ACADEMIC CURRICULUM
(REGULATION 2022)
FOR

UNDER GRADUATE PROGRAMMES
CHOICE BASED CREDIT SYSTEM
(Applicable to the students admitted from the Academic Year 2023 – 2024 onwards)

B. E – ELECTRONCIS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

B. E – ELECTRONCIS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

ABOUT THE DEPARTMENT

The Department of Electronics Engineering (VLSI Design and Technology), was established in the year 2023 with an intake of 60, is a four-year program to provide engineering graduates with comprehensive knowledge about integrated circuit designs, which is usually known as chip design. The program emphasizes the key aspects of software and hardware design and development for VLSI applications. The course material is intended to provide students with an in-depth understanding of semiconductor devices, VLSI circuit design and verification, FPGA design, and the fabrication process, in addition to providing hands-on experience with leading EDA (Electronic Design and Automation) tools. The curriculum is designed to prepare students for future industry-specific requirements. In addition, students have the opportunity to pursue flexible course work, participate in industrial internships, work on real-world projects, and receive hands-on experience with the machinery and procedures used in the fabrication of integrated circuits. The students completing this course will be readily employable in the semiconductor chip designing and fabrication industry.

VISION

The Department of Electronics Engineering (VLSI Design and Technology) supports the mission of the College by providing programs of the highest quality to produce world class engineers through teaching, research and service who can address challenges of the millennium and to be recognized by the society at large as an excellent department.

MISSION

MISSION 1: To provide an environment that encourages the graduates to excel in the field of VLSI design and verification with the best of their abilities.

MISSION 2: To create an academic eco-system that encourages the students towards start-up and entrepreneurship.

MISSION 3: To develop graduates who can perform research and transfer results into technology and products to meet the changing needs of the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

Bachelor of Electronics Engineering (VLSI Design and Technology) curriculum is designed to prepare the graduates having attitude and knowledge to

PEO1: Identify and apply appropriate Electronic Design Automation (EDA) to solve real world problems in VLSI domain to create innovative products and systems.

PEO2: Develop managerial skill and apply appropriate approaches in the domain of VLSI design incorporating safety, sustainability and become a successful professional or an entrepreneur in the domain.

PEO3: Pursue career in research in VLSI design domain through self-learning and self-directed on cutting edge technologies

PEO4: To demonstrate self – management and teamwork in a collaborative and multidisciplinary arena

PROGRAMME OUTCOMES (POs)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Acquire competency in areas of VLSI including IC Fabrication, Design, Testing, Verification and Integrate multiple sub-systems to develop System on Chip.

PSO2: Design, implement, analyse and interpretation of VLSI projects using CAD& EDA tools: Cadence-Spice, Xilinx ISE, MATLAB, Mentor graphics, micro wind, DSCH

.

B.E ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTER I – VIII
SEMESTER 1

S. No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
MANDATORY COURSE										
*	22IP100	Induction Programme	-	-	-	-	-	03 Weeks	0	-
THEORY COURSES										
1		Language Elective I	L+P	3	0	2	0	5	4	HSMC
2	22BST101	Basic Mathematics for Engineers	L	3	1	0	0	4	4	BSC
3	22BST102	Engineering Physics	L	3	0	0	0	3	3	BSC
4	22BST103	Engineering Chemistry	L	3	0	0	0	3	3	BSC
5	22EST101	Problem Solving and Python Programming	L	3	0	0	0	3	3	ESC
6	22HSM101	தமிழர் மரபு/ Heritage of Tamils	L	1	0	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
7	22EET101	Engineering and Professional Skills	L+P	1	0	2	0	3	2	EEC
PRACTICAL COURSES										
8	22ESP101	Problem Solving and Python Programming Laboratory	P	0	0	4	0	4	2	ESC
9	22BSP101	Physics and Chemistry Laboratory	P	0	0	4	0	4	2	BSC
EMPLOYABILITY ENHANCEMENT COURSE										
10	22EEP101	Product Tinkering Laboratory	P	0	0	2	0	2	1	EEC
			TOTAL	**16**	**01**	**16**	**00**	**33**	**25**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1		Language Elective II	L+P	3	0	2	0	5	4	HSMC
2	22BST203	Transforms and Numerical methods	L	3	1	0	0	4	4	BSC
3	22VLT201	Analog Electronic Circuits	L	3	0	0	0	3	3	PCC
4	22EST203	Basics of Electrical Engineering and Circuits	L	3	0	0	0	3	3	ESC
5	22EST202	Engineering Graphics	L+P	1	0	4	0	5	3	ESC
6	22HSM201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	L	1	0	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
7	22EET201	Innovation and Design Thinking*	L	2	0	0	0	2	2	EEC
PRACTICAL COURSES										
8	22ESP201	Engineering Product Laboratory	P	0	0	3	0	3	1.5	ESC
9	22VLP201	Analog Devices and Circuits Laboratory	P	0	0	3	0	3	1.5	PCC
10	22NXP201	NCC/NSS/YRC Credit Course Level – I #	-	1	0	0	0	1	1#	-
			TOTAL	**17**	**01**	**12**	**00**	**30**	**23**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

 # NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
***Common for all branches**

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22BST302	Probability and Random Process	L	3	1	0	0	4	4	BSC
2	22EST401	Environmental Sciences and Sustainability	L	2	0	0	0	2	2	ESC
3	22VLT301	Signal and Systems for VLSI	L	3	1	0	0	4	4	PCC
4	22ECT303	Digital Electronics	L	3	0	0	0	3	3	PCC
5	22VLT302	Introduction to CMOS VLSI	L	3	0	0	0	3	3	PCC
6	22HST301	Entrepreneurship and startups*	L	2	0	0	0	2	2	HSMC
PRACTICAL COURSES										
7	22VLP301	Signal and Systems for VLSI Laboratory	P	0	0	3	0	3	1.5	PCC
8	22ECP302	Digital Electronics Laboratory	P	0	0	3	0	3	1.5	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
9	22EEP301	Soft Skills*	P	0	0	2	0	2	1	EEC
			TOTAL	**16**	**2**	**8**	**0**	**26**	**22**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

*** Common to all branches**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22VLT401	Analog and Digital Communication	L	3	1	0	0	4	4	PCC
2	22ECT402	Linear Integrated Circuits and Applications	L	3	0	0	0	3	3	PCC
3	22VLT402	Digital Signal Processing	L+P	3	0	2	0	5	4	PCC
4	22VLT403	Introduction to Micro fabrication	L	3	0	0	0	3	3	PCC
5	22VLT404	Computer Architecture and Organization	L	3	0	0	0	3	3	PCC
PRACTICAL COURSES										
6	22ECP401	Linear Integrated Circuits Laboratory	P	0	0	3	0	3	1.5	PCC
7	22VLP401	Analog and Digital Communication Laboratory	P	0	0	3	0	3	1.5	PCC
8	22NXP401	NCC/NSS/YRC Credit Course Level-II #	-	1	0	0	0	1	1#	-
EMPLOYABILITY ENHANCEMENT COURSE										
9	22EEP401	Quantitative Aptitude and Logical Reasoning – I *	P	0	0	2	0	2	1	EEC
			TOTAL	**16**	**1**	**10**	**0**	**27**	**21**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
 # NCC Credit Course level II is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22VLT501	Microprocessors and Microcontrollers	L	3	0	0	0	3	3	PCC
2	22VLT502	Advanced Digital System Design with HDL	L	3	1	0	0	4	4	PCC
3		Management elective	L	3	0	0	0	3	3	HSMC
PROFESSIONAL ELECTIVE										
4		Professional Elective I	L	3	0	0	0	3	3	PEC
EMPLOYABILITY ENHANCEMENT COURSE										
5	22EET501	Engineering Economics and Financial Management*	L	3	0	0	0	3	3	EEC
MANDATORY COURSE										
6		Mandatory Course - I	L	3	0	0	0	3	0	MCC
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
7		Minor/ Honour/ Remedial class **	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES										
8	22VLP501	Microprocessors and Microcontrollers Laboratory	P	0	0	3	0	3	1.5	PCC
9	22VLP502	Advanced Digital System Design with HDL Laboratory	P	0	0	3	0	3	1.5	PCC
EMPLOYABILITY ENHANCEMENT COURSE-										
10	22EEP501	Internship*	P	0	0	0	0	0	1	EEC
			TOTAL	**21**	**1**	**6**	**0**	**28**	**20**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22VLT601	Static Timing Analysis	L	3	0	0	0	3	3	PCC
2	22VLT602	CAD for VLSI	L+P	3	0	2	0	5	4	PCC
3	22VLT603	Design for Testability	L	3	0	0	0	3	3	PCC
OPEN ELECTIVE										
4		Open Elective-I	L	3	0	0	0	3	3	OEC
PROFESSIONAL ELECTIVE										
5		Professional Elective - II	L	3	0	0	0	3	3	PEC
6		Professional Elective - III	L	3	0	0	0	3	3	PEC
MANDATORY COURSE										
7		Mandatory Course - II	L	3	0	0	0	3	0	MCC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
8		Minor/Honour/remedial class**		3	0	0	0	3	3**	PEC**
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
9	22EEP601	Quantitative Aptitude and Logical Reasoning – II *	P	0	0	2	0	2	1	EEC
10	22EEP602	Comprehensive Assessment*		0	0	2	0	2	1	EEC
PRACTICAL COURSES										
11	22VLP601	RTL Synthesis and Static Timing Analysis Laboratory	P	0	0	4	0	4	2	PCC
12	22NXP601	NCC/NSS/YRC Credit Course Level- III #	-	1	0	0	0	1	1#	-
			TOTAL	**25**	**0**	**10**	**0**	**35**	**23**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**
 # NCC Credit Course level III is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22VLT701	Low Power VLSI Design	L	3	1	0	0	4	4	PCC
OPEN ELECTIVE										
2		Open Elective-II	L	3	0	0	0	3	3	OEC
PROFESSIONAL ELECTIVE										
3		Professional Elective – IV	L	3	0	0	0	3	3	PEC
4		Professional Elective – V	L	3	0	0	0	3	3	PEC
5		Professional Elective – VI	L	3	0	0	0	3	3	PEC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
6		Minor/ Honour/ Remedial class **	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES										
7	22VLJ701	Mini Project	J	0	0	0	2	2	1	EEC
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
8	22EEP701	Product Design and Development *	P	0	0	0	4	4	2	EEC
9	22EEP702	Internship *	P	0	0	0	0	0	1	EEC
			TOTAL	**18**	**1**	**0**	**6**	**25**	**20**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**

SEMESTER VIII

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
1	22VLJ801	Project Work	J	0	0	0	16	16	8	EEC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
2		Minor/Honour/remedial class **	L	3	0	0	0	3	3**	PEC**
			TOTAL	**03**	**00**	**00**	**16**	**19**	**8**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

**** Common to all branches, selection from one minor vertical/approved honors subjects**

CREDIT DISTRIBUTION

Semester	HSMC	BSC	ESC	PCC	PEC	OEC	EEC	MC	TOTAL	Total PER %
I	5	12	5				3		25	15.5
II	5	4	7.5	4.5			2		23	14
III	2	4	2	13			1		22	13.5
IV				20			1		21	13
V	3			10	3		4		20	12.5
VI				12	6	3	2		23	14
VII				4	9	3	4		20	12.5
VIII							8		8	5
TOTAL	18	20	14.5	63.5	18	6	25		162	100

CATEGORY		Breakup of Credits	PER % in Total
HSMC	Humanities & Social Science Including Management	15	9
BSC	Basic Science Courses	20	12
ESC	Engineering Science Courses	14.5	9
PCC	Professional Core Courses	63.5	39
PEC	Professional Elective Courses	18	11
OEC	Open Elective Courses	6	4
EEC	Employment Enhancement Courses	25	15
MCC	Mandatory Courses	-	-
	Total Credits	162	100

PROFESSIONAL ELECTIVES COURSES: VERTICALS

VERTICAL I	VERTICAL II	VERTICAL III	VERTICAL IV	VERTICAL V	VERTICAL VI
Semiconductor Chip Design and Testing	**Multicore Implementation**	**Signal/Image Processing**	**RF Technologies**	**Embedded and IoT**	**Artificial Intelligence and Machine Learning**
Solid state Device Modelling	Multicore Architecture and Programming	VLSI Signal Processing	RF Transceivers	Distributed Embedded Computing	Foundation of Data science
RTL Synthesis	ASIC Design	Adaptive Signal Processing Techniques	RF System Design	Real Time Operating Systems	Nano Electronics
Validation and Testing Technology	Physical design	Image Processing	Signal Integrity for high Speed Design	Hardware and Software Co Design	Computational Intelligence
Analog IC Design	Power Management and Clock Distribution Circuits	Image Analysis and Computer Vision	EMI and EMC in System Design	Embedded Automotive systems	Introduction to Generative Artificial Intelligence
Mixed Signal IC Design Testing	System on Chip	Pattern Recognition and Machine Learning	RF IC Design	SoC Design for Embedded System	Robotics
Design verification methodologies	Network on Chip	FPGA	RF ID System Design and Testing	Industrial IoT and Industry 4.0	Drones and Autonomous Systems

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V, VI, and VII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI. The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulation.

