50	50	100	3
5	PEC	24EE0 1PR06 03	Programme Elective-II	0	2	1	25	25	50	-
6	PEC	24EE0 1TH06 04	Programme Elective-III	3	0	3	50	50	100	3
7	PEC	24EE0 1PR06 04	Programme Elective-III	0	2	1	25	25	50	-
8	MDM	24EE0 1TH06 05	MDM-4	3	0	3	50	50	100	3
9	VSEC	24EE0 1PR06 06	Software Laboratory Practice -II	0	2	1	25	25	50	-
10	AEC	24EE0 1PR06 07	Advanced Competitive coding	0	2	1	25	25	50	-
11	FP/CEP	24EE0 1PR06 08	Project-I	0	4	2	50	50	100	-
<b>TOTAL</b>				<b>15</b>	<b>14</b>	<b>22</b>				

Exit option: Award of UG Degree with additional 8 credits

Exit Course

1	TBI/Industry/Research Internship	Online/offline Certification Course	8
2	AI & ML on Cloud Platform		8
3	HLS Design		8

**Semester VII/VIII**

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Durati on (Hrs)
				L	P		Continuo us Evaluati on	End Sem/ Intern al Eval	Tot al	
1	PCC	24EE0 1TH07 01	Fundamentals of Digital Communication	3	0	3	50	50	100	3
2	PCC	24EE0 1PR07 01	Fundamentals of Digital Communication	0	2	1	25	25	50	-
3	PEC	24EE0 1TH07 02	Program Elective-IV	3	0	3	50	50	100	3
4	VEC	24EE0 1TH07 03	Cyber Laws and Ethics in IT	2	0	2	50	50	100	2
5	PRJ	24EE0 1PR07 04	Project-II	0	8	4	50	50	100	-
6	FP	24EE0 1PR07 05	Internship Evaluation	0	2	0	-	-		-
7	AEC	24EE0 1PR07 06	Participative Learning	0	2	1	50	50	100	-
			<b>TOTAL</b>	<b>8</b>	<b>14</b>	<b>14</b>				



**Semester VIII/VII**

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continu ous Evalu ation	End Sem/ Intern al Eval	Total	
1	PE C	24EE0 1TH08 01	Programme Elective-V	3	0	3	50	50	100	3
2	PE C	24EE0 1TH08 02	Programme Elective-VI	3	0	3	50	50	100	3
3	PRJ	24EE0 1PR08 03	Project-III	0	12	6	50	50	100	-
<b>TOTAL</b>				<b>6</b>	<b>12</b>	<b>12</b>				

**OR**

S N	Course Type	Code	Course	Hours/week		C	Maximum marks			ESE Duration (Hrs)
				L	P		Continu ous Evalu ation	End Sem/ Intern al Eval	Total	
1	Internship /OJT	24EE 01PR 0804	Industry Internship/ TBI Internship/ Research Internship*	0	24	12	50	50	100	-
<b>TOTAL</b>				<b>0</b>	<b>24</b>	<b>12</b>				

### HONORS Specialization in Research

S N	Sem	Code	Course	Hours/week		C	Maximum marks			ESE Durati on (Hrs)
				L	P		Continuo us Evaluati on	End Sem/ Intern al Eval	Tot al	
1	VII	24EE0 1TH07 07	Research Methodology	3	0	3	50	50	100	3
2	VII	24EE0 1PR07 08	Research Project Phase -I	0	6	3	50	50	100	-
3	VIII	24EE0 1PR08 05	Research Project Phase-II	0	24	12	50	50	100	-
			<b>TOTAL</b>	<b>3</b>	<b>30</b>	<b>18</b>				
				<b>33 Hrs.</b>						

### Programme Electives

	Semester V	Semester VI		Semester VII	Semester VIII	
	Elective-I	Elective-II	Elective-III	Elective-IV	Elective-V	Elective-VI
<b>Course Code</b>	24EE01TH0506-1/24EE01PR0506-1	24EE01TH0603-1/24EE01PR0603-1	24EE01TH0604-1/24EE01PR0604-1	24EE01TH0702-1	24EE01TH0801-1	24EE01TH0802-1
<b>Course Name</b>	Natural Language Processing	AI & ML on Cloud Platform	Deep Learning for Visual Recognition	Embedded Machine Learning	Generative AI-I	Generative AI-II
<b>Course Code</b>	24EE01TH0506-2/24EE01PR0506-2	24EE01TH0603-2/24EE01PR0603-2	24EE01TH0604-2/24EE01PR0604-2	24EE01TH0702-2	24EE01TH0801-2	24EE01TH0802-2
<b>Course Name</b>	FPGA based System Design	Digital Design Verification	Design for Testability	C Based VLSI Design	VLSI Signal Processing	VLSI Physical Design
<b>Course Code</b>	24EE01TH0506-3/24EE01PR0506-3	24EE01TH0603-3/24EE01PR0603-3	24EE01TH0604-3/24EE01PR0604-3	24EE01TH0702-3	24EE01TH0801-3	24EE01TH0802-3
<b>Course Name</b>	System on Chip Design	Embedded Linux	Real-Time Operating Systems Design and Programming	Internet of Things	Mechatronics and Robotics	Graphics and Mobile Gaming
<b>Course Code</b>	24EE01TH0506-4/24EE01PR0506-4	24EE01TH0603-4/24EE01PR0603-4	24EE01TH0604-4/24EE01PR0604-4	24EE01TH0702-4	24EE01TH0801-4	24EE01TH0802-4
<b>Course Name</b>	Fundamentals of Cloud Computing	Fundamentals of Cloud Security	Parallel Architecture	Distributed Computing	Cloud Services and AI Interpretation	Edge AI Computing