VERTICAL I Semiconductor Chip Design and Testing								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22VLE001	Solid state Device Modelling	3	0	0	0	3	3
2	22VLE002	RTL Synthesis	3	0	0	0	3	3
3	22VLE003	Validation and Testing Technology	3	0	0	0	3	3
4	22ECE006	Analog IC Design	3	0	0	0	3	3
5	22ECE005	Mixed Signal IC Design Testing	3	0	0	0	3	3
6	22VLE004	Design verification methodologies	2	0	2	0	4	3

VERTICAL II Multicore Implementation								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22VLE005	Multicore Architecture and Programming	3	0	0	0	3	3
2	22VLE006	ASIC Design	3	0	0	0	3	3
3	22VLE007	Physical design	3	0	0	0	3	3
4	22VLE008	Power Management and clock Distribution Circuits	3	0	0	0	3	3
5	22VLE009	System on Chip	3	0	0	0	3	3
6	22VLE010	Network on Chip	3	0	0	0	3	3

VERTICAL III Signal / Image Processing								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22VLE011	VLSI Signal Processing	3	0	0	0	3	3
2	22VLE012	Adaptive Signal Processing Techniques	3	0	0	0	3	3
3	22ECE008	Image Processing	3	0	0	0	3	3
4	22VLE013	Image Analysis and Computer Vision	3	0	0	0	3	3
5	22VLE014	Pattern Recognition and Machine Learning	3	0	0	0	3	3
6	22VLE015	FPGA	3	0	0	0	3	3

VERTICAL IV RF Technologies								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22ECE013	RF Transceivers	3	0	0	0	3	3
2	22VLE016	RF System Design	3	0	0	0	3	3
3	22VLE017	Signal Integrity for high Speed Design	3	0	0	0	3	3
4	22VLE018	EMI and EMC in System Design	3	0	0	0	3	3
5	22VLE019	RF IC Design	3	0	0	0	3	3
6	22ECE018	RF ID System Design and Testing	2	0	2	0	4	3

VERTICAL V Embedded and IoT								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22VLE020	Distributed Embedded Computing	3	0	0	0	3	3
2	22VLE021	Real Time Operating Systems	3	0	0	0	3	3
3	22VLE022	Hardware and Software Co Design	3	0	0	0	3	3
4	22VLE023	Embedded Automotive systems	3	0	0	0	3	3
5	22VLE024	SoC Design for Embedded System	3	0	0	0	3	3
6	22ECE028	Industrial IoT and Industry 4.0	3	0	0	0	3	3

VERTICAL VI Artificial Intelligence and Machine Learning								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22CST401	Foundation of Data science	3	0	0	0	3	3
2	22VLE026	Nano Electronics	3	0	0	0	3	3
3	22VLE027	Computational Intelligence	3	0	0	0	3	3
4	22VLE028	Introduction to Generative Artificial Intelligence	2	0	2	0	4	3
5	22VLE029	Robotics	3	0	0	0	3	3
6	22VLE030	Drones and Autonomous Systems	3	0	0	0	3	3

ELECTIVE – MANAGEMENT (Semester V)								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22EMT001	Principles of Management	3	0	0	0	3	3
2	22EMT002	Total Quality Management	3	0	0	0	3	3
3	22EMT003	Engineering Economics and Financial Accounting	3	0	0	0	3	3
4	22EMT004	Human Resource Management	3	0	0	0	3	3
5	22EMT005	Knowledge Management	3	0	0	0	3	3
6	22EMT006	Industrial Management	3	0	0	0	3	3

MANDATORY COURSE I								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22MCT001	Introduction to Women and Gender Studies	3	0	0	0	3	0
2	22 MCT002	Elements of Literature	3	0	0	0	3	0
3	22 MCT003	Film Appreciation	3	0	0	0	3	0
4	22MCT004	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	0	0	0	3	0
5	22MCT005	Indian Constitution	3	0	0	0	3	0
6	22MCT006	Industrial Safety	3	0	0	0	3	0

MANDATORY COURSE II								
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22 MCT007	Ethics and Values	3	0	0	0	3	0
2	22 MCT008	History of Science and Technology in India	3	0	0	0	3	0
3	22MCT009	Political and Economic Thought for a Humane Society	3	0	0	0	3	0
4	22MCT010	State, Nation Building and Politics in India	3	0	0	0	3	0
5	22MCT011	Disaster Management	3	0	0	0	3	0

LANGUAGE ELECTIVE (SEMESTER II)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22LET101	Japanese Language Level I	3	0	2	0	5	4
2	22LET102	French Language Level I	3	0	2	0	5	4
3	22LET103	German Language Level I	3	0	2	0	5	4
4	22HST101	Professional English	3	0	2	0	5	4

LANGUAGE ELECTIVE (SEMESTER II)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22LET201	Functional English	3	0	2	0	5	4
2	22LET202	French Language Level II	3	0	2	0	5	4
3	22LET203	German Language Level II	3	0	2	0	5	4
4	22LET205	Japanese Language Level II	3	0	2	0	5	4

SEMESTER I

Course Code	Course Title	L	T	P	J	C
22BST101	BASIC MATHEMATICS FOR ENGINEERS	3	1	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To develop the use of matrix algebra techniques that are needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize the student with functions of several variables. This is needed in many branches of engineering.
4. To make the students understand various techniques of integration and its applications.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

COURSE OUTCOME:

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

1. Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

UNIT-1	MATRICES	9+3 HOURS

Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT-2	DIFFERENTIAL CALCULUS	9+3 HOURS

Representation of functions - Limit of a function- Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Logarithmic differentiation - Maxima and Minima of functions of one variable.

UNIT-3	FUNCTIONS OF SEVERAL VARIABLES	9+3 HOURS

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT-4	INTEGRAL CALCULUS	9+3 HOURS

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals -

Applications: Hydrostatic force and pressure, moments and centres of mass.		
UNIT-5	**MULTIPLE INTEGRALS**	**9+3 HOURS**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia.		
	TOTAL LECTURE AND TUTORIAL HOURS:	**45+15 HOURS**

TEXT BOOK(S):

1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons,10th Edition, New Delhi, 2016.
2.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi,44th Edition , 2018.
3.	James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

1.	Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain . R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus", 14th Edition, Pearson India, 2018.

Course Code	Course Title	L	T	P	J	C
22BST102	ENGINEERING PHYSICS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To make the students effectively achieve an understanding of mechanics.
2. To enable the students to gain knowledge of electromagnetic waves and its applications.

3. To introduce the basics of oscillations, optics and lasers.
4. Equipping the students to successfully understand the importance of quantum physics.
5. To motivate the students towards the applications of quantum mechanics.

COURSE OUTCOME:

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

1. Understand the importance of mechanics.
2. Express their knowledge in electromagnetic waves.
3. Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
4. Understand the importance of quantum physics.
5. Comprehend and apply quantum mechanical principles towards the formation of energy bands

UNIT-1	**MECHANICS**	**9 HOURS**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - MI of a diatomic molecule - theorems of MI –moment of inertia of continuous bodies –- torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule.

UNIT-2	**ELECTROMAGNETIC WAVES**	**9 HOURS**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure – basic introduction to Satellite Communication (qualitative treatment)

UNIT-3	**OSCILLATIONS, OPTICS AND LASERS**	**9 HOURS**

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave -– interference–Michelson interferometer – Theory of laser – characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT-4	**BASIC QUANTUM MECHANICS**	**9 HOURS**

Photons and light waves - Electrons and matter waves – Photoelectric effect - The Schrodinger equation (Time dependent and time independent forms) - interpretation of wave function –Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes-Normalization and probabilities – Bohr's correspondence principle (concept only).

UNIT-5	**APPLIED QUANTUM MECHANICS**	**9 HOURS**

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunnelling (qualitative)- Tunnelling microscope - Resonant diode – Principle of quantum superposition – concept of quantum entanglement – concepts of quantum communication and quantum teleportation	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):	
1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
REFERENCE BOOKS:	
1.	R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer- Verlag, 2012.

Course Code	Course Title	L	T	P	J	C
22BST103	ENGINEERING CHEMISTRY	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To inculcate a sound understanding of water quality parameters and water treatment techniques.
2. To impart knowledge on the basic principles and preparatory methods of nanomaterials.
3. To introduce the different polymers and composites for engineering applications.
4. To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5. To familiarize the students with the operating principles, working processes and applications of storage devices and computational chemistry that are essential for chemistry.

COURSE OUTCOME:

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

1. To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
2. To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. To analyse the properties of different polymers and distinguish the polymers which can be degraded and demonstrate their usefulness and composites for material selection requirements.
4. To recommend suitable fuels for engineering processes and applications.
5. To solve chemical problems by simulating chemical systems (molecular, biological, materials) in order to provide reliable, accurate and comprehensive information at an atomic level.

Unit-1	**WATER AND ITS TREATMENT**	9 hours

Water: Sources and impurities, Requirements of portable water, Desalination of brackish water: Reverse Osmosis. Requirements of water for industrial use, Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment -Ion exchange demineralization and zeolite process. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination).

UNIT-2	**NANOCHEMISTRY**	**9 HOURS**

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT-3	**POLYMERS AND COMPOSITES**	**9 HOURS**

Definition of biodegradable polymers- Classification of biodegradable

Polymers – Advantages, conducting polymers-polyaniline, polyacetylene, recycling of e-plastic waste (waste to wealth).

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer, matrix, metal matrix and ceramic matrix) and Reinforcement (fibre, particulates, flakes and whiskers). Properties and applications of Metal matrix composites (MMC),

Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		
UNIT-4	**FUELS AND COMBUSTION**	**9 HOURS**
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel, Knocking - octane number, diesel oil-cetane number; Power alcohol and biodiesel. Combustion of fuels: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT Method. CO2 emission and carbon footprint.		
UNIT-5	**COMPUTATIONAL CHEMISTRY AND STORAGE DEVICES**	**9 HOURS**
Computational chemistry-molecular dynamics and chemical reactivity. Cheminformatics and Green IOT in biomedical applications, Artificial intelligence and machine learning methods to predict physicochemical properties. Batteries: a brief introduction to electrochemical cell (Daniel cell), Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; battery used in Electric vehicles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):

1.	P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition.

REFERENCE BOOKS:

1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Textbook of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4.	Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

Course Code	Course Title	L	T	P	J	C
22EST101	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To understand the basics of algorithmic problem solving.
2. To learn to solve problems using Python conditionals and loops.
3. To define Python functions and use function calls to solve problems.
4. To use Python data structures - lists, tuples, dictionaries to represent complex data.
5. To do input/output with files in Python.

COURSE OUTCOME:

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

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Write simple Python programs using conditionals and loops for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries etc.
6. Read and write data from/to files in Python programs.

UNIT-1	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9 HOURS

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT-2	DATA TYPES, EXPRESSIONS, STATEMENTS	9 HOURS

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT-3	CONTROL FLOW, FUNCTIONS, STRINGS	9 HOURS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
UNIT-4	**LISTS, TUPLES, DICTIONARIES**	**9 HOURS**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.		
UNIT-5	**FILES, MODULES, PACKAGES**	**9 HOURS**
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.	
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017	
REFERENCE BOOKS:		
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition,2021.	
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.	
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021	
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.	
5.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.	

Course Code	Course Title	L	T	P	J	C
22HSM101	தமிழர் மரபு/ HERITAGE OF TAMILS	1	0	0	0	1
Pre-requisite		Syllabus version		v. 1.0		

Unit-1	LANGUAGE AND LITERATURE	03 hours

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Unit-2	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	03 hours

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

Unit-3	FOLK AND MARTIAL ARTS	03 hours

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Unit-4	THINAI CONCEPT OF TAMILS	03 hours

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

Unit-5	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	03 hours

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

Total Lecture hours:	15 hours

TEXT BOOK(S)

1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram

REFERENCE BOOKS

1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Course Code	Course Title	L	T	P	J	C
22EET101	ENGINEERING AND PROFESSIONAL SKILLS	1	0	2	0	2
		Syllabus Version		v. 1.0		

COURSE OBJECTIVES: After studying this course, you should be able to:

1.Understand the characteristics of 'engineering' and the quality engineers have played in shaping engineering up to the present and into the future

2.Understand a range of principles in science, mathematics, and engineering in order to make well-founded decisions as part of a design process

3.To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the present ability and overall utility value of content

4.To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered

5.To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, present ability, aesthetics, using mediaelements and enhance the overall quality of presentations

COURSE OUTCOME: After completion of this course, the students should be able to

1.Understand the basic knowledge in evolution of engineering

2.Understand the basic knowledge in Engineering approach

3.Use the MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements

4.Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

5.Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

UNIT-I	EVOLUTION OF ENGINEERING	6 HOURS

Evolution of Engineering: Description of Engineering, Early stages of Engineering, Outline of Ancient Engineering, Case studies of historic engineers.

Introduction to Engineering Career: Engineering as a career and common qualities of employable engineers History of Engineering Domains Impact of engineering on society. Roles of Engineers and Career Paths.

UNIT-II	ENGINEERING APPROACH	6 HOURS

Introduction, problem statement: Detailing Customer Requirements, Setting Objectives, Identifying Constraints, Establishing Functions, generating solution Alternatives and Choosing a solution.

Steps in problem-solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. seven steps in solving engineering problems, reverse engineering, forward engineering, concurrent engineering,
and Value Engineering.

UNIT-III	MS WORD	6 HOURS

Create and format a document, Working with tables, Working with Bullets and Lists, Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools, Creating and Using document templates, Inserting equations, symbols and special characters, Working with Table of contents and References, citations Insert and review comments, Create bookmarks, hyperlinks, endnotes footnote, Viewing document in different modes, Working with document protection and security, Inspect document for accessibility.

UNIT-IV	MS EXCEL	6 HOURS

Create worksheets, insert and format data, Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae, Create and Work with different types of charts, Use pivot tables to summarizeand analyse data, Perform data analysis using own formulae and functions, Combine data from multiple worksheets using own formulae and built-in functions to generate results, Export data
and sheets to other file formats, Working with macros, Protecting data and Securing the workbook

UNIT-V	MS POWERPOINT	6 HOURS

Hours Select slide templates, layout and themes, Formatting slide content and using bullets and numbering, Insert and format images, smart art, tables, charts Using Slide master, notes and handout master, Working with animation and transitions, Organize and Group slides Import or create and use media objects: audio, video, animation, Perform slideshow recording and Record narration and create presentable videos.

TOTAL LECTURE HOURS:	**30 HOURS**

LIST OF EXPERIMENTS

1. Create a Bio – Data by using MS-Word.
2. Create a Time Table by using MS-Word.
3. Create an Agenda by using MS-Word.
4. Create a mail merge by using MS-Word.
5. Create a Piechart by using MS-Word.
6. Paragraph Formatting, Line Spacing And Sorting, Bullets And Numbering
7. Create an Interactive form in MS-Word
8. Create a Resume by using MS-Word templates.
9. Calculate student mark details by using MS-Excel.

10. Create an employee work details list by using MS-Excel.
11. Create two types of charts by using MS-Excel.
12. Create a presentation using MS POWERPOINT.
13. Create an advertisement by using PowerPoint presentation
14. Create an organization chart by using PowerPoint.
15. Create an organization chart for college results by using MS PowerPoint templates.
16. Create an advertisement for TV channel by using Power Point.

TEXT BOOK(S):

1. Remesh S., Vishnu R. G., Life Skills for Engineers, Ridhima Publications, 1stEdition,2016.
2. Barun K. Mitra, Personality Development & Soft Skills, Oxford Publishers, Third impression, 2017.
3. Dorothy House, Microsoft Word, Excel, and PowerPoint: Just for Beginners, Import, 29

REFERENCE BOOKS:

1. Paul H .Wright, Introduction to Engineering, School of Civil and Environmental Engineering, 3rd Edition, John Wiley & Sons, Inc,

Course Code	Course Title	L	T	P	J	C
22ESP101	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	0	0	4	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To understand the problem-solving approaches.
2. To learn the basic programming constructs in Python.
3. To practice various computing strategies for Python-based solutions to real world problems.
4. To use Python data structures - lists, tuples, dictionaries.
5. To do input/output with files in Python.

COURSE OUTCOME:

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

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute simple Python programs.
3. Implement programs in Python using conditionals and loops for solving problems. Deploy functions to decompose a Python program.
4. Process compound data using Python data structures.
5. Utilize Python packages in developing software applications.

LIST OF EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern) Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL LECTURE HOURS:	**60 HOURS**

Course Code	Course Title	L	T	P	J	C
22BSP101	**PHYSICS AND CHEMISTRY LABORATORY**	**0**	**0**	**4**	**0**	**2**
		Syllabus version			v. 1.0	

PHYSICS LABORATORY
(Any Seven Experiments)

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To learn the proper use of various kinds of physics laboratory equipment.
2. To learn how data can be collected, presented and interpreted in a clear and concise manner.
3. To learn problem solving skills related to physics principles and interpretation of experimental data.
4. To determine error in experimental measurements and techniques used to minimize such error.
5. To make the student an active participant in each part of all lab exercises..

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Understand the functioning of various physics laboratory equipment.
2. Use graphical models to analyze laboratory data.
3. Use mathematical models as a medium for quantitative reasoning and describing physical reality.
4. Access, process and analyze scientific information.
5. Solve problems individually and collaboratively.

LIST OF EXPERIMENTS:

1.Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL LECTURE HOURS:	**30 HOURS**

Course Code	Course Title	L	T	P	J	C
22BSP101	**PHYSICS AND CHEMISTRY LABORATORY**	**0**	**0**	**4**	**0**	**2**
		Syllabus version			v. 1.0	

CHEMISTRY LABORATORY

(Any seven experiments to be conducted)

COURSE OBJECTIVES:

After studying this course, you should be able to:

1.To impart practical skills in the estimation of water quality parameters by volumetry and gravimetry.
2.To familiarize the students with the estimation of impurities in aqueous solutions through electro-analytical techniques such as pH metre, potentiometry and conductometry.
3.To demonstrate the analysis of metals by UV-Visible spectroscopy.

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. To independently estimate the water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, chloride and copper contents by appropriate wet chemical analyses.
2. To quantitatively analyze the impurities in aqueous solution by electroanalytical techniques.
3. To determine the amount of metal ions in aqueous samples by spectroscopic techniques.

LIST OF EXPERIMENTS:

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of TDS of a water sample by gravimetry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Determination of strength of acids in a mixture of acids using conductivity meter.
9. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
10. Estimation of iron content of the given solution using potentiometer.
11. Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline / thiocyanate method).

Total Lecture hours:	**30 HOURS**

Course Code	Course Title	L	T	P	J	C
22EEP101	**PRODUCT TINKERING LABORATORY**	**0**	**0**	**2**	**0**	**1**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Hands on practical training, maintenance and troubleshooting on mechanical and electrical appliances in day-to-day life.
2. Analyze single phase and three phase residential building wiring (Energy meter, fuse, earthing)
3. Understand the internal structure and layout of the computer system.
4. Learn to diagnose minor problems with the computer functioning.
5. Know the proper usage and threats of the world wide web.

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Students will able to understand domestic wiring procedures practically.

2. Students are capable of assembling a personal computer, and can perform installation of system software like MS Windows and required device drivers.

3. Students can detect and perform minor hardware and software level troubleshooting.

4. Capacity to work on Internet & World Wide Web and make effective usage of the internet for academics.

LIST OF EXPERIMENTS:

1. **MECHANICAL EQUIPMENT STUDY**

(a) Hand drilling machine, Screw Jack and centrifugal pump

(b) Two wheeler, Refrigeration and Air Conditioning system.

2. **ELECTRICAL EQUIPMENT STUDY**

Light fittings, LED, Stabilizer, UPS, Iron box, calling bell, Fan regulator

3. ELECTRONIC EQUIPMENT STUDY

a) Study the elements of a smart phone.

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

4. COMPUTER PERIPHERALS STUDY

PC HARDWARE Identification of the peripherals of a computer, components in a CPU and its functions. Block diagram of the CPU along with the configuration of each peripheral. Functions of Motherboard. Assembling and Disassembling of PC. System Software and application software installation.

5. BIOMEDICAL EQUIPMENT

a) Assembly and dismantle of Electrocardiogram (ECG)

b) Assembly and dismantle of ventilator.

c) Assembly and dismantle of Doppler Ultra sound Scanner.

TROUBLESHOOTING

Hardware Troubleshooting: Students are to be given a PC which does not boot due to proper assembly or defective peripherals and the students should be taught to identify and correct the problem.

Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

Internet: Web Browsers, Access of websites, Surfing the Web, Search Engines, Customization of web browsers, proxy settings, bookmarks, search toolbars, pop-up blockers. Antivirus downloads, Protection from various threats.

TOTAL LECTURE HOURS:	**30 HOURS**

LANGUAGE ELECTIVE I

Course Code	Course Title	L	T	P	J	C
22LET101	JAPANESE LEVEL I	3	0	2	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To train the students to learn basic Japanese including three writing systems
2. To teach them to learn basic grammar and vocabulary
3. To train them to converse in Japanese in day-to-day scenarios.

COURSE OUTCOME:

Upon completion of the course, the student will be able to

CO1: Acquire familiarity in all 3 Japanese alphabet & basic vocabulary (Understand) CO2: Listen and identify individual sounds of Japanese (Understand)

CO3: Use basic sounds and words while speaking (Apply)

CO4: Read and understand simple advertisements, brochures and invitations (Apply)

CO5: Use basic grammar and appropriate vocabulary in completing language tasks (Apply)

UNIT-1	INTRODUCTION TO JAPANESE	9 HOURS

Japanese written system - Japanese sounds - Hiragana (あ、い、う、え、お…) -Hiragana variations - Katakana - Katakana variations-Exchange greetings - Recognise Japanese characters.

UNIT-2	MYSELF	9 HOURS

Countries - Languages - Occupations - Self-introduction - Family - People - Numbers - My family - wa…desu - mo particle- to particle - ni particle - no particle.

UNIT-3	FOOD	9 HOURS

Food - Drinks - 7 Kanji - Food for lunch - Eating places - ga suki desu - sukijanai - o particle - de particle - My breakfast - My lunch.

UNIT-4	HOME	9 HOURS

Home - Furniture - 4 kanjis - Places to visit nearby - Rooms - Things in the room - ni + ga + arimasu- ni + ga + imasu - general counter - My home - My room

UNIT-5	DAILY LIFE	9 HOURS

Daily routines - Time - 10 kanjis - Free-time activities - Places - Calendar - telling time - ni particle - kara… made… - time expression - ii adjective.	
Total Lecture hours:	**45 hours**
TEXT BOOK(S)	
1.	独立行政法人国際交流基金, 来嶋, 柴原 & 八田. Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Competences / まるごと 日本のことばと文化 入門 A1 りかい 2023.
REFERENCE BOOKS	
1.	Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers, and Distributors Pvt. Ltd., Delhi, 2007.
2.	Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers, and Distributors Pvt. Ltd., Delhi, 2007.
3.	www.japaneselifestyle.com
4.	www.learn-japanese.info/
5.	www.kanjisite.com/ & www.learn-hiragana-katakana.com/typing-hiragana-characters/

LIST OF EXPERIMENTS :
1. Give a simple self introduction
2. Tell someone about your family, using a family photo
3. Talk about your favorite foods
4. Offer someone a drink
5. Talk about your breakfast
6. Say what your favorite dish is
7. Order food and drinks at a hamburger shop
8. Say what kind of home you live in
9. Say what you have in your home
10. Write an E-mail inviting someone to your home
11. Talk about your daily routine
12. Write a birthday card

Course Code	Course Title	L	T	P	J	C
22LET102	FRENCH LEVEL I	3	0	2	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To acquire an understanding of basic French language parts of speech
2. To facilitate learner's ability to learn the French language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

COURSE OUTCOME:

1. Read and write technical basic French language parts of speech
2. Speak appropriately learner's ability to learn the French language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

UNIT-1	INTRODUCTION TO THE FRENCH LANGUAGE	12 Hours

Découvrir la langue française - Identifier la langue - Les lettres de l'alpahbet - Se presenter, presenter quelqu'un - Les nationalités - Les nombres 0-60

UNIT-2	GRAMMAR OF COMMUNICATION	12 HOURS

Les articles définis et indéfinis - Les prépositions des pays - Les verbes – 1er groupe - Les verbes irréguliers- être, avoir, aller, venir, faire, vouloir, pouvoir, devoir, savoir, prendre - Les adjectifs interrogatifs - Les adjectifs possessifs - Les articles contractés - Les prépositions de lieu

- Les verbes pronominaux - Le pronom « on »

UNIT-3	SENTENCE STRUCTURE	12 HOURS

Raconter et reporter-donner son avis - Futur simple, pronomcomplètementd'objet direct, passé compose - plusieursrégion de France, imparfait, pronom y/en, imparfait

UNIT-4	ACTIVE AND COMMUNICATIVE ASPECTS	12 HOURS

- Proposing a party/ visit a place
- Inviting/accepting an invitation/refusing an invitation
- Exprimerl'accord/désaccord (to express an agreement / disagreement)
- Rapporter les paroles (reported speech)
- Organiser/faire un projet de sortie (to organize/ to do a trip)

UNIT-5	FRENCH CULTURE AND CIVILISATION	12 HOURS

- Les familles françaises - Presentation of a city and its monuments - Introduction to the geography of France - Festivals and events of France - The French school calendar + les horairesfrançaises - Les reseauxsociaux - Les villesen France	
Total Lecture hours:	45 hours
TEXT BOOK(S)	
1.	Méthode de français A1, Jacky Girardet et al, CLE International
2.	Christine Andantétal "À propos (livre de l'élève", LANGER., NEW DELHI,2012
REFERENCE BOOKS	
1.	Michael D. Oates "Entre Amis: An Interactive Approach", 5 th Edition, Houghton Mifflin., 2005
2.	Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French"
3.	Simone Renaud, Dominique van Hooff "En bonne forme

Course Code	Course Title	L	T	P	J	C
22LET103	GERMAN LANGUAGE LEVEL I	3	0	2	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To train the students to learn basic German
2. To teach them to learn basic grammar and vocabulary.
3. To train them to converse in German in day-to-day scenarios

COURSE OUTCOME:

After the course, the students will be able to:

1. help students acquire familiarity in the German alphabet & basic vocabulary
2. listen and identify individual sounds of German
3. use basic sounds and words while speaking

UNIT-1	INTRODUCTION TO GERMANY AND ITS REGIONS –GERMAN BASIC PHRASES, ALPHABETS, NUMBERS, COUNTRIES AND NATIONALITY	12 HOURS

Grammaire – Verbs – sein, haben, definite and indefinite articles
Communication – Greetings, Self-Introduction

UNIT-2	**BASIC VOCABULARY, COLOURS, MONTHS AND DAYS**	**12 HOURS**
Grammaire - Verbes - Conjugation: Present tense (regular verbs) – Adjective possessive Communication – Talk about family and friends, date, time etc		
UNIT-3	**HOBBIES, INTERESTS AND DAILY ROUTINE**	**12 HOURS**
Grammaire – Irregular verbs Communication – Talking about hobbies and interests.		
UNIT-4	**VOCABULARY OF PLACES AND TRANSPORT**	**12 HOURS**
Grammaire – Cases, adjective demonstrative, past tense, propositions Communication – Narrating an incident or story		
UNIT-5	**VOCABULARY OF FOOD, SERVICES, MONEY**	**12 HOURS**
Grammaire – Negation, Verbs – kaufen, essen, bezahlen Communication – Accept andrefuse an invitation, situation in a restaurant		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)	
1.	Mit ErfogZum Goethe-Zertifikat A1
REFERENCE BOOKS	
1.	Studio d - Deutsch alsFremdsprache - Grundstufe - A1
2.	Fit Fur Goethe-Zertifikat A1 (Start Deutsch 1)
SOFTWARE	
1.	All internet tools

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22HST101	**PROFESSIONAL ENGLISH**	**3**	**0**	**2**	**0**	**4**
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. Provide learners with basic vocabulary and grammar to recognize and use in real time Contexts
2. Improve communicative competence
3. Help use the language effectively in academic /work contexts
4. Build language skills by engaging in listening, speaking, vocabulary and grammar learning activities relevant to authentic contexts
5. Develop the ability to read and write complex texts, summaries, articles, blogs, definitions, essays, and user manuals

COURSE OUTCOME:

After the completion of this course, the students should be able to 1. Become accustomed to the basic vocabulary and grammar 2. Listen and comprehend complex academic texts 3. Read and infer the denotative and connotative meanings of technical texts 4. Write definitions, descriptions, narrations, and essays on various topics 5. Speak fluently and accurately in formal and informal communicative contexts		
UNIT-1	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**	**9 HOURS**
Reading – Newspaper- sports/health; technical Brochures Writing – Professional emails; Formal letters Grammar – Word formation, Parts of speech, Framing questions Vocabulary – Synonyms and Antonyms, One-word substitution, Abbreviations and Acronyms		
UNIT-2	**NARRATION AND SUMMATION**	**9 HOURS**
Reading – Biographies/ Travelogues Writing - Guided writing- Paragraph; Short Report on an event (field trip etc.) Grammar – Tenses; Subject-Verb Agreement; Prepositions Vocabulary – Narrative vocabulary; Phrasal verbs		
UNIT-3	**DESCRIPTION OF A PROCESS / PRODUCT**	**9 HOURS**
Reading – Gadget reviews; Advertisements Writing - Product description, Process description; Instruction writing Grammar – Imperatives; Degrees of comparison Vocabulary – Compound words; Homonyms, homophones; discourse markers- Connectives and Sequence words		
UNIT-4	**CLASSIFICATION AND RECOMMENDATIONS**	**9 HOURS**
Reading – Newspaper articles; journal reports Writing – Note-making; Interpretation of charts; Recommendations Grammar – Articles; Modal verbs Vocabulary - Collocations; Fixed / Semi fixed expressions.		
UNIT-5	**EXPRESSION**	**9 HOURS**
Reading – Editorials; opinion blogs Writing – Reports – Accident & Survey; Business letters Grammar – Punctuation; Negations; Simple, Complex and Compound sentences Vocabulary - Cause & Effect Expressions; Content vs Function words		
TOTAL HOURS:		**45 HOURS**
TEXT BOOK(S):		
1.	Hewings, Martin Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition	
2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.	
REFERENCE BOOKS:		
1.	Ian wood, Anne Williams with Anna Cowper, “Pass Cambridge BEC Preliminary”, 2nd edition, Cengage Learning, 2015.	
2.	Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta	

	Sharma, Oxford Univ. Press, 2016, New Delhi.
3.	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd
4.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.