### Honors (Full-Stack JavaScript Developer)

III sem	JavaScript Programming Essentials
IV sem	Front and Back end App development
V sem	Cloud native applications, Containers and Microservices
VI sem	Back-end Database Applications and JavaScript Full Stack Capstone Project
VII sem	Capstone Project

### List of MDM

Sr. No.	Semester	Course Code	Course Name
1	III	MDM-1	Elements of IoT
2	IV	MDM-2	IoT sensors and Devices
3	V	MDM-3	Industrial IOT and Industry 4.0
4	VI	MDM-4	Electric Vehicles

**OR**

Sr. No.	Semester	Course Code	Course Name
1	III	MDM-1	Basics of Chip Design using Verilog HDL
2	IV	MDM-2	MIPS Processor Design and Testing
3	V	MDM-3	Chip Verification using System Verilog
4	VI	MDM-4	VLSI Physical Design

Course Code	24EE01TH0101			
Category	Engineering Science Course			
Course Title	Basic Electronics and Computer Fundamentals			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	I

### Course Outcomes

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

1. Apply the knowledge of basic laws to analyze simple DC circuits.
2. Design and analyze simple diode and MOSFET circuits.
3. Understand the basic components of computer system and use different number systems for information representation
4. Understand the basics of computer networking

### Syllabus

#### Module I:

**Basic circuit elements and RLC Circuit:** circuit elements resistor, inductor and capacitor, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel circuits excited by independent voltage sources; energy sources, dependent sources, star- delta transformation.

#### Module II:

**Semiconductors and p-n junction diode:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Current flow in semiconductors, diffusion and drift, p-n junction diode, forward bias, reverse bias, Application of diode, Introduction to Bipolar Junction Transistors

#### Module III

**MOSFET Transistors and Biasing:** MOSFET construction and working principle, AC/DC load line concept, Operating Point Analysis, need of biasing, biasing techniques, bias stabilization, compensation techniques, Application of MOSFET as Amplifier.

#### Module IV

**Computer Basics and Data Representation:** Introduction to Computer: Generation of Computer, Computer Architecture: Input /Output devices, CPU, Memory: Primary and secondary, Basic data encoding, Software: System, Application, Driver, Ports in Computer: Display, Ethernet, USB.

#### Module V

**Network Fundamentals:** Network Standards, OSI, and TCP I/P models. Types of networks: LAN, WAN, MAN, Network Topologies

### Textbooks

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar: Microelectronic Circuits: Theory and Applications: Seventh Edition, Oxford University Press, 2017.
2. Brookshear J. G., "Computer science: an overview", Eleventh Edition, Addison-Wesley Publishing Company; 2011.

### Reference Books

1. E Balagurusamy, Fundamentals of Computers, Tata Mcgraw Hill Publications
2. Donald Neamen "Electronic Circuits: Analysis and Design" Third Edition, McGraw-Hill Publication

Course Code	24HS03TH0102			
Category	Basic Science Course			
Course Title	Calculus and Linear Algebra			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	I

### Course Outcomes

On successful completion of the course, student shall be able to

1. Apply the concepts of continuity and differentiability to find Taylor's and Maclaurin series.
2. Understand the methods of partial derivatives and apply these concepts to determine extreme values of the functions of two variables.
3. Demonstrate the basic knowledge of vector differentiation and line integral.
4. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
5. Internalize convergence of sequences and apply it to determine whether infinite series convergent or divergent with appropriate tests.

### Syllabus

#### Module 1 : (8 Lectures)

Differential Calculus: Functions of univariate, Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem, Taylor's and Maclaurin series.

#### Module 2: (10 Lectures)

Partial Differentiation: Partial derivatives, Euler's Theorem, chain rule, application of partial differentiation: total derivative, Jacobians, Maxima, Minima for the functions of two variables., Extrema of function of multivariable,

#### Module 3: (8 Lectures)

Vector Calculus: Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, application of vector calculus: Line integral, Gradient Descent method.

#### Module 4: (8 Lectures)

Rank-nullity theorem; Consistency of system of linear equations and its solution, Orthogonal matrices, Eigen values and eigenvectors, Diagonalization of matrices, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional vector spaces, Singular value decomposition and its applications.

#### Module 5: (6 Lectures)

Infinite series: Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, uniform convergence, power series, radius of convergence.

### 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. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India)

Course Code	24EE01TH0102/24EE01PR0102			
Category	Engineering Science Course			
Course Title	Digital Logic Design			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	I

### Course Outcomes

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

1. Understand Number Systems and its conversions
2. Apply various optimization techniques to minimize digital circuits.
3. Design combinational logic circuits.
4. Analyze and design asynchronous and synchronous sequential circuits.

### Module-I

Basics of Digital Electronics: Motivation for digital systems: Number Systems and arithmetic's, Representation of Signed Numbers, Boolean algebra, Logic gates, SOP, POS, Minimization of Switching functions using Karnaugh-maps.

### Module-II

Timing issues in Digital Circuit: Fan-In, Fan-Out, Propagation Delay, Power Dissipation, Noise Margin

### Module-III

Combinational Circuit Design: Adders, Subtractors, Multiplexer, De-multiplexers, Encoders, Decoders, Code Converters, Comparators.