LIST OF EXPERIMENTS:
1. Listening to introductions of successful people
2. Self-Introduction and introducing a friend
3. Listening and filling out a form
4. Narrating a story using hints
5. Listening to telephone conversation
6. Telephonic Interview- Role play
7. Listening to podcasts, anecdotes/event narration
8. Narrating personal experiences/ events
9. Listening to celebrity interviews
10. Conversation Skills- Politeness strategies
11. Listening to process descriptions
12. Describing a process
13. Listening to travelogues
14. Narrating travel experiences
15. Listening to educational videos
16. Group discussion
17. Listening to TED Talks
18. Mini Presentations
19. Listening to description of art work
20. Picture description
21. Listening to scientific lectures
23. Listening to definitions/ descriptions of objects
24. One-minute speech - Describing an object
26. Anchoring a reality show
27. Listening to advertisements
28. Adzap
29. Listening to autobiography
30. Visume
TOTAL HOURS: 45 HOURS

SEMESTER II

Course Code	Course Title	L	T	P	J	C
22BST203	TRANSFORMS AND NUMERICAL METHODS	3	1	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Apply the concept of testing of hypothesis for small and large samples in real life problems.
2. Apply the basic concepts of classifications of design of experiments in the field of agriculture.
3. Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
4. Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
5. Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

UNIT-1	FOURIER SERIES	9+3 HOURS

Dirichlet's conditions — General Fourier series — Odd and even functions — Half range sine series — Half range cosine series — Parseval's identity — Harmonic analysis.

UNIT-2	FOURIER TRANSFORMS	9+3 HOURS

Fourier transform pair — Fourier sine and cosine transforms — Properties — Transforms of simple functions — Convolution theorem – Parseval's identity.

UNIT-3	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3 HOURS

Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel- Eigenvalues of a matrix by Power method.

UNIT-4	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**	**9+3 HOURS**
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		
UNIT-5	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9+3 HOURS**
Taylor's series method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Milne's forth predictor corrector methods for solving first order differential equations.		
	Total Lecture hours:	**60 HOURS**

TEXT BOOK(S)	
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
3	Narayanan S., Manicavachagom Pillay.T. K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
REFERENCE BOOKS	
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5.	Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
6.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016

Course Code	Course Title	L	T	P	J	C
22VLT201	ANALOG ELECTRONIC CIRCUITS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To understand the structure of basic electronic devices.
2. To be exposed to active and passive circuit elements.
3. To familiarize the operation and applications of transistor like BJT and FET.
4. To explore the characteristics of amplifier, gain and frequency response.
5. To learn the required functionality of positive and negative feedback systems.

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode)
2. Design clipper, clamper, half wave and full wave rectifier, regulator circuits using PN junction diodes
3. Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT
4. Analyze the performance of various configurations of BJT and MOSFET based amplifier
5. Explain the characteristics of MOS based cascade and differential amplifier
6. Explain the operation of various feedback amplifiers and oscillators

UNIT-1	PN JUNCTION DEVICES	9 HOURS

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance – Clipping & Clamping circuits - Rectifiers – Half Wave and Full Wave Rectifier– Display devices- LED, Laser diodes, Zener diode characteristics- Zener diode Reverse characteristics – Zener diode as regulator.

UNIT-2	TRANSISTORS AND THYRISTORS	9 HOURS

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics

UNIT-3	AMPLIFIERS	9 HOURS

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT-4	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	9 HOURS

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode

analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).		
UNIT-5	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**9 HOURS**
Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.		
	Total Lecture hours:	**45 HOURS**

TEXT BOOK(S)

1.	David A. Bell , "Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2.	Sedra and smith, "Microelectronic circuits",7th Edition., Oxford University Press, 2017

REFERENCE BOOKS

1.	Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014
2.	Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3.	Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4.	Robert L.Boylestad, "Electronic devices and circuit theory", 11th edition, Pearson prentice Hall 2013.
5.	Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, Second edition, 2012.

Course Code	Course Title	L	T	P	J	C
22EST203	**BASICS OF ELECTRICAL ENGINEERING AND CIRCUITS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To develop an understanding of the fundamental laws, theorems, elements of electric circuits and to analyze dc and ac circuits
2. To understand transient response behaviour of electric circuits.
3. To introduce different methods of circuit analysis using network theorems, duality and topology

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Apply the circuit theorems in real time
2. Analyze resonance and coupled circuits
3. Analyze the transient response for DC circuits

4. Explain the two port networks and parameters 5. Design, understand and evaluate the AC and DC circuits.		
UNIT-1	**FUNDAMENTALS OF ELECTRICAL ENGINEERING**	**9 hours**
Fundamental concepts of dc and ac circuits, Steady state solution of DC circuits, Circuit laws and their applications in solving problems Introduction to AC Circuits, Sinusoidal steady state analysis, Power and Power factor, Single phase and three phase balanced circuits.		
UNIT-2	**NETWORK THEOREMS FOR DC AND AC CIRCUITS**	**9 hours**
Source transformation, Superposition theorem, Thevenin's & Norton's theorems, Reciprocity and Maximum power transfer theorem, Application of Network theorems - Network reduction: voltage and current division, source transformation – star delta conversion.		
UNIT-3	**RESONANCE AND COUPLED CIRCUITS**	**9 hours**
Resonance - Series resonance - Parallel resonance, Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency, Bandwidth - Q factor – Selectivity, Self-inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multi winding coupled circuits, Series, parallel connection of coupled inductors - Single tuned and double tuned coupled circuits		
UNIT-4	**TRANSIENT ANALYSIS**	**9 hours**
Natural response - Forced response Transient response of RC, RL and RLC circuits to excitation by step signal, impulse signal and exponential sources Complete response of RC, RL and RLC circuits to sinusoidal excitation.		
UNIT-5	**TWO PORT NETWORKS**	**9 hours**
Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) parameters Interconnection of two port networks		
	Total Lecture hours:	**45 hours**

TEXT BOOK(S)	
1.	Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, 2017, Sixth Edition, Tata McGraw Hill Education Private Limited, India.
2.	Abhijit Chakrabarti, Circuit Theory Analysis and Synthesis, 2018, Seventh Edition, Dhanpat Rai and Co.
REFERENCE BOOKS	
1.	Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.
2.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 9th Reprint, 2015.
3.	Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, 5th Edition, 1st Indian Reprint, 2013.

Course Code	Course Title	L	T	P	J	C
22EST202	ENGINEERING GRAPHICS	1	0	4	0	3
		Syllabus version	v. 1.0			

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To develop students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing National standards related to technical drawings.
3. To Familiarize with basic geometrical constructions and orthographic projections.
4. To make the students to draw the different projections of the solids.
5. To view the true shape and apparent shape of the sectioned solids and their developments.
6. To get an idea about 3D views through isometric projections.

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Perform basic geometrical constructions and principles of orthographic projections.
2. Project orthographic projections of lines and plane surfaces.
3. Draw projections of solids and development of surfaces.
4. Visualize and to project isometric views and conversion of Isometric views to Orthographic views.
5. Understand the basics of AUTO CAD and fundamentals of perspective projections.

UNIT-0	CONCEPTS AND CONVENTIONS (Not for Examination)	3+9 HOURS

Importance of graphics in engineering applications — Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-1	PLANE CURVES, PROJECTIONOF POINTS AND LINES	3+9 HOURS

Conic Sections - Construction of Ellipse, Parabola & hyperbola by eccentricity method – Construction of cycloid. Introduction of Orthographic projection.

First angle projection - projection of points and Projection of Lines (only for understanding)

UNIT-2	PROJECTION OF PLANES AND SOLIDS	3+9 HOURS

Projection of simple planes (Square, circular, Hexagon, Pentagon) inclined to both the principal planes by rotating object method. Projection of simple solids like Prism, Pyramid, Cylinder& Cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT-3	SECTION AND DEVELOPMENT SURFACES OF SOLIDS	3+9 HOURS

Sectioning of simple solids (Prism, Pyramid, Cylinder& Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of surfaces of right regular sectioned solids

UNIT-4	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	3+9 HOURS

Principles of Isometric Projections-Isometric scale- Isometric Views of simple and truncated solids. Conversion of Isometric views of the objects to Orthographic views Exercises using free hand sketching.		
UNIT-5	**COMPUTER AIDED DRAFTING (Only for Internal Evaluation)**	**3+9 HOURS**
Introduction to engineering graphics CAD tools, Drawing Orthographic views from Isometric views using CAD tools--Floor plans of simple buildings- Exercise of circuit diagram (2D Orthographic Views) and 3D modeling (Isometric Views) using AutoCAD Software.		
Special points applicable to University Examinations on Engineering Graphics: 1. There will be five questions, each of either-or type covering all units of the syllabus. 2. All questions will carry equal marks of 20 each making a total of 100. 3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size. 4. The examination will be conducted in appropriate sessions on the same day.		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S):

1.	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2.	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCE BOOKS:

1.	Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edit ion, 2019.
2.	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

Course Code	Course Title	L	T	P	J	C
22HSM201	தமிழரும் தொழில் நுட்பமும் /TAMILS AND TECHNOLOGY	1	0	0	0	1
		Syllabus version			v. 1.0	

Unit-1	WEAVING AND CERAMIC TECHNOLOGY	03 hours

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

Unit-2	DESIGN AND CONSTRUCTION TECHNOLOGY	03 hours

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Unit-3	MANUFACTURING TECHNOLOGY	03 hours

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

Unit-4	AGRICULTURE AND IRRIGATION TECHNOLOGY	03 hours

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

Unit-5	SCIENTIFIC TAMIL & TAMIL COMPUTING	03 hours

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total Lecture hours:	15 hours

TEXT BOOK(S)

1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram
5.	Porunai- Attrangarai Nagarigam

REFERENCE BOOKS

1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in

	print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

Course Code	Course Title	L	T	P	J	C
22EET201	INNOVATIONS AND DESIGN THINKING	2	0	0	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Learn design thinking concepts and principles
2. Use design thinking methods in every stage of the problem
3. Learn the different phases of design thinking
4. Apply various methods in design thinking to different problems

COURSE OUTCOME:

Upon completion of the course, the students should be able to

1. Innovation of the new environmental conditions
2. Define key concepts of design thinking
3. Practice design thinking in all stages of problem-solving
4. Apply design thinking approach to real-world problems

UNIT-1	INNOVATIONS	6 HOURS

Introduction, innovation in current environment, types of innovation, schools of innovation, analyzing the current business scenario, challenges of innovation, steps of innovation management, experimentation in innovation management, participation for innovation, co-creation for innovation, prototyping to incubation. blue ocean strategy –I, blue ocean strategy-II. marketing of innovation, technology innovation process.

UNIT-2	DESIGN THINKING	6 HOURS

Design Thinking Approach: -Introduction to Design Thinking, Iterative Design Thinking Process Stages. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment, System Thinking, Product Thinking.

UNIT-3	UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM	6 HOURS

Search field determination - Problem clarification - Understanding of the problem - Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

UNIT-4	**IDEATION AND PROTOTYPING**	**6 HOURS**
Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.		
UNIT-5	**TESTING AND IMPLEMENTATION**	**6 HOURS**
Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking. Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.		
	Total Lecture hours:	**30 hours**

Text Book(s)

1.	Christian Mueller-Rotenberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2.	Designing for Growth: a design thinking tool kit for managers by Jeanne Liedtka and Tim Ogilvie.
3.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown.
4.	John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage Learning (International edition) Second Edition, 2013

Reference Books

1.	Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3.	HassoPlattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2014.
4.	Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**J**	**C**
22NXP201	**NCC Credit Course Level 1*(ARMY WING)**	**1**	**0**	**0**	**0**	**1**
		Syllabus version			**v. 1.0**	
UNIT-I	**NCC GENERAL**				**3 HOURS**	

NCC 1 Aims, Objectives & Organization of NCC NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		
UNIT-II	**NATIONAL INTEGRATION AND AWARENESS**	**3 HOURS**
NI 1 National Integration: Importance & NecessityNI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-III	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem SolvingPD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		
UNIT-IV	**LEADERSHIP**	**2 HOURS**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour CodeL 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-V	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o YouthSS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel SafetySS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

Course Code	Course Title	L	T	P	J	C
22ESP201	ENGINEERING PRODUCT LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

LIST OF EXPERIMENTS:

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK 15

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

PART II ELECTRICAL ENGINEERING PRACTICES 15

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring with introduction to CFL and LED types.
3. Stair case wiring
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter.
5. Measurement of energy using single phase energy meter.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

Demonstrating welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

BASIC MACHINING WORK:

Demonstrating of a) (simple)Turning. b) (simple)Drilling. c) (simple)Tapping.

3D PRINITNG:

Demonstrating of working principle of 3D Printer machine.

FOUNDRY WORK:

a) Demonstrating basic foundry operations

SHEET METAL WORK:

b) Making of a square tray
c) Making of a cone

FITTING EXERCISE:

Make a model by using fitting exercise

PART IV ELECTRONIC ENGINEERING PRACTICES 15

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2.Study of logic gates AND, OR, EOR and NOT.

3.Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits – Using general purpose PCB. 5. Measurement of ripple factor of HWR and FWR.
Total Laboratory hours: 60 hours

Course Code	Course Title	L	T	P	J	C
22VLP201	**ELECTRONIC DEVICES AND CIRCUITS LABORATORY**	**0**	**0**	**3**	**0**	**1.5**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Study the Frequency response of CE, CB and CC Amplifier
2. Learn the frequency response of CS Amplifiers
3. Study the Transfer characteristics of differential amplifier
4. Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
5. Perform SPICE simulation of Electronic Circuits
6. Design and implement the Combinational and sequential logic circuits

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Design and Test rectifiers, filters and regulated power supplies.
2. Design and Test BJT/JFET amplifiers.
3. Differentiate cascode and cascade amplifiers.
4. Analyze the limitation in bandwidth of single stage and multi stage amplifier
5. Measure CMRR in differential amplifier
6. Simulate and analyze amplifier circuits using PSpice.
7. Design and Test the digital logic circuits.

LIST OF EXPERIMENTS:

1.	Design of Regulated Power supplies
2.	Frequency Response of CE, CB, CC and CS amplifiers
3.	Darlington Amplifier
4.	Differential Amplifiers - Transfer characteristics, CMRR Measurement
5.	Cascode amplifiers
6.	Determination of bandwidth of single stage amplifiers
7.	Analysis of BJT with Fixed bias and Voltage divider bias using Spice
8.	Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software like Spice
9.	Analysis of Cascode amplifiers using Spice
10.	Analysis of Frequency Response of BJT and FET using Spice
TOTAL LABORATORY HOURS:	**45 HOURS**

LANGUAGE ELECTIVE II

Course Code	Course Title	L	T	P	J	C
22LET201	**FUNCTIONAL ENGLISH**	**3**	**0**	**2**	**0**	**4**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Gain confidence to respond in English in both academic and professional contexts
2. Improve presentation skills to make effective presentations
3. Foster the ability to write effectively in all contexts
4. Strengthen the skills related to teamwork and leadership roles in society as well as in workplace

COURSE OUTCOME:

1. To communicate fluently in professional situations
2. To express flexibility and appropriacy on Technical Events
3. To demonstrate complex forms and sentence structures with adequate vocabulary
4. To report events and the processes of technological & Industrial firms.
5. To present effective Profile in context of job search

UNIT-1	**COMMUNICATIVE COMPETENCE**	**9 HOURS**

Speaking – Interactive skills- Initiation & turn taking, relevance to the topic, puzzles & riddles **Reading** – Skimming, Scanning, Churning & Assimilation **Writing** – Blog Writing, Formal letters -Thanking & Apology **Grammar** – Order of Adjectives, Verbs Types **Vocabulary** – Morphemes, Phonetics – Vowels & Diphthongs		
UNIT-2	**SITUATIONAL CONVERSATIONS**	**9 HOURS**
Speaking – Practicing fluency- cohesion, coherence and speed of delivery **Reading** – Reading brochures and user manuals **Writing** – Checklist, Dialogue Writing **Grammar** – Infinitives, Gerunds, Participles **Vocabulary** – Phonetics- Consonants, Idioms		
Unit-3	**REPORT ON TECHNICAL EVENTS**	**9 hours**
Speaking –Mock TV news Reading/ anchoring **Reading** – Motivational essays on famous Engineers and Technologists **Writing** – Report Writing- Feasibility & Project Report, Project proposals **Grammar** – Reported Speech, Active, Passive and Impersonal Passive Voice **Vocabulary** – Technical Vocabulary, Jargons		
Unit-4	**DEVELOPING DISCUSSION SKILLS**	**9 hours**
Speaking – Giving short talks on technical topics **Reading** - Descriptive passages - newspapers / magazines/ articles **Writing** – Essay Writing: Opinion Essay, Problem solution, Compare & Contrast Essay, Jumbled Sentences **Grammar** – Indirect questions, Conjunctions **Vocabulary** – Single sentence Definition, Purpose Statements,		
Unit-5	**PRESENTATION SKILLS**	**9 hours**
Speaking – Presentations - visual aids- Visume using appropriate body language and gestures, stating, and asking for opinions and clarifications **Reading** – Predicting the content, speed reading techniques **Writing** – Job Application- Cover Letter & Resume, Minutes of Meeting **Grammar** – Mixed Tenses, Clauses **Vocabulary** – Error Spotting, Sentence Completion		
TOTAL LECTURE HOURS:		**45 HOURS**
List of Experiments:		
1. Initiation and turn taking		
2. Writing opinion paragraph		
3. Situational conversations		
4. Writing Checklists		
5. Mock TV news reading		
6. Writing the project proposal and report		

7. Short talk on technical topics	
8. Writing Recommendations	
9. Book/Movie Review	
10. Profile writing	
TOTAL PRACTICAL HOURS:	**30 HOURS**
Text Book(s)	
1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University
2.	Functional English for Communication (2022 edition) Ujjwala Kakarla, Guru Nanak Institutions Technical Campus (Autonomous), Hyderabad.
Reference Books	
1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Hewings, Martin. Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition
3.	Klaus Bruhn Jensen. A handbook of Media and Communication Research. Routledge, 2003

Course Code	Course Title	L	T	P	J	C
22LET202	FRENCH LEVEL II	3	0	2	0	4
		Syllabus version			v. 1.0	

Course Objectives:

1. To acquire an understanding of basic French language parts of speech
2. To facilitate learner's ability to learn the French language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

Course Outcome:

1. Read and write technical basic French language parts of speech
2. Speak appropriately learner's ability to learn the French language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

Unit-1	LES ASPECTS ACTIONNELS ET COMMUNICATIFS	12 hours
• Proposing a party/ visit a place • Inviting/accepting an invitation/refusing an invitation • Exprimer l'accord/dés accord (to express an agreement / disagreement) • Rapporter les paroles (reported speech) • Organiser/faire un projet de sortie (to organize/ to do a trip)		
Unit-2	**LA GRAMMAIRE DE LA COMMUNICATION**	**12 hours**
- Le futur proche – Impératif - Les Articles partitifs - Les expressions de la quantité - Les verbes irréguliers - savoir, vouloir, pouvoir, devoir, partir, dormir - Expression de l'appartenance - Donner une explication		
Unit-3	**LANGUAGE AND COMMUNICATION**	**12 hours**
- To create a simple travel plan (itinerary) - To use a map and reach a particular destination - Different types of lodging - Meubles et objets de la maison- vocabulary related to the objects of a household. - Expressions des nécessités - Donner des instructions - Une fiche de réservation – filling up a reservation form - To express a problem- exprimer un problème		
Unit-4	**CULTURAL AND CIVILISATIONAL ASPECTS**	**12 hours**
- Les Français et le logement - Les loisirs et les sorties en France - Les sorties des jeunes - Déjeuner en France - La nourriture		
Unit-5	**PASSAGE D'ÉCRITURE**	**12 hours**
1. Faites une invitation à votre ami (un mariage/un anniversaire/ passer le weekend/ une sortie) 2. Acceptez/ Refusez l'invitation 3. Ecrivez une carte postale 4. Faites le plan de Paris avec les monuments importants 5. Rédiger un emploi du temps 6. Décrire un itinéraire		
	Total Lecture hours:	**60 hours**

Text Book(s)

1.	Méthode de français A1, Jacky Girardet et al, CLE International
2.	"Littérature Progressive du français »-Niveau intermédiaire (2e Édition)-Nicole Blondeau, Ferroudja Allouache, Marie-Françoise Né.

Reference Books

1.	Michael D. Oates "Entre Amis: An Interactive Approach", 5 th Edition, Houghton Mifflin., 2005
2.	Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French"
3.	Simone Renaud, Dominique van Hooff "En bonne forme

Course Code	Course Title	L	T	P	J	C
22LET203	GERMAN LANGUAGE LEVEL II	3	0	2	0	4
		Syllabus version			v. 1.0	

Course Objectives:

1. To acquire an understanding of basic German language parts of speech
2. To facilitate learner's ability to learn the German language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

Course Outcome:

1. Equip the students in greeting forms to greet the person in the first encounter
2. Develop and use familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs.
3. Introduce him/her self and others as well as ask others about themselves – e.g. where they live, who they know and what they own – and can respond to questions of this nature
4. Make use of familiarizing with the days of the week, months, and dates
5. Evaluate the basics of German grammar and practice it in the real time situations

Unit-1	MODULE I	13 hours

Alphabet, Pronunciation (vowels, consonants), Verb conjugation and Personal Pronouns, Greetings, Introduce oneself and others, Numbers up to 20

Unit-2	MODULE II	13 hours

Interrogative sentence, Yes or No Questions, The verb 'haben' (to have) and 'sein' (to be)- Definite Articles "der, das, die", Nouns (singular, plural), Week days and Months, Jobs, Hobbies

Unit-3	MODULE III	09 hours

Indefinite Articles „ein, ein, eine", - Negation, Imperative with ‚Sie", Strong verbs

Unit-4	MODULE IV	11 hours

Verbs with Accusative, Food and Life in Germany, Conversations on Shopping

Unit V	MODULE V	14 hours

Time, Adverb of time, Possessive Pronouns, Modal verbs, Separable Verbs, Prepositions, Personal Pronouns in accusative, Past tense of "haben" and "sein", Conversations in a

Restaurant, To write an Invitation Letter / E-mail	
Total Lecture hours:	**60 hours**
Reference Books	
1.	Lernziel Deutsch I – Deutsch als Fremdsprache. Max Hueber Verlag, München.
2.	Deutsche Sprachlehre für Ausländer, Heinz Griesbach, Dora Schulz, 2011
3.	Themen Aktuell 1, Hartmurt Aufderstrasse, Heiko Bock, Mechthild Gerdes, Jutta Müller

Course Code	Course Title	L	T	P	J	C
22LET205	**JAPANESE LEVEL II**	**3**	**0**	**2**	**0**	**4**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To train the students to learn basic Japanese including three writing systems
2. To teach them to learn basic grammar and vocabulary
3. To train them to converse in Japanese in day-to-day scenarios.

COURSE OUTCOME:

Upon completion of the course, the student will be able to

CO1: Acquire familiarity in all 3 Japanese alphabet & basic vocabulary (Understand) CO2: Listen and identify individual sounds of Japanese (Understand)

CO3: Use basic sounds and words while speaking (Apply)

CO4: Read and understand simple advertisements, brochures and invitations (Apply)

CO5: Use basic grammar and appropriate vocabulary in completing language tasks (Apply)

UNIT-1	HOLIDAYS	9 HOURS

Hobbies (sports. films, music, etc.) - Places - 18 kanjis - Events - Calendar - ga particle – dekimasu - de particle - masen ka - Shall we go together?

UNIT-2	TOWNS	9 HOURS

Countries - Languages - Occupations - Self-introduction - Family - People - Numbers - My family - wa…desu - mo particle- to particle - ni particle - no particle.

UNIT-3	SHOPPING	9 HOURS

Food - Drinks - 7 Kanji - Food for lunch - Eating places - ga suki desu - sukijanai - o particle - de particle - My breakfast - My lunch.

UNIT-4	TRAVEL	9 HOURS

Food - Drinks - 7 Kanji - Food for lunch - Eating places - ga suki desu - sukijanai - o particle - de particle - My breakfast - My lunch.		
UNIT-5	**JLPT PREPARATION**	**9**
Daily routines - Time - 10 kanjis - Free-time activities - Places - Calendar - telling time - ni particle - kara… made… - time expression - ii adjective.		
	Total Lecture hours:	**45 hours**

TEXT BOOK(S)

1.	独立行政法人国際交流基金, 来嶋, 柴原 & 八田. Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Competences / まるごと 日本のことばと文化 入門 A1 りかい 2023.

REFERENCE BOOKS

1.	Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers, and Distributors Pvt. Ltd., Delhi, 2007.
2.	Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers, and Distributors Pvt. Ltd., Delhi, 2007.
3.	www.japaneselifestyle.com
4.	www.learn-japanese.info/
5.	www.kanjisite.com/ & www.learn-hiragana-katakana.com/typing-hiragana-characters/

LIST OF EXPERIMENTS :

1. Talk about what you want to buy
2. Talk about where to shop for something you want
3. Say briefly what you thought about your days off
4. Write a short blog about your days off
5. Say what you did on your travels
6. Say where you want to go next time
7. Talk about where to shop for something you want
8. Say briefly what you thought about your days off
9. Write a short blog about your days off
10. Say what you did on your travels
11. Say where you want to go next time
12. Presentation about your favourite city

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	J	C
22BST302	PROBABILITY AND RANDOM PROCESSES	3	1	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
2. To understand the basic concepts of probability, one- and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
3. To understand the basic concepts of random processes which are widely used in IT fields.
4. To understand the concept of correlation and spectral densities.
5. To understand the significance of linear systems with random inputs.

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
3. Apply the concept random processes in engineering disciplines.
4. Understand and apply the concept of correlation and spectral densities.
5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyse the response of random inputs to linear time invariant systems.

UNIT-1	PROBABILITY AND RANDOM VARIABLES	12 hours

Probability – Axioms of probability – Conditional probability – Baye ‘s theorem – Discrete and continuous random variables – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT-2	TWO – DIMENSIONAL RANDOM VARIABLES	12 hours

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables

UNIT-3	RANDOM PROCESSES	12 hours

Classification – Stationary process – Markov process – Markov chain – Poisson process

UNIT-4	CORRELATION AND SPECTRAL DENSITIES	12 hours

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT-5	**LINEAR SYSTEMS WITH RANDOM INPUTS**	**12 hours**
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.		
	Total Lecture hours:	**60 hours**

TEXT BOOK(S)

1.	Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007
2.	Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.

REFERENCE BOOKS

1.	Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012
2.	Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3.	Miller. S.L. and Childers. D.G., —Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.
4.	Stark. H. and Woods. J.W., —Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3rd Edition, 2002.
5.	Yates. R.D. and Goodman. D.J., —Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

COURSE CODE	COURSE TITLE	L	T	P	J	C
22EST401	**ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**	**2**	**0**	**0**	**0**	**2**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To study the nature and facts about environment.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth‟s interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Environmental Pollution or problems cannot be solved by mere laws. Public participation is

an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

2. Public awareness of environmental is at infant stage.
3. Ignorance and incomplete knowledge have led to misconceptions
4. Development and improvement in std. of living has lead to serious environmental disasters

UNIT-1	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	6 HOURS

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT-2	ENVIRONMENTAL POLLUTION	6 HOURS

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT-3	NATURAL RESOURCES	6 HOURS

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT-4	SOCIAL ISSUES AND THE ENVIRONMENT	6 HOURS

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT-5	HUMAN POPULATION AND THE ENVIRONMENT	6 HOURS

Population growth, variation among nations – population explosion – family welfare Programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

	TOTAL LECTURE HOURS:	30 HOURS

TEXT BOOK(S)

1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006
3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.

REFERENCE BOOKS	
1.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi,2007.
2.	Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015
3.	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

COURSE CODE	COURSE TITLE	L	T	P	J	C
22VLT301	SIGNAL AND SYSTEMS FOR VLSI	3	1	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To understand the basic properties of signal & systems
2. To know the methods of characterization of LTI systems in time domain
3. To analyze continuous time signals and system in the Fourier and Laplace domain
4. To analyze discrete time signals and system in the Fourier and Z transform domain

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Determine if a given system is linear/causal/stable.
2. Determine the frequency components present in a deterministic signal.
3. Characterize continuous LTI systems in the time domain and frequency domain.
4. Characterize discrete LTI systems in the time domain and frequency domain.
5. Study the applications of signal processing applications.

UNIT-1	CLASSIFICATION OF SIGNALS AND SYSTEMS	9 HOURS

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & aperiodic signals, Deterministic & Random signals, Energy & Power signals -Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT-2	ANALYSIS OF CT AND DT SIGNALS	9 HOURS

Fourier Transform – properties- Laplace Transforms and Properties, Z Transform & Properties.

UNIT-3	LINEAR TIME INVARIANT CONTINOUS TIME SYSTEMS	9 HOURS

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT-4	LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS	9 HOURS
Impulse response–Difference equations -Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.		
UNIT-5	**APPLICATIONS OF MULTIRATE SIGNALS**	**9 HOURS**
Introduction to Sampling and Quantization, Interpolation, Decimation, and Adaptive filter.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)	
1.	Oppenheim, Willsky and Hamid, “Signals and Systems”, 2nd Edition, Pearson Education, New Delhi, 2015.
2.	Simon Haykin, Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley, 2002
REFERENCE BOOKS	
1.	B. P. Lathi, “Principles of Linear Systems and Signals”, 2nd Edition, Oxford, 2009.
2.	M. J. Roberts, “Signals and Systems Analysis using Transform methods and MATLAB”, McGraw- Hill Education, 2018.
3.	John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

COURSE CODE	COURSE TITLE	L	T	P	J	C
22ECT303	DIGITAL ELECTRONICS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to: At the end of the course, the student will be able to

1. To present the fundamentals of digital circuits and simplification methods
2. To practice the design of various combinational digital circuits using logic gates
3. To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits
4. To learn integrated circuit families.
5. To introduce semiconductor memories and related technology

COURSE OUTCOME:

After studying this course, you should be able to: At the end of the course, the student will be able to

1. Use Boolean algebra and simplification procedures relevant to digital logic.
2. Design various combinational digital circuits using logic gates.
3. Analyse and design synchronous sequential circuits.
4. Analyse and design asynchronous sequential circuits.