### Module-IV

Sequential Circuit Design-I: Storage elements, Flip-flops and latches: D, T, JK, SR flip-flops: level triggered, edge triggered, Master Slave flip-flop, flip flop conversion, timing analysis.

### Module-V

Sequential circuit Design-II: Design of asynchronous and synchronous counters, Registers & Shift registers, Application of shift register: Ring counter, Johnson counter.

### Module-VI

Design of synchronous sequential circuit using Mealy model and Moore model

### Text books:

1. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989.
2. Modern Digital Electronics: R. P Jain, Tata McGraw Hill, 3rd Edition.

### Reference Books:

1. Digital Logic and Computer Design: Morris Mano, PHI, 3rd Edition.

## List of Experiments

1. To verify truth table of different logic gates.
2. Design basic logic gates using universal gate and verify its truth table.
3. To verify following Boolean expressions.

$$Y=A+AB+A'B'$$

4. To implement the following arithmetic circuits using logic gates IC's
  - a) Half adder
  - b) Full subtractor
5. Implement the function  $F = \sum m(1,3,5,7,8,9,11,13,15) + d(12,14)$  using 16:1 and 8:1 multiplexer.
6. Verify the truth table of SR, JK, T and D flip flop.
7. To study the following functions of Shift register.
  - a) SIPO
  - b) PIPO
  - c) PISO
  - d) SISO
8. Design and verify 2-bit synchronous down counter using S-R flip-flop.
9. Design and verify the functionality of a sequence detector to detect the sequence 101 using Mealy and Moore model and use J-K flop-flop to implement the design.



Course Code	24EE01TH0103/24EE01PR0103			
Category	Engineering Science Course			
Course Title	Fundamentals of Programming			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	I

## Course Outcomes

On successful completion of the course, students 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 1 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 2 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 3 Arrays and Basic Algorithms

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

### Module 4 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.

### Module 5 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.

## **Module 6 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 f flush ().

### **Text Books**

1. Programming in ANSIC: E. Balguruswami Mc GrawHill
2. Mastering C: K. R. Venugopal and S.R. Prasad, Tata Mc GrawHill

### **Reference Books**

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, B P B Publication

## **List of Experiments**

1. Using basic data types of C, implement arithmetic expressions. 2. Implement

Programs using Decision Control Structures

3. Demonstrate use of Loop Control Structures

4. Implement Programs using Multi-way Decision Control Structures (Switch Case)

5. Apply Functions and Recursion to simple programs.

6. Initialize array and apply it to solve problems of 1D and 2D arrays.

7. Demonstrate use of Structures and Pointers. 8. Apply file

handling concepts in C.

Note :- 2/3 Practice Programs will be taken on each of the experiments mentioned above.

Course Code	24EE01PR0104			
Category	Vocational and Skill Enhancement Course			
Course Title	Computer workshop-I			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

## Advanced Excel Experiments:

### 1. Experiment 1: Data Analysis using Formulas

**Objective:** To understand and apply various Excel formulas for data analysis.

- **Tasks:**
  - Use **SUM**, **AVERAGE**, **MAX**, **MIN**, and **IF** functions to analyze a dataset (e.g., sales data).
  - Calculate the total sales, average sales, maximum and minimum sales values.
  - Use the **IF** function to categorize data (e.g., sales above a certain threshold as "High" and below as "Low").

### 2. Experiment 2: Data Visualization and Filtering

- **Objective:** To create and format graphs and apply filters to a dataset.
- **Tasks:**
  - Plot a **line graph** and **bar chart** using given data (e.g., monthly expenses).
  - Apply **filters** to display specific data, such as expenses in a particular month or category.
  - Customize the chart with titles, labels, and colors.

## HTML, CSS, and JavaScript Experiments:

### 1. Experiment 1: Basic HTML Structure

- **Objective:** To create a simple webpage using basic HTML elements.
- **Tasks:**
  - Create an HTML page with a **title**, **heading**, **paragraph**, **list** (ordered and unordered), and **image**.
  - Structure the content using **<div>** and **<span>** tags.
  - Use **<a>** tags to create hyperlinks.

### 2. Experiment 2: Styling with CSS

- **Objective:** To apply basic CSS to style an HTML page.
- **Tasks:**
  - Create an HTML page and link an external CSS file.
  - Use CSS to set the **background color**, **font style**, **text alignment**, and **margins**.
  - Apply CSS to style **buttons** and **images** (e.g., rounded corners, hover effects).

### 3. Experiment 3: Creating a Simple Web Form

- **Objective:** To design a basic web form using HTML and CSS.
- **Tasks:**
  - Create a web form with fields like **text input, password, email, dropdown menu, radio buttons,** and **submit button.**
  - Style the form using CSS to improve its appearance (e.g., padding, border-radius, hover effects).
  - Validate the form fields using basic HTML5 attributes (e.g., **required**).

### 4. Experiment 4: Introduction to JavaScript

- **Objective:** To add interactivity to a webpage using JavaScript.
- **Tasks:**
  - Create an HTML page with a **button** that, when clicked, displays an **alert** message.
  - Write a simple JavaScript function to **change the content** of a paragraph when a button is clicked.
  - Use JavaScript to perform basic arithmetic operations (e.g., adding two numbers) and display the result on the page.

Course Code	24EE01PR0105			
Category	Vocational and Skill Enhancement Course			
Course Title	Prompt Engineering			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### **Module 1: Introduction to Prompt Engineering**

- Lab 1: What is Prompt Engineering, and why do we care?
- Lab 2: English as a new programming language

### **Module 2: Getting Started with Prompt Engineering**

- Lab 3: Getting to know our GPT-based AI tool
- Lab 4: The Naive Prompting Approach and the Persona Pattern
- Lab 5: The Interview Pattern

### **Module 3: The Chain-of-Thought Approach**

- Lab 6: The Chain-of-Thought Approach in Prompt Engineering

### **Module 4: Advanced Techniques**

- Lab 7: The Tree-of-Thought Approach in Prompt Engineering
- Lab 8: Controlling Verbosity and the Nova System
- Lab 9: Getting to Know watsonx Prompt Lab

### **Module 5: Capstone Project**

Course Code	24HS04PR0101			
Category	Co-Curricular Activity			
Course Title	Sports-Yoga-Recreation			
Scheme & Credits	L	P	Credit	Semester
	0	2	1	I

### Course Outcomes:

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

1. Understand fundamental skills, basic principle and practices of sports and Yoga.
2. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
3. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
4. practice Healthy & active living with reducing Sedentary Life style.

### Module 1: - Practical- Exercises for Health and Wellness

- Warm-Up and Cool Down - General & Specific Exercises
- Physical Fitness Activities
- Stretching Exercises
- General & Specific Exercises for Strength, Speed, Agility, Flexibility, coordinative abilities
- Cardiovascular Exercises
- Assessment of BMI
- Relaxation techniques
- Physical Efficiency Tests

### Module 2: - Yoga

- Shukshma Vyayam
- Suryanamaskar
- Basic Set of Yogasanas – Sitting, standing, supine and prone position
- Basic Set of Pranayama & Meditation

### References:

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD “Health related Physical Fitness Test Manual.”1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS ‘Science)

**Course Title: Liberal / Performing Arts**

<b>Course Code</b>	<b>Course Name</b>	<b>Sem</b>	<b>Hours /week</b>	<b>Credits</b>	<b>Continuous Evaluation Max. marks</b>
24HS02PR0105-01	Fundamentals of Indian Classical Dance: Bharatnatayam	I	2	1	50
24HS02PR0105-02	Fundamentals of Indian Classical Dance: Kathak	I	2	1	50
24HS02PR0105-03	Introduction to Digital Photography	I	2	1	50
24HS02PR0105-04	Introduction to Basic Japanese Language	I	2	1	50
24HS02PR0105-05	Art of Theatre	I	2	1	50
24HS02PR0105-06	Introduction to French Language	I	2	1	50
24HS02PR0105-07	Introduction to Spanish Language	I	2	1	50
24HS02PR0105-08	Art of Painting	I	2	1	50
24HS02PR0105-09	Art of Drawing	I	2	1	50
24HS02PR0105-10	Nature Camp	I	2	1	50
24HS02PR0105-11	Developing Self-awareness	I	2	1	50
24HS02PR0105-12	Art of Poetry	I	2	1	50
24HS02PR0105-13	Creative and content writing	I	2	1	50
24HS02PR0105-14	Science of life through Bhagwad Gita	I	2	1	50



Course Code	24HS02PR0105-01			
Category	Co-Curricular Activity			
Course Title	Fundamentals of Indian Classical Dance: Bharatnatayam			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Understand the importance of dance and Bharatnataym as an Indian dance form
2. Develop skills to perform the dance form at its basic level.
3. Evaluate their strengths and interest to take bridge course to give Pratham (1<sup>st</sup> level formal exam of Bharatnatayam).

### Syllabus

1. Orientation in Bharatnatayam
2. Tattu Adavu till 8, NaattaAdavu 4 Steps, PakkaAdavu 1 step, Metta Adavu 1 Step, Kuditta Metta Adavu 4 Steps
3. Practice sessions
4. Tatta Kuditta Adavu (Metta), Tatta Kuditta Adavu (Metta) 2 Steps, Tirmanam Adavu 3 Steps, KattuAdav - 3 Steps, Kattu Adav - 3 Steps
5. Practice sessions
6. Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps
7. Practice sessions
8. Final practice sessions and performances.

### Recommended reading

1. Introduction to Bharata's Natyasastra, Adya Rangacharya, 2011
2. The Natyasastra and the Body in Performance: Essays on the Ancient Text, edited by Sreenath Nair, 2015
3. Bharatanatyam How to ... : A Step-by-step Approach to Learn the Classical Form, Eshwar Jayalakshmi, 2011

Course Code	24HS02PR0105-02			
Category	Co-Curricular Activity			
Course Title	Fundamentals of Indian Classical Dance: Kathak			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Understand the importance of dance and Kathak as an Indian dance form
2. Develop skills to perform the dance form at its basic level.
3. Evaluate their strengths and interest to take bridge course to give Prarambhik (1<sup>st</sup> level formal exam of Kathak).

### Syllabus

1. Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5count (Bhramari),
2. practice sessions of practical 1
3. Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings
4. practice sessions of practical 3
5. Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,
6. practice sessions of practical 5
7. 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions
8. Final performances.

### Recommended reading

1. Kathak Volume 1 A "Theoretical & Practical Guide" (Kathak Dance Book), Marami Medhi & Debasish Talukdar, 2022, Anshika Publication (13 September 2022)

Course Code	24HS02PR0105-03			
Category	Co-Curricular Activity			
Course Title	Introduction to Digital Photography			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

## Course Outcomes

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

1. Develop an understanding of the technical aspects and aesthetics of Photography.
2. Apply the rules of digital photography for creating photographs.
3. Develop skills to enhance photographs through post processing.
4. Create a portfolio of their photographs in selected genre.