5. Build logic gates and use programmable device		
UNIT-1	**BASIC CONCEPTS**	**9 HOURS**
Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions - Karnaugh map, completely and incompletely specified functions, Basic Gates, Implementation of Boolean expressions using universal gates, Tabulation methods**.**		
UNIT-2	**COMBINATIONAL LOGIC CIRCUITS**	**9 HOURS**
Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder — Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/ Demux		
UNIT-3	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**9 HOURS**
Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Moore/Mealy models, state minimization, state assignment, Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.		
UNIT-4	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**9 HOURS**
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits		
UNIT-5	**LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES**	**9 HOURS**
Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basic memory, static ROM, PROM, EPROM, EEPROM EAPROM		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	M. Morris Mano and Michael D. Ciletti, “Digital Design”, 5th Edition, Pearson, 2014.	
2.	Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011	
REFERENCE BOOKS		
1.	Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.	
2.	S.Salivahanan and S.Arivazhagan“Digital Electronics”, Ist Edition, Vikas Publishing House pvt Ltd, 2012.	
3.	Soumitra Kumar Mandal “ Digital Electronics”, McGraw Hill Education Private Limited,2016.	

Course Code	Course Title	L	T	P	J	C
22VLT302	INTRODUCTION TO CMOS VLSI	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To understanding CMOS Transistor Fundamentals
To Circuit Characterization and Performance Analysis
To Designing Arithmetic Building Blocks
To Exploring CMOS Chip Implementation Strategies
To VHDL Synthesis and Testing

COURSE OUTCOME:

After studying this course, you should be able to: At the end of the course, the student will be able to
CO1: Knowledge of CMOS Transistor Principles
CO2: Proficiency in Circuit Characterization
CO3: Skills in Designing Arithmetic Circuits
CO4: Competence in CMOS Chip Design Methodologies
CO5: Expertise in VHDL Synthesis and Testing

UNIT-1	Introduction of CMOS	9 HOURS

CMOS Transistor, layout and background of design rule, Basic CMOS fabrication process, circuit elements, MOS transistor theory-MOS transistor types, conduction characteristics, Threshold voltage, MOS DC equation, Channel length modulation, noise margin, Rise time and fall time.

UNIT-2	Circuit characterization and performance	9 HOURS

Stick Diagrams , Resistance estimation, capacitance estimation, switching characteristics, analytic delay models, gate transistor sizing, power dissipation, charge sharing, transistor sizing, design margining, scaling of MOS transistor dimensions.

UNIT-3	Design arithmetic building blocks	9 HOURS

Design of data path circuits, architecture for ripple carry adder, Carry look ahead adder, multipliers, barrel shifter
Physical Design: Floor-Planning, Placement, routing, Power delay estimation, Clock and Power routing .

UNIT-4	Implementation Strategies for CMOS chip design	9 HOURS

Implementation Strategies-CMOS chip design: Full-custom, Standard Cells, Cell libraries, FPGAs building block architecture, CPLDs and FPGA routing procedure.

UNIT-5	Verilog HDL and CMOS Testing	9 HOURS

VHDL Synthesis: Specification using Verilog HDL: Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools. Introduction of Verilog coding with different modelling. CMOS Testing: need for testing, manufacturing test principles, Design strategies for test, system level test techniques-boundary scan, chip level test techniques, Built-in-self-test	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)	
1.	N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007
2.	Jan D Rabaey, Anantha Chandrakasan, " Digital Integrated Circuits: A Design Perspective", PHI, 2016.
REFERENCE BOOKS	
1.	A.L visalatchi, B.Priya, S.Praveena "Modern vlsi Design" anuradha publication 1st Edition
2.	M.Morris Mano and Michel.D.Ciletti, Digital Design with an introduction to HDL, VHDL and Verilog, Sixth edition Pearson education
3.	Michael J Smith ," Application Specific Integrated Circuits, Addison Wesley,
4.	Samir Palnitkar," Verilog HDL:A guide to Digital Design and Synthesis", Second Edition, Pearson Education,2003

COURSE CODE	COURSE TITLE	L	T	P	J	C
22HST301	ENTREPRENEURSHIP AND STARTUPS	2	0	0	0	2
		Syllabus version			v. 1.0	
COURSE OBJECTIVES:						
After studying this course, you should be able to: 1. To provide practical, proven tools for transforming an idea into a product or service that creates value for others 2. To build a winning strategy, how to shape a unique value proposition, prepare a business plan 3. To impart practical knowledge on business opportunities 4. To inculcate the habit of becoming an entrepreneur 5. To know the financing, growth, and new venture & its problems						
COURSE OUTCOME:						

At the end of the course, the student will be able to

1. Transform ideas into real products, services, and processes by validating the idea, testing it, and turning it into a growing, profitable, and sustainable business.
2. Identify the major steps and requirements to estimate the potential of an innovative idea as the basis of an innovative project.
3. Reach creative solutions via an iteration of a virtually endless stream of world-changing ideas and strategies, integrating feedback and learning from failures along the way.
4. Apply the ten entrepreneurial tools in creating a business plan for a new innovative venture.
5. Apply methods and strategies learned from interviews with start-up entrepreneurs and innovators

UNIT-1	**ENTREPRENEURIAL COMPETENCE**	**9 HOURS**

Introduction to Entrepreneurship & Entrepreneur Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, the role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management, and the Future of Entrepreneurship. The Entrepreneur: Means the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system.

UNIT-2	**BUSINESS PLAN PREPARATION AND PROTOTYPING**	**9 HOURS**

Business Opportunity Identification and Preparing a Business Plan Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan. Experimentation and incubation, Participation in Innovation & Co-creation, and Prototyping

UNIT-3	**ENTREPRENEURIAL ENVIRONMENT**	**9 HOURS**

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations

UNIT-4	**LAUNCHING OF SMALL BUSINESS**	**9 HOURS**

Financing & Launching the New Venture Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks. Launching the New Venture: Choosing the legal form of the new venture, protection of intellectual property, and formation of the new venture

UNIT-5	**MANAGEMENT OF SMALL BUSINESS**	**9 HOURS**

Managing Growth & Rewards in New Venture Characteristics of high growth new ventures, strategies for growth, and building the new ventures. Managing Rewards: Exit Strategies for Entrepreneurs, Mergers and acquisitions, Succession and exit strategy, managing failures – bankruptcy - Business Sickness - Effective Management of Small Business - Case Studies	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)	
1.	Stephen Key, “One Simple Idea for Start-ups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company”, 1st Edition, Tata Mc Graw hill Company, New Delhi, 2013.
2.	Charles Bamford and Garry Bruton, “ENTREPRENEURSHIP: The Art, Science, and Process for Success”, 2nd Edition, Tata Mc Graw hill Company, New Delhi, 2016.
REFERENCE BOOKS	
1.	Philip Auerswald, “The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy”, Oxford University Press, 2012.
2.	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, “Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance”, 2011.
3.	Edward D. Hess, “Growing an Entrepreneurial Business: Concepts and Cases”, Stanford Business Books, 2011.

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**J**	**C**
22VLP301	**SIGNAL AND SYSTEMS FOR VLSI LABORATORY**	**0**	**0**	**3**	**0**	**1.5**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To understand the basic properties of signal & systems.
2. To know the methods of characterization of LTI systems in time domain.
3. To determine if a given system is linear/causal/stable.
4. To determine characterize LTI systems in the time domain and frequency domain.

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Determine the frequency components present in a deterministic signal.
2. Characterize continuous LTI systems in the time domain and frequency domain.
3. Characterize discrete LTI systems in the time domain and frequency domain.

LIST OF EXPERIMENTS:

MATLAB / EQUIVALENT SOFTWARE PACKAGE.

1. Generation of elementary Discrete-Time sequences.
2. Time and Amplitude transformations: Write a MATLAB program to perform amplitude-scaling, time-scaling and time shifting on a given signal.
3. Fourier Series:

a. To calculate Fourier series coefficients associated with Square Wave.
b. To Sum the first 10 terms and plot the Fourier series as a function of time.
c. To Sum the first 50 terms and plot the Fourier series as a function of time.

4. Calculating transforms using MATLAB

a. Calculate and plot Fourier transform of a given signal.
b. Calculate and plot Z-transform of a given signal.

5. Autocorrelation and Cross-correlation

a. Write a MATLAB program to compute autocorrelation of a sequence x(n) and verify the property.
b. Write a MATLAB program to compute cross-correlation of sequences x(n) and y(n) and verify the property.

6. Write a MATLAB program to plot the following continuous time and discrete time signals. i. Step Functionii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function

7. Pole-zero diagram : Write a MATLAB program to find pole-zero diagram of a given system from the given system function.

TOTAL LABORATORY HOURS:	**45 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22ECP302	DIGITAL ELECTRONICS LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Get practical experience in design, realization and verification of Demorgan's Theorem
2. Design Full/Parallel Adders and Subtractors
3. Design and learn Multiplexer using logic gates, Demultiplexer and Decoder
4. Verify the function of Flip-Flops
5. Design Shift registers and Counters using Flip flops

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Justify NAND and NOR as Universal gates and verify SOP and POS expressions using

them.

2. Verify De Morgan's Theorem for 2 variables using logic gates.
3. Design, Build and test combinational circuits such as adders, Subtractor, comparators, multiplexers demultiplexers and decoders.
4. Construct flips-flops using NAND gates and verify their functionality.
5. Realize synchronous and asynchronous counters and its applications using flip-flop IC's
6. Construct the types of shift registers using flip-flop IC's and verify their functionality.

LIST OF EXPERIMENTS:

1.To realize Basic gates (AND, OR, NOT) From Universal Gates (NAND & NOR).

2.To verify

(a) Demorgan's Theorem for 2 variables

(b) The sum-of product and product-of-sum expressions using universal gates

3.(a)To design and implement Half adder and Full Adder, Half Subtractor and Full subtractor

(b) 4-bit Parallel Adder Using IC 7483

4.(a) To realize (a) 4:1 and 8:1 Multiplexer using 74151 gate

(b) To realize 1:8 Demultiplexer

5. To Design 8:3 Encoder and 3:8 Decoder using IC74138

6.To design 4-bit comparator circuit using logic gates

7. To realize the following flip-flops using NAND Gates:

(a)Clocked SR Flip-Flop

(b)JK Flip-Flop

8. To realize the following shift registers using Ic7474:

(a) SISO (b) SIPO (c) PISO (d) PIPO

9.To design 4-bit synchronous Counter using JK Flip flops - Ic7476

10.To design 4 bit Ripple counter using JK Flip flops - IC7476

TOTAL LABORATORY HOURS:	**45 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22EEP301	SOFT SKILLS	0	0	2	0	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Do self-introspection and develop right attitude

2. Understand the self-motivation and mange his abilities with time

3. Understand the inter personal skills

4. Know the leader's qualities and develop as a leader

5.Undersating the conflict at work and make right decisions

COURSE OUTCOME:

1. Able to develop self-confidence through right attitude

2. Use self-motivation and to manage his abilities

3. Effectively use inter personal skills

4. Develop leadership qualities

5. Able to make right decisions and solving conflicts

UNIT-1	**SELF ANALYSIS**	**6 HOURS**
Introduction, SWOT analysis, self-introspection, self confidence and self-esteem, Creativity -Out of the box thinking, Creative thinking and Lateral thinking, Factors influencing attitude, Influence of attitude on behaviour, Synergy between knowledge, skill and attitude,		
UNIT-2	**GROWTH FACTORS**	**6 HOURS**
Motivation, Motivational factors, Self-motivation, Intrinsic and extrinsic motivators, Goal setting, SMART goals, Short, long, life time goals, Time management, Value of time, Test your Time management skill, Prioritizing work, Time management matrix		
UNIT-3	**INTERPERSONAL SKILLS**	**6 HOURS**
Gratitude, Secret of happiness, Understanding the integration of leadership, networking and teamwork, situation analysis, Importance of teamwork, Teamwork activity, Stress Management-Causes of stress and its impact, how to manage and de-stress		
UNIT-4	**LEADERSHIP**	**6 HOURS**
Skills needed for a good leader, Types of leadership style, Assessment of leadership skills, Wheel of leadership, Personal, social and professional etiquette Emotional intelligence, Emotional quotient and intelligence quotient, Emotion scale, Managing emotions		
UNIT-5	**CONFLICT RESOLUTION AND DECISION MAKING**	**6 HOURS**
Conflicts in human relations, Self-assessment test for conflict management, Approaches to conflict resolution, Case study **Decision making-** Importance of decision making, Impact of decision in life, Process and practical way of decision making.		
	TOTAL LECTURE HOURS:	**30 HOURS**

TEXT BOOK(S)

1.	SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.

REFERENCE BOOKS	
1.	Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2.	Carnegie Dale, How to Win Friends and Influence People, New York: Simon & Schuster, 1998.
3.	Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972.
4	Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.
5	Carnegie Dale, How to stop worrying and start living, New York: Simon & Schuster, 1985.
6	http://empower.srmuniv.ac.in (online LMS)

SEMESTER –IV

Course Code	Course Title	L	T	P	J	C
22VLT401	ANALOG AND DIGITAL COMMUNICATION	3	1	0	0	4
		Syllabus version				v. 1.0

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. Understand analog and digital communication techniques.
2. Learn data and pulse communication techniques.
3. Be familiarized with source and Error control coding.
4. Gain knowledge on multi-user radio communication

COURSE OUTCOME:

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

1. Apply analog and digital communication techniques.
2. Use data and pulse communication techniques.
3. Analyze Source and Error control coding.
4. Utilize multi-user radio communication.

UNIT-1	ANALOG COMMUNICATION	9 HOURS

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

UNIT-2	PULSE AND DATA COMMUNICATION	9 HOURS

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.

UNIT-3	DIGITAL COMMUNICATION	9 HOURS

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM)

UNIT-4	SOURCE AND ERROR CONTROL CODING	9 HOURS
Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.		
UNIT-5	**MULTI-USER RADIO COMMUNICATION**	**9 HOURS**
Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.		
	TOTAL LECTURE HOURS:	**30 HOURS**

TEXT BOOK(S)	
1.	Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2009.
REFERENCE BOOKS	
1.	Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons 2004
2.	Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
3.	H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3 rd Edition, Pearson Education, 2007.
4	B. P.Lathi, “Modern Analog and Digital Communication Systems”, 3 rd Edition, Oxford University Press, 2007.
5	Blake, “Electronic Communication Systems”, Thomson Delmar Publications, 2002.
6	Martin S.Roden, “Analog and Digital Communication System”, 3 rd Edition, Prentice Hall of India, 2002.
7.	B.Sklar, “Digital Communication Fundamentals and Applications” 2 nd Edition Pearson Education 2007.