## Syllabus

- 1.Orientation in digital photography: Genres, camera handling and settings
2. Rules of Composition
- 3.Rules of Composition: practice sessions
- 4.Understanding Exposure and Art of Pre-Visualization
- 5.Rules of Composition andArt of Pre-Visualization: practice sessions
6. Post Processing Photographs and Portfolio creation
- 7.Post Processing Photographs: practice sessions
- 8.Portfolio finalization and presentation in selected genre.

## Reference material

- 1.Scott Kelby (2020) The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros, Rocky Nook, USA
- 2.Larry Hall (2014) Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography, Speedy Publishing LLC, Newark
- 3.J Miotke(2010) BetterPhoto Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro, AMPHOTO Books, Crown Publishing Group, USA

Course Code	24HS02PR0105-04			
Category	Co-Curricular Activity			
Course Title	Introduction to Japanese Language			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

## Course Outcomes

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

1. Gain a brief understanding about Japan as a country and Japanese culture.
2. Develop ability to use vocabulary required for basic level communication in Japanese language.
3. Write and read the first script in Japanese language.
4. Frame simple sentences in Japanese in order to handle everyday conversations
5. Write in basic Japanese about the topics closely related to the learner.

## Syllabus

1. Orientation about Japan, its language, and its culture
2. Communication Skills 1: Vocabulary for basic Japanese language
3. Practice sessions
4. Writing Skills 1: Reading and writing first script in Japanese
5. Practice sessions
6. Communication Skills 2: framing sentences
7. Practice sessions
8. Writing Skills 2: Write basic Japanese and practice

## Recommended reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Course Code	24HS02PR0105-05			
Category	Co-Curricular Activity			
Course Title	Art of Theatre			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

## Course Outcomes

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

1. Understand and synthesize the working of the prominent genres of theatre across the world.
2. Apply the skill of voice and speech in theatre and public speaking
3. Apply the art of acting and also develop generic skills such as confidence, communication skills, self-responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.
4. Apply the skills, acquired related to technical/production aspects of theatre and also develop problemsolving and interpersonal skills.

## Syllabus

1. Orientation in theatre
2. Voice and Speech training
3. Voice and Speech training: practice sessions
4. Art of acting
5. Art of acting: practice sessions
6. Art of script writing
7. Art of script writing: practice sessions
8. Final performances

## Reference books

1. Boleslavsky, R. (2022). Acting: The First Six Lessons (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). No Drama Just Theatre(1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., & Zigler, S. (1986). A Practical Handbook for the Actor (1st ed.). Vinatge Books New York.

Course Code	24HS02PR0105-06			
Category	Co-Curricular Activity			
Course Title	Introduction to French Language			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

## Course Outcomes

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

1. Demonstrate basic knowledge about France, the culture and similarities/differences between India and France
2. Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic French about themselves and others.
4. Develop ability to understand beginner level texts in French

## Syllabus

### List of Practicals

1. Orientation about France, the language, and culture
2. Communication Skills 1: Vocabulary building for everyday conversations
3. Practice sessions
4. Reading and writing Skills : Reading and writing simple text in French
5. Practice sessions
6. Communication Skills 2: listening comprehension
7. Practice sessions
8. Writing Skills: Write basic French and practice

### Recommended reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de Civilisation Françaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Course Code	24HS02PR0105-07			
Category	Co-Curricular Activity			
Course Title	Introduction to Spanish Language			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France
2. Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic Spanish about themselves and others.
4. Develop ability to read and understand beginner level texts in Spanish

### Syllabus

#### List of Practicals

1. Orientation about Spain, the language, and culture
2. Communication Skills 1: Vocabulary building for everyday conversations
3. Practice sessions
4. Reading and writing Skills: Reading and writing simple text in Spanish
6. Communication Skills 2: listening comprehension
7. Practice sessions
8. Writing Skills: Write basic Spanish and practice

#### Recommended reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas, Eva Garcia, Agustin Garmendia.
3. Chicos Chicas Libro del Alumno by María Ángeles Palomino

Course Code	24HS02PR0105-08			
Category	Co-Curricular Activity			
Course Title	Art of Painting			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Become familiar with the basic methods, techniques & tools of painting.
2. Train the eye and hand to develop sense of balance, proportion and rhythm.
3. Develop the ability to observe and render simple natural forms.
4. Enjoy the challenging and nuanced process of painting.

### Syllabus

1. Orientation in Painting tools & basics of lines, shapes, light, shadows and textures
2. The art of observation how to see shapes in drawing
3. Introduction Water color how to handle water paints
4. Introduction to acrylic color how to handle acrylic paints
5. Explore layering paint and capturing the quality of light with paint.
6. Create landscape painting
7. Create Abstract painting
8. Paint on Canvas (try to recreate any famous painting)

### Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine



Course Code	24HS02PR0105-09			
Category	Co-Curricular Activity			
Course Title	Art of Drawing			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Become familiar with the basic methods, techniques & tools of drawing.
2. Train the eye and hand to develop sense of balance, proportion and rhythm.
3. Develop the ability to observe and render simple natural forms.
4. Enjoy the challenging and nuanced process of drawing.