COURSE CODE	COURSE TITLE	L	T	P	J	C
22ECT402	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To introduce the basic building blocks of linear integrated circuits
2. To learn the linear and non-linear applications of operational amplifiers
3. To learn the theory of ADC and DAC
4. To introduce the concepts of waveform generation and introduce some special function ICs
5. To introduce the theory and applications of analog multipliers and PLL

COURSE OUTCOME:

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

1. Design linear and nonlinear applications of OP – AMPS
2. Design applications using analog multiplier and PLL
3. Design ADC and DAC using OP – AMPS
4. Analyze special function ICs
5. Gain knowledge of Analog multiplier and PLL

UNIT-1	BASICS OF OPERATIONAL AMPLIFIERS	9 HOURS

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT-2	APPLICATIONS OF OPERATIONAL AMPLIFIERS	9 HOURS

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT-3	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	9 HOURS

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters		
UNIT-4	**WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS**	**9 HOURS**
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator -Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Optocouplers and fiber optic IC.		
UNIT-5	**ANALOG MULTIPLIER AND PLL**	**9 HOURS**
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, closed loop analysis, Voltage controlled oscillator, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization.		
TOTAL LECTURE HOURS:		**45 HOURS**
TEXT BOOK(S)		
1.	D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V)	
2.	Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)	
REFERENCE BOOKS		
1.	Ramakant A. Gayakwad, “OP-AMP and Linear ICs”, 4th Edition, Prentice Hall / Pearson Education, 2015	
2.	Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.	
3.	S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, TMH,2nd Edition, 4th Reprint, 2016	

COURSE CODE	COURSE TITLE	L	T	P	J	C
22VLT402	DIGITAL SIGNAL PROCESSING	3	0	2	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To learn discrete fourier transform, properties of DFT and its application to linear filtering
2. To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
3. To understand the effects of finite precision representation on digital filters
4. To understand the fundamental concepts of multi rate signal processing and its applications
5. To introduce the concepts of adaptive filters and its application to communication engineering

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Apply DFT for the analysis of digital signals and systems
2. Design IIR and FIR filters
3. Characterize the effects of finite precision representation on digital filters
4. Design multirate filters
5. Understand the architecture of DSP processors.

UNIT-1	DISCRETE FOURIER TRANSFORM	9 HOURS

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT-2	**INFINITE IMPULSE RESPONSE FILTERS**	**9 HOURS**
Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain.		
UNIT-3	**FINITE IMPULSE RESPONSE FILTERS**	**9 HOURS**
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations		
UNIT-4	**FINITE WORD LENGTH EFFECTS**	**9 HOURS**
Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow		
UNIT-5	**DSP ARCHITECTURE**	**9 HOURS**
DSP Architecture Fixed and Floating point architecture principles, addressing modes and instruction set.		
TOTAL LECTURE HOURS:		**45 HOURS**

LIST OF EXPERIMENTS:

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations
7. Study of architecture of Digital Signal Processor
8. Perform MAC operation using various addressing modes
9. Generation of various signals and random noise
10. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
11. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
12. Implement an Up-sampling and Down-sampling operation in DSP Processor

TOTAL PRACTICAL HOURS:	**30 HOURS**
TOTAL HOURS	**75 HOURS**

TEXT BOOK(S)/REFERENCE BOOK	
1.	John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2.	A. V. Oppenheim, R.W. Schafer and J.R. Buck, —Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004
REFERENCE BOOK	
1.	Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002
2.	Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3.	Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006

COURSE CODE	COURSE TITLE	L	T	P	J	C
22VLT403	INTRODUCTION TO MICROFABRICATION	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To learn various cleanroom processes in the classroom setting
2. To re-define the microfabrication terms learned in the classroom
3. To experience the microfabrication processes in the cleanroom
4. To create video clips of these processes with a personal style.

COURSE OUTCOME:

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

1. Elucidate the CMOS process flow

2. Analyze various critical processing steps in microfabrication

3. Appreciate the advanced methods involved in IC fabrication.

4. Analyze the advancements in CMOS process fabrication with scaling in technology

UNIT-1	INTRODUCTION	9 HOURS

History of IC's; Operation & Models for Devices of Interest: CMOS and MEMS. Electronic Materials: Crystal Structures, Defects in Crystals, Si, Poly Si, Si Crystal Growth. Clean room and Wafer Cleaning: Definition, Need of Clean Room, RCA cleaning of Si.

UNIT-2	OXIDATION	9 HOURS

Dry and Wet Oxidation, Kinetics of Oxidation, Oxidation Rate Constants, Dopant Redistribution, Oxide Charges, Device Isolation, LOCOS, Oxidation System.

UNIT-3	LITHOGRAPHY	9 HOURS

Lithography: Overview of Lithography, Radiation Sources, Masks, Photoresist, Components of Photoresist Optical Aligners, Resolution, Depth of Focus, Advanced Lithography: E-beam Lithography, X-ray Lithography, Ion Beam Lithography.

UNIT-4	DIFFUSION	9 HOURS

Pre-Deposition and Drive-in Diffusion Modeling, Dose, 2-Step Diffusions, Successive Diffusion, Lateral Diffusion, Series Resistance, Junction Depth, Irvin's Curves, Diffusion System.

UNIT-5	**ETCHING**	**9 HOURS**
Etching: Anisotropy, Selectivity, Wet Etching, Plasma Etching, Reactive Ion Etching. Overview of Interconnects, Contacts, Metal gate/Poly Gate, Metallization, Problems in Aluminum Metal contacts, Al spike, Electromigration, Metal Silicides, Multi-Level Metallization, Planarization, Inter Metal Dielectric		
TOTAL LECTURE HOURS:		**45 HOURS**

TEXT BOOK(S)	
1.	Silicon VLSI Technology, Plummer, Deal and Griffin ,1st Edition, Pearson Education,2009
2.	Fundamental of Semiconductor Fabrication, Sze and May,2nd Edition, Wiley India, 2009
3.	Silicon Process Technology, S K Gandhi,2nd Edition, Wiley India,2009
REFERENCE BOOKS	
1.	James Plummer, M. Deal and P.Griffin, Silicon VLSI Technology, Prentice Hall Electronics
2.	Stephen Campbell, The Science and Engineering of Microelectronics, Oxford University Press, 1996
3.	S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988
4.	C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**J**	**C**
22VLT404	**COMPUTER ARCHITECTURE AND ORGANIZATION**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To make students understand the basic structure and operation of digital computer
2. To familiarize with implementation of fixed point and floating-point arithmetic operations
3. To study the design of data path unit and control unit for processor
4. To understand the concept of various memories and interfacing
5. To introduce the parallel processing technique

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Describe data representation, instruction formats and the operation of a digital computer
2. Illustrate the fixed point and floating-point arithmetic for ALU operation
3. Discuss about implementation schemes of control unit and pipeline performance
4. Explain the concept of various memories, interfacing and organization of multiple processors
5. Discuss parallel processing technique and unconventional architectures

UNIT-1	**COMPUTER ORGANIZATION & INSTRUCTIONS**	**9 HOURS**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations

UNIT-2	**ARITHMETIC**	**9 HOURS**

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism

UNIT-3	**THE PROCESSOR**	**9 HOURS**

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT-4	**MEMORY AND I/O ORGANIZATION**	**9 HOURS**

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT-5	**ADVANCED COMPUTER ARCHITECTURE**	**9 HOURS**

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies

TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)	
1.	David A. Patterson and John L. Hennessey, “Computer Organization and Design”, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)
2.	Miles J. Murdocca and Vincent P. Heuring, “Computer Architecture and Organization: An Integrated approach”, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)
REFERENCE BOOKS	
1.	V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organization“, Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2.	William Stallings “Computer Organization and Architecture”, Seventh Edition, Pearson Education, 2006.
3.	Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22NXP401	**(ARMY WING) NCC Credit Course Level - II**	**1**	**0**	**0**	**0**	**1**
		Syllabus version			v. 1.0	

PERSONALITY DEVELOPMENT	**09 HOURS**
PD 3 Group Discussion: Change your mindset, Time Management, Social Skills PD 5 Public Speaking	
LEADERSHIP	**7 HOURS**
L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	
DISASTER MANAGEMENT	**13 HOURS**
DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation DM 2 Initiative Training, Organising Skills, Do's & Don’t's, Natural Disasters, Man Made Disasters DM 3 Fire Service & Fire Fighting	
ENVIRONMENTAL AWARENESS & CONSERVATION	**03 HOURS**
EA 1 Environmental Awareness and Conservation	
GENERAL AWARENESS	**04 HOURS**
GA 1 General Knowledge	
ARMED FORCES	**06 HOURS**
AF 1 Armed Forces, Army, CAPF, Police	
ADVENTURE	**01 HOUR**

AD 1 Introduction to Adventure Activities	
BORDER & COASTAL AREAS	**02 HOURS**
BCA 1 History, Geography & Topography of Border/Coastal areas	
TOTAL PRACTICAL HOURS:	**45 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22ECP401	LINEAR INTEGRATED CIRCUITS LAB	0	0	3	0	1.5
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To gain hands on experience in designing electronic circuits.
2. To learn simulation software used in circuit design.
3. To learn the fundamental principles of amplifier circuits.
4. To differentiate feedback amplifiers and oscillators.
5. To differentiate the operation of various multivibrators.

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Analyze various types of feedback amplifiers.
2. Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators.
3. Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators, filters using SPICE Tool.
4. Design amplifiers, oscillators, D-A converters using operational amplifiers.
5. Design filters using op-amp and perform an experiment on frequency response.

LIST OF EXPERIMENTS:

Design and Analysis of the Following Circuits

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. RC Integrator and Differentiator circuits using Op-Amp
5. Clippers and Clampers

6. Instrumentation amplifier

7. Active low-pass, High pass & Band pass filters

8. PLL Characteristics and its use as frequency multiplier, clock synchronization

9. R-2R ladder type D-A converter using Op-Amp

Simulation Using SPICE (Using Transistor):

1. Tuned Collector Oscillator

2. Twin -T Oscillator / Wein Bridge Oscillator

3. Double and Stagger tuned Amplifiers

4. Bistable Multivibrator

5. Schmitt Trigger circuit with Predictable hysteresis

6. Analysis of power amplifier

Total Lecture hours:	**45 hours**

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**J**	**C**
22VLP401	**ANALOG AND DIGITAL COMMUNICATION LABORATORY**	**0**	**0**	**3**	**0**	**1.5**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To visualize the effects of sampling and TDM
2. To Implement AM & FM modulation and demodulation
3. To implement PCM & DM
4. To simulate Digital Modulation schemes
5. To simulate Error control coding schemes.

COURSE OUTCOME:

At the end of the course, the student will be able to

1. Simulate & validate the various functional modules of a communication system
2. Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
3. Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
4. Simulate end-to-end communication Link.

LIST OF EXPERIMENTS:	
1. Signal Sampling and reconstruction 2. Time Division Multiplexing 3. AM Modulator and Demodulator 4. FM Modulator and Demodulator 5. Pulse Code Modulation and Demodulation 6. Delta Modulation and Demodulation 7. Line coding schemes 8. Simulation of ASK, FSK, and BPSK generation schemes 9. Simulation of DPSK, QPSK and QAM generation schemes 10. Simulation of signal constellations of BPSK, QPSK and QAM 11. Simulation of ASK, FSK and BPSK detection schemes 12. Simulation of Linear Block and Cyclic error control coding schemes 13. Simulation of Convolutional coding scheme 14. Communication link simulation	
Total Laboratory hours:	**45 hours**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22EEP401	QUANTITATIVE APTITUDE AND LOGICAL REASONING -1	0	0	2	0	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. This module would train the students on the quick ways to solve quantitative aptitude problems and questions applying logical reasoning, within a short time span given during the placement drives.

COURSE OUTCOME:

At the end of the course, the student will be able to

2. Solve quantitative aptitude problems
3. Apply logical Reasoning
4. Developing quantitative literacy skills

LIST OF EXPERIMENTS:

1. Mock interviews on one-on-one basis
2. Quantitative aptitude
3. Partnership
4. Simple Interest, Compound Interest

5. Profit and Loss 6. Problems on Clock, Calendar and Cubes 7. Permutation and Combination 8. Allegation and mixtures 9. Logical Reasoning 10. Letter and Symbol series 11. Number series 12. Analyzing arguments 13. Making judgments	
TOTAL LECTURE HOURS:	**30 Hours**

SEMESTER – V

Course Code	Course Title	L	T	P	J	C
22VLT501	MICROPROCESSOR AND MICROCONTROLLER	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the architecture of Microprocessor & Microcontroller.
2. To familiarize the students in writing assembly programming and interfacing with peripherals.
3. To provide foundation and confidence to the students to solve real-world problem using Microprocessor and Microcontroller.

COURSE OUTCOME:

On completion of the course, student will be able to
CO1 – Analyze the internal architecture and operations of microprocessor related to industrial and performance-oriented logics and techniques
CO2 - Analyze various addressing modes and instruction set of microprocessors to structure the programming skills
CO3 - Examine the various processors and to select appropriate processor and controller, based on the performance requirements and implementation
CO4 - Develop assembly language programs through simulation and hardware implementation by assembling and disassembling the machine codes of microcontroller
CO5 - Implement electronic circuitry to the Microprocessor I/O ports in order to interface the processor and controller for various applications
CO6 - Evaluate various assembly language programs based on computation complexity to address Real World Problems

UNIT-1	8086 MICROPROCESSOR	9 HOURS

Introduction, 8086 Architecture, Pin Diagram and signals, Timing Diagram, Interrupts and its types,.8086 assembly language programming and its practices – Addressing Modes.

UNIT-2	8086 INTERFACING	9 HOURS

Memory interfacing – Interrupt controller (8259A) – DMA controller (8237) - Multiprocessor configurations - Serial communication USART (8251), Programmable Peripheral Interface (8255), Programmable Interrupt Controller(8259),Programmable interval timer(8254, Analog to Digital Converter(ADC),and Digital to Analog Converter(DAC) interfacing. Validate of applications

UNIT-3	8051 MICROCONTROLLERS	9 HOURS

Introduction to microcontrollers, Difference between microprocessor and microcontroller, Architectural of 8051, Memory architecture, Timers, Interrupts, Addressing Modes and Instructions to 8051. 8051 assembly language programming and its practices.

UNIT-4	8051 INTERFACING	9 HOURS

. I/O Ports – Timer port architecture and programming - Serial port architecture and programming g - Interrupts Handling - LCD & Keyboard Interfacing – ADC & DAC Interfacing – DC & Stepper Motor Interfacing – Introduction to PIC16X Microcontroller. Validate of applications.		
UNIT-5	**GPU ARCHITECTURE**	**9 HOURS**
Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Prentice Hall of India, Second Edition, 2015.	
2.	Soumitra Mandal, ”Microprocessors and Microcontrollers Architecture, Programming and Interfacing Using 8085, 8086 and 8051” Mc Graw Hill Education, 2017	
REFERENCE BOOKS		
1.	Kenneth J Ayala, “The 8051 Microcontroller”,3rd Edition, Thomson, 2007.	
2.	Muhammad Ali Mazidi. ”The 8051 Microcontroller and Embedded Systems”, 2nd Edition, Pearson Education, 2008	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLT502	**ADVANCED DIGITAL SYSTEM DESIGN WITH HDL**	**3**	**1**	**0**	**0**	**4**
		Syllabus version			v. 1.0	
COURSE OBJECTIVES:						
Improve the student background and basic knowledge in the fields of HDL programming. 1.Improve the student skills in the logical design of digital systems. 2.To explain combinational, sequential circuits and Concept of PLA and PLDs. 3.To explain the verilog HDL with detailed study of structural data flow and behavioural modeling. 4.To explain the test bench and simulation of combinational and sequential circuits 5.To Study of RTL Coding Guidelines, Modelsim Simulation Tool, Synplify synthesis tool Tool, Xilinx Place & Route Tool. 6.Design of Memories – ROM, RAM, Design of Arithmetic Circuits, System Design.						
COURSE OUTCOME:						

1.Student will be able to understand the concept of VLSI Design flow and will able design the combinational circuit using PLDs and PAL 2.Student will able design the sequential circuit i.e. different types of registers and counters etc. Student will be able to understand the concept of Design Flow of VLSI Circuits 3.Student will be able to explain HDL languages and its type .Student will able to design combinational and sequential circuit using structural modeling, dataflow modeling and behavioral modeling of Verilog HDL 4. Student will able to write the test bench of digital circuits. Student will able to design system using ASM Chart , able to work on Model sim and will able to simulate the combinational and sequential circuit on it. 5.Student will able to design the ROM , RAM , arithmetic circuits and system like ATM machine , weighing machine etc. using Verilog HDL		
UNIT-1	**Combinational circuit using PLDs and PAL**	**12 HOURS**
Introduction to VLSI Design, Combinational Circuit Design, Programmable Logic Devices, Programmable Array Logic .		
UNIT-2	**Sequential circuit Design flow**	**12 HOURS**
Review of Flip-Flops, Sequential Circuits, Sequential Circuit Design, Design Flow of VLSI Circuits.		
UNIT-3	**HDL languages and its type**	**12 HOURS**
Verilog Modeling of Combinational Circuits, Modeling of Verilog Sequential Circuits, RTL Coding Guidelines, Coding Organization - Complete Realization.		
UNIT-4	**Test bench of digital circuits using Modelsim.**	**12 HOURS**
Writing a Test Bench, System Design using ASM Chart, Example of System Design using ASM Chart, Examples of System Design using Sequential Circuits, Simulation of Combinational and Sequential Circuits, Analysis of Waveforms using Modelsim.		
UNIT-5	**Design of Memories**	**12 HOURS**
Model Sim Simulation Tool, Synthesis Tool, Synplify Tool - Schematic Circuit Diagram View, Xilinx Place & Route Tool, Design of Memories – ROM, RAM , Design of Arithmetic Circuits, System Design Examples.		
	TOTAL LECTURE HOURS:	**60 HOURS**
TEXT BOOK(S)		
1.	Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, PHI	
2.	“John F Wakerley,”Digital Design Principles and Practice”, PHI	
REFERENCE BOOKS		
1.	Advanced Digital Design with the Verilog HDL" by Michael D. Ciletti **Publisher:** Pearson	

Course Code	Course Title	L	T	P	J	C
22EET501	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

Make the student to

1. Examine the application of microeconomics theory as applied to the manager's responsibilities in an organization.
2. Explain the basic principles of managerial economics, accounting and current business environment underlying business decision making.
3. Emphasize the quantitative and qualitative applications of economic principle to business analysis
4. Be proficient in assessing capital requirements, identifying sources of finance, and to evaluate investment proposals effectively for informed financial decision-making.
5. possess the ability to effectively perform financial accounting tasks and analysing financial data using various ratios of engineering enterprises and projects.

COURSE OUTCOMES:

After completion of this course the students are able to:

1. Evaluate various forms of business entities, forecast demand, and interpret elasticity within the business environment
2. Analyse production functions, cost structures, and perform break-even analysis to make informed decisions.
3. Analyse market structures and pricing policies, understand the dynamics of competition, optimal pricing strategies, and to make strategic pricing decisions
4. Assess capital requirements, identifying sources of finance and to evaluate investment proposals effectively in engineering projects and enterprises.
5. Apply accounting principles for Performing financial accounting tasks and to analyse financial data using various ratios

UNIT-1	BUSINESS ENVIRONMENT AND MANAGERIAL ECONOMICS	9 HOURS

Business Environment -Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Latest trends in Business Environment (Entrepreneurship).

Managerial Economics - Definition, Nature and Scope of Managerial Economics— Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand, Types, Significance of Elasticity of Demand, Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT-2	THEORY OF PRODUCTION AND COST ANALYSIS	9 HOURS

Theory of Production - Production Function — ISO quants and ISO costs, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

Cost Analysis - Cost concepts, Opportunity cost, fixed vs. Variable costs, explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA.

UNIT-3	MARKET STRUCTURES AND PRICING POLICIES	9 HOURS

Introduction to Markets & Market structures -Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.

B: Pricing Policies & Methods - Cost plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, PLC based pricing methods.

UNIT-4	CAPITAL AND CAPITAL BUDGETING	9 HOURS

Capital -Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance.

Capital Budgeting - Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

UNIT-5	FINANCIAL ACCOUNTING AND RATIOS	9 HOURS

Financial Accounting -Introduction, Accounting principles, Accounting Cycle, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Financial Analysis Through Ratios - Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

	Total Lecture hours:	45 hours

Text Book(s)

1.	Aryasri, “Managerial Economics and Financial Analysis”, TMH, 2‘d edition, 2005.
2.	Varshney & Maheswari, “Managerial Economics”, 5° edition Sultan Chand, 2003

Reference Books

1.	H. Craig Peterson & W. Cris Lewis, “Managerial Economics”, PHI, 4th Edition.
2.	Domnick Salvatore, “Managerial Economics In a Global Economy”, Thomson, 4th Edition.
3.	Raghunatha Reddy & Narasimhachary, “Managerial Economics& Financial Analysis”, 4th Edition Scitech.

4	S.N.Maheswari & S.K. Maheswari, “Financial Accounting”, 6th Edition Vikas.
5	S. Dwivedi, “Managerial Economics”, Vikas, 6th Edition.
6	E-RESOURCES 1. http://www.1earnerstv.com/Free-Economics-video-lecture-courses.htm 2. http://nptel.ac.in/courses/110105067/ 3. http://npte1.ac.in/courses/110107073/ 4. http://npte1.ac.in/courses/110101005/ 5. http://npte1.ac.in/courses/109104073/

Course Code	Course Title	L	T	P	J	C
22VLP501	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

• To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

COURSE OUTCOME:

At the end of the course the student will be able to
- Know microprocessor programming
- Develop their own projects

List of Experiments

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:

(i)Ascending / Descending order, Maximum / Minimum of numbers
(ii)Programs using Rotate instructions
(iii)Hex / ASCII / BCD code conversions.

3. Interface Experiments: with 8085

(i) A/D Interfacing. & D/A Interfacing.

4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including
   (i) Conditional jumps, looping
   (ii) Calling subroutines.
9. Programming I/O Port 8051
   (i) Study on interface with A/D & D/A
   (ii)Study on interface with DC & AC motor.
10. Mini project development with processors.

REFERENCE BOOKS

1.	Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Prentice Hall of India, Second Edition, 2015.

2.	Soumitra Mandal," Microprocessors and Microcontrollers Architecture, Programming and Interfacing Using 8085, 8086 and 8051" Mc Graw Hill Education, 2017

Course Code	Course Title	L	T	P	J	C
22VLP502	ADVANCED DIGITAL SYSTEM DESIGN WITH HDL LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To Conceptualize a novel idea / technique
2. To Use EDA tool to design complex combinational and sequential circuits.
3. To Understand the management techniques for implementation of the circuits
4. To Design the complex combinational and sequential logic circuits using various constructs in Cadence and kit.
5. To Implement the design using Xilinx and ALTERA FPGAs.

COURSE OUTCOME:

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

1. Conceptualize a novel idea / technique

2. Use EDA tool to design complex combinational and sequential circuits.

3. Understand the management techniques for implementation of the circuits

4. Design the complex combinational and sequential logic circuits using various constructs in Cadence and kit.

5. Implement the design using Xilinx and ALTERA FPGAs.

List of Experiments

1. Design MIPS 32-Bit RISC Processor and implement it using ALTERA Cyclone IV FPGA and Study about it's performance.
2. Design a Reconfigurable FIR Filter and verify it's functionality through test bench. Implement the design using ALTERA Cyclone IV FPGA
3. Design and Implementation of Smart Traffic Light System for congested four way road using ALTERA Cyclone IV FPGA.
4. Design and Implementation of CORDIC Algorithm using ALTERA Cyclone IV FPGA.
5. Design a MOS based SRAM cell using 180 nm technology and verify its characteristics.
6. Design NOR gate using Domino logic CMOS inverter and verify its characteristics.
7. Design CMOS transmission gate and perform all the analysis to verify its characteristics.
8. Design XOR and XNOR gate using dynamic CMOS logic circuits and verify its characteristics.

Laboratory Requirements

1.	ALTERA Cyclone IV FPGA-10 Nos
2.	Cadence -10 Users
3.	Xilinx

REFERENCE BOOKS	
1.	Neil H. E. Weste , David Money Harris -CMOS VLSI Design-A Circuits and Systems Perspective, Fourth Edition,2011
2.	Digital Integrated Circuits a Design Perspective-Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic
3.	Fundamentals of Digital Logic with VHDL Design (3rd ed.), S.Brown, Z. Vranesic (2008), ISBN: 978-0077221430
4.	FPGA Prototyping by VHDL Examples, Xilinx Spartan-3 version, Pong P. Chu (2008), ISBN: 978-0470185315
5.	VHDL for Logic Synthesis, Andrew Rushton (2011), ISBN: 978-0470688472
Web Resources	
1.	https://web.itu.edu.tr/~ateserd/CADENCE%20Manual.pdf
2.	https://www.xilinx.com/support/documentation/sw_manuals/xilinx2020_2/ug888-vivado-designflows-overview-tutorial.pdf
3.	https://www.intel.com/content/dam/www/programmable/us/en/pdfs/literature/manual/intro_to_quartus2.pdf
4.	• http://www.cse.unt.edu/~smohanty/Teaching/2004Fall_DSD/LectureSlides.html • http://www.ece.unm.edu/~jimp/vhdl_fpgas/

Course Code	Course Title	L	T	P	J	C
22EEP501	**INTERNSHIP**	**0**	**0**	**0**	**0**	**1**
	Completion of minimum of Two semesters	**Syllabus version**			**v. 1.0**	

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To enhance the knowledge of the students in professional engineering practice sought through industrial training on different current technologies.
2.To expose students to real work life situations and to equip them with abreast of new technology that intensify their job acumen.
3.To employ the students in industrial projects and strengthen the practical skills of the students.
4.To develop significant commitment in the students' profession and specialization.

COURSE OUTCOMES: After completion of this course, the students should be able to

1. Have an exposure to industrial practices and to work in teams
2. Communicate effectively
3. Understand the impact of engineering solutions in a global, economic, environmental and societal context
4. Develop the ability to engage in research and to involve in life-long learning
5. Extend the knowledge through research and development in the chosen fields of specialization.

1.Four weeks of work at industry site and Supervised by an expert at the industry.
2.Mode of Evaluation: Internship Report, Presentation and Project Review
3.The students individually undertake training in reputed Mechanical, Mechatronics and Automation engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 04 WEEKS

SEMESTER-VI

Course Code	Course Title	L	T	P	J	C
22VLT601	STATIC TIMING ANALYSIS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Identify and apply timing arc information from a library, including unateness, delays, and slew
2. Identify cell delays from a library and calculate output slew degradation
3. Use wire-load information to calculate net delays
4. Identify the properties of a clock, including period, edges, slew, and duty cycle
5. Apply setup and hold checks to diagnose design violations

COURSE OUTCOME:

1. Understand the concepts and arithmetic behind digital logic circuitry timing analysis
2. Perform Static Timing Analysis on a digital circuit
3. Figuring out the maximum operating frequency of any sequential circuit
4. Identify the timing violations and mitigate them
5. Identify all the timing paths in a circuit

UNIT-1	INTRODUCTION TO STA	9 HOURS

Introduction to STA, STA Vs DTA, Set up checks for filp-flop and latches, hold Checks for filp-flops and latches.

UNIT-2	STANDARD CELL AND TIMING LIBRARIES	9 HOURS

Primitive cell libraries, timing Libraries and modes (NLDH &CCS),Timing Arc and Unate, Timing Libraries and Constrains.

UNIT-3	PARASITIC CORNERS	9 HOURS

C wrost, C best, RC worst, RC best, Typical, PVT corners.

UNIT-4	DELAY CALCULATION	9 HOURS

Cell Delay, Net Delay Calculation, Multi VT Libraries, Delay Vs Multi VT Libraries, SDC synopsis Design Constraints, Clock Deformation, Path exception, ID delay modeling.

UNIT-5	TIMING ANALYSIS	9 HOURS

Max Tran, Max Cap & Max Fanout Analysis, Setup & Hold Timing Analysis.

TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S)	
1.	Static Timing Analysis for Nanometer Designs: A Practical Approach 2009th Edition by J. Bhasker, Rakesh Chadha
REFERENCE BOOKS	
1.	Golshan, Khosrow. (2007). Physical design essentials: An asic design implementation perspective.
2.	https://onlinecourses.nptel.ac.in/noc22_ee44/preview

Course Code	Course Title	L	T	P	J	C
22VLT602	CAD FOR VLSI	3	0	2	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the VLSI design methodologies and design methods.
2.To introduce data structures and algorithms required for VLSI design.
3. To study algorithms for partitioning and placement.
4. To study algorithms for floor planning and routing.
5. To study algorithms for modelling, simulation and synthesis.

COURSE OUTCOME:

1.Specify layout techniques in IC.
2.Identify algorithms required for circuit simulators.
3.Incorporate timing analysis and floor