### Syllabus

1. Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures
2. The art of observation how to see shapes in drawing
3. One/two-point basic linear perspective
4. Nature drawing and landscapes
5. Gestalt principles of visual composition
6. Figure drawing: structure and proportions of human body
7. Gesture drawing: expression and compositions of human figures
8. Memory drawing: an exercise to combine the techniques learnt

### Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling

Course Code	24HS02PR0105-10			
Category	Co-Curricular Activity			
Course Title	Nature Camp			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	I

### Course Outcomes

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

1. Develop an affinity with nature by observing and understanding its marvels with guidance from experts
2. Develop an understanding of the challenges and solutions associated with nature and its conservation.

### Course content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Vidarbha region or Forest fringe villages or work with an NGO from Vidarbha region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, other wildlife etc)
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs
4. Man-animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department
5. Traditional practices in environment conservation – role of local communities and local NGOs

Course Code	24EE01TH0106/24EE01PR0106			
Category	Vocational and Skill Enhancement Course			
Course Title	Creativity Innovation and Design Thinking			
Scheme & Credits	L	P	Credit	Semester
	1	2	2	I

### 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. Cambridge University Press, 2002.

Course Code	24EE01TH0201/24EE01PR0201			
Category	Programme Core Course			
Course Title	CMOS Digital Circuit Design			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	II

### Course Outcomes

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

1. Acquire knowledge about various NMOS, PMOS and CMOS digital circuits and interconnects
2. Implement digital logic structure of various types
3. Estimate various performance metrics for digital circuits.
4. Analyse memory elements.
5. Analyse performance of moderately sized CMOS circuits by using modern tools to verify the functionality, timing, power and parasitics using schematic and/or layout simulation for a given technology.

### Syllabus

#### Module I: (8 Hours)

Overview of VLSI Design Methodology, Design Flow & hierarchy, Introduction to MOS Transistors, Threshold voltage, body effect, MOS device design equations, second order effects, MOS Models-Level-1, Level-2, Level-3.

#### Module II: (8 Hours)

Static Load MOS Inverters, CMOS Inverter: The Static Behavior, Switching threshold, Noise Margins, The Dynamic Behavior, Power, Energy, and Energy-Delay, the Tri State Inverter, Transmission Gate. CMOS fabrication process flow, N-well, P-well, Twin-tub process flow, Silicon on insulator, Latch-up, Layout design rules (DRC).

#### Module III: (7 Hours)

Circuit Characterization and Performance Estimation: Introduction, Resistance Estimation Capacitance Estimation, CMOS gate transistor sizing, Driving Large capacitive loads, Scaling of MOS transistors.

#### Module IV: (9 Hours)

Designing combinational logic gates in CMOS: Complementary CMOS, Ratioed Logic, Pass- Transistor Logic, Dynamic CMOS Design, Dynamic Logic: Basic Principles, Issues in Dynamic Design, Cascading of Dynamic Gates, Domino Logic.

#### Module V: (7 Hours)

Sequential logic design: Timing Metrics for Sequential Circuits, Classification of Memory Elements, Static Latches and Registers, Dynamic Latches and Registers

**Module VI: (6 Hours)**

Clocking Strategies, CMOS Sub-system design: SRAM, DRAM.

**Text Book**

1. Digital Integrated Circuits: A Design Perspective: J. Rabaey, 2nd edition PHI

**Reference Books**

1. CMOS VLSI Design: A circuits and systems perspective: N. Weste and K. Eshraghian, 2nd edition, PHI
2. CMOS Digital Integrated Circuits Analysis & Design: S M Kang, Yusuf Lalebici, 3rd edition TMH  
3. VLSI Design Technique for Analog and Digital Circuit: Randel Geiger, P Allen, N Strader, 2nd edition TMH
3. Introduction to VLSI System: Carver Mead, Lynn Conway, 1st edition Addison- Wesley
4. MOS Integrated Circuits- Theory, Fabrication, Design and System Applications of MOS LSI: William M. Penny, Lillian Lau, Van Nostrand Reihold Company. 1st edition
5. Basic VLSI Systems and Circuits: Douglas Pucknell and K. Eshraghian 3rd edition, PHI

## List of Experiments:

- 1) Evaluate the output characteristics for 1 $\mu$ m (long channel) and 50nm (short channel) technology N-channel and P-channel MOSFET by plotting the output characteristics.
- 2) Using SPICE, plot the transfer characteristics for the inverter seen in Fig.2 in both the long- and short-channel CMOS technology. From the plot, determine  $V_M$ ,  $V_{IL}$ ,  $V_{IH}$ ,  $V_{OH}$ , and  $V_{OL}$ . Calculate noise margin in both the cases. Use  $V_{DD}=5V$  for long channel devices and  $V_{DD}=1V$  for short channel devices. Comment on dynamic power consumption.

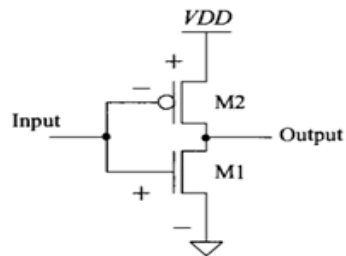


Fig.2

- 3) Investigate using SPICE and the long-channel CMOS process parameters supplied to you, the transfer curves for the CMOS inverter with trans-conductance ratios  $\beta_n/\beta_p$  3, 1, and 1/3. Explain what changing the ratio does to the transfer characteristics. Estimate and simulate the intrinsic propagation delays of inverter if short channel devices are used (PMOS: NMOS=2:1).
- 4) Draw the layout of inverter designed for equal rise and fall time and extract the layout and simulate the netlist in SPICE.
- 5) Design a buffer (Chain of Inverter) to drive the load capacitance with a minimum delay. You need to start the design from the minimum sized inverter. Load that needs to be driven is of 10 pF.
- 6) Implement D F/F. Define and estimate setup time for your design through SPICE simulation.
- 7) To design and simulate SRAM cell with sense amplifier circuit.
- 8) Design a Ring-Oscillator in 50nm CMOS technology. Study the effect of process variations on oscillation frequency.

Course Code	24HS03TH0212			
Category	Basic Science Course			
Course Title	Probability and Statistics			
Scheme & Credits	L	P	Credits	Semester
	3	0	3	II

Course

### Outcomes

On successful completion of the course, student shall be able to

1. Grasp the meaning of discrete and continuous random variables, probability distribution. Interpret the meaning of probabilities derived from distributions. This involves understanding what the calculated probabilities represent in practical terms and drawing conclusions from the results.
2. To analyze and interpret stochastic models, including calculating probabilities, transition probabilities, and steady-state probabilities within stochastic systems.
3. Grasp the fundamental concepts of curve fitting like regression techniques, model selection, and the use of different types of curves or functions to approximate data.
4. Understand the fundamental concept of hypothesis testing, including the null hypothesis (H<sub>0</sub>) and alternative hypothesis (H<sub>1</sub>), significance levels, p-values, and the basic logic behind hypothesis testing.
5. To apply MLE to various statistical models, such as linear regression, exponential distribution, etc. They should understand how to formulate likelihood functions and derive estimators for unknown parameters.

### Syllabus

#### **Module 1 (8 hours)**

Measure of central tendency, quartile, inter quartile range and outliers, Probability spaces, conditional probability, independence, Discrete random variables, Continuous random variables, Expectation and variances, Binomial distribution, Poisson distribution, Normal distribution and their applications.

#### **Module 2: ( 8 Lectures)**

Joint probability function, Introduction to stochastic process, random walk, stationary and auto regressive process, transition probability Matrix, Discrete time Markov chain and its applications in queueing problems.

#### **Module 3: (8 hours)**

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 and its application in analysis of data.

#### **Module 4: (8 Lectures)**

Sampling Distributions, Point and Interval Estimations, Testing of Hypothesis for single mean and proportion.

#### **Module 5: (7 Lectures):**

Testing of Hypothesis for difference of mean and proportion, Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes, maximum likelihood estimation

**Text Books:**

1. M R. Spiegel , Theory and Problems of probability and statistics :,2<sup>nd</sup>ed :,Schaum series
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

**Reference Books:**

1. Maurtis Kaptein, Statistics for data science, An introduction to probability, statistics and Data Analysis, Springer 2022.
2. Jay L Devore, Probability and Statistics for Engineering and sciences, 8<sup>th</sup> edition, Cenage learning.



Course Code	24EE01TH0202/24EE01PR0202			
Category	Programme Core Course			
Course Title	Digital System Design			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	II

### Course Outcomes

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

1. Utilize/Apply the knowledge of digital circuits to design basic combinational and sequential blocks and hierarchical implementation of digital systems
2. Make use of dataflow, structural and behavioral modelling styles of verilog HDL for simulating the combinational/sequential circuits and systems
3. Understand, design and analyse the functionality of digital systems
4. Modelling of FSM, Data path and control unit.
5. Use of EDA tools and FPGA development platform for digital system design, verification, testing and implementation.

### 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 (8 Hrs)

Gate level, Dataflow and Behavioral Modeling for combinational circuits like Multiplexer, Demultiplexer, 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 Zvonko Vranesic; McGraw Hill, 2nd Edition

### **Reference Books**

1. Digital Systems Design Using Verilog; Charles Roth, Lizy K. John, ByeongKil Lee; Cengage Learning 2nd Edition
2. A Verilog HDL Primer: J Bhaskar; Star Galaxy Publishing; 2<sup>nd</sup> Edition.

## List of Experiments

1. Design the following combinational circuits using Verilog HDL. Write a functional simulation test bench to test these designs. Generate all combinations of test inputs with a delay of 5 ns between the set of each test input. Observe the output in the console window.
  - a. Full adder using operators
  - b. Full adder using two Half adders
  - c. 4:1 Mux using 2:1 MuxSynthesize the design and count the number of LUT. Plan a pin constraint for any one design for implementation on FPGA.
2. Compare the designs of a 16 bit ripple carry adder circuit and carry select adder. Write a post implementation simulation test bench to test these designs. Generate random combinations of test inputs with a delay more than critical path delay between the set of each test input. Observe the output in the console window.

Synthesize the design and count the number of LUT. Find the critical path delay. Plan a pin constraint for any one design for implementation on FPGA.
3. Model the 4 bit counter with following specifications:
  - a. Reset synchronous to clock positive edge.
  - b. Counter has a 4 bit load terminal to count Up or down from this user loaded value.Write a test bench to test this design and implement it on FPGA.
4. Design a 4 bit sequence detector using verilog HDL. Write a test bench to test this design.
5. Create a Verilog RAM module with 8 bit wide data and 16 locations, initialize it with data, and perform a read operation to verify data retrieval. Find the average of the retrieved data in the console window.

Course Code	24EE01TH0203/24EE01PR0203			
Category	Engineering Science Course			
Course Title	Elements of IoT			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	II

#### Course Outcomes

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;

Module 1: Introduction to Internet of Everything, IoT Reference Model, Different IoT models, Elements in IoT Infrastructure

Module 2: 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 3: Perception Layer, Network Layer, Application Layer Architecture in IoT system

Module 4: Resources used at Perception Layer, Network Layer, Application Layer

Module 5: Use cases of IoT Systems builds across SAM IoT/ Arduino Nano IOT/ ESP32 / Node MCU/ PI-PICO H/W variants etc,

#### Text Book:

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

#### Reference Books:

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

## List of Experiments

The hands-on lab will be based on the following

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

Course Code	24EE01TH0204/24EE01PR0204			
Category	Programme Core Course			
Course Title	Object Oriented Programming			
Scheme & Credits	L	P	Credits	Semester
	3	2	4	II

## Course Outcomes

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

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. Utilize modern design tools and collection framework to solve real world problems

## Syllabus

### Module 1

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 2

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.

### Module 3

Creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

### Module 4

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 5

Generics, generic class with two type parameter, bounded generics. Collection classes: Array list, Linked List, Hash set, Tree set, Hash Map.

### Module 6

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, Inter Thread communications. Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns.

**Text Books**

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

## List of Experiments

1. Implement the Classes and Objects in Java.
2. Implement a program in java with Constructors and destructors. Also implement the concept of overloading.
3. Demonstrate use of Inheritance.
4. Implement a concept of Interface in Java.
5. Demonstrate use of Multi Thread.
6. Implement Packages and import that package in program.
7. Demonstrate use of Exception handling mechanism.
8. Apply concept of generics class and method.
9. Demonstrate collection framework and perform some basic operations on the Array List and Hashset.
10. Apply file handling concepts in Java.



Course Code	24EE01PR0205			
Category	Vocational and Skill Enhancement Course			
Course Title	Computer Workshop - II			
Scheme & Credits	L	P	Credits	Semester
	0	2	1	II

### Course Outcomes

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

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

### Practicals based on:

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

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

Processes, File Operations, Text Editors, User Environment, Manipulating Text, Network Operations.

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

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.

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.

Course Code	24HS02TH0201/24HS02PR0201			
Category	Ability Enhancement Course			
Course Title	English for Professional Communication			
Scheme & Credits	L	P	Credits	Semester
	2	2	3	II

## Course Outcomes

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

1. Demonstrate effective use of word power in written as well as oral communication.
2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.
3. Apply the principles of functional grammar in everyday as well as professional communication.
4. Effectively implement the comprehensive principles of written communication by applying various writing styles.
5. Create precise and accurate written communication products.

## Syllabus

### Module 1 Vocabulary Building

Importance of using appropriate vocabulary

Techniques of vocabulary development

Commonly used power verbs, power adjectives and power adverbs.

Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations

### Module 2 Listening and Reading Comprehension

Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening

Reading Comprehension: types and strategies.

### Module 3 Functional Grammar and Usage

Identifying Common Errors in use of: articles, prepositions, modifiers, modal auxiliaries, redundancies, and clichés

Tenses

Subject-verb agreement, noun-pronoun agreement

Voice

### Module 4 Writing Skills

Sentence Structures

Sentence Types  
Paragraph Writing: Principles, Techniques, and Styles

### **Module 5 Writing Practices**

Art of Condensation: Précis, Summary, and Note Making Correspondence writing techniques and etiquettes – academic writing ,Essay Writing

#### **Reference Books**

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

## **Course Outcomes**

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

1. Apply effective listening and speaking skills in professional and everyday conversations.
2. Demonstrate the techniques of effective Presentation Skills
3. Evaluate and apply the effective strategies for Group Discussions
4. Analyse and apply the effective strategies for Personal Interviews
5. Implement essential language skills- listening, speaking, reading, and writing

## **List of practicals**

### **Computer Assisted and Activity Based Language Learning**

1. Everyday Situations: Conversations and Dialogues – Speaking skills
2. Pronunciation, Intonation, Stress, and Rhythm
3. Everyday Situations: Conversations and Dialogues – Listening Skills

### **Activity Based Language Learning**

4. Presentation Skills: Orientation & Mock Session
5. Presentation Skills: Practice
6. Group Discussions: Orientation & Mock Session
7. Group Discussions: Practice
8. Personal Interviews: Orientation & Mock Session
9. Personal Interviews: Practice

Course Code	24HS02TH0205			
Category	Indian Knowledge System			
Course Title	Foundational Literature of Indian Civilization			
Scheme & Credits	L	P	Credits	Semester
	1	0	1	II

### Course Outcomes

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

1. Understand the Indian knowledge system and its scientific approach
2. Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus
3. Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools
4. Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

### Syllabus

#### Module 1 Overview of Indian Knowledge System

Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.

#### Module 2 The Vedic corpus

Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

#### Module 3 Indian Philosophical systems

Development and unique features, Vedic schools of philosophy, Samkhya and Yoga School of philosophy, Nyaya and Vaisheshika school of philosophy, Purva-mimamsa and Vedanta schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches

#### Module 4 Indian wisdom through ages

Panchatantras, Purans: contents and issues of interests, Itihasa: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: Kalidas, Vishakadutta, Bhavbhuti, Shudraka\* \*any one text as decided by the course teacher

#### Reference material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022
2. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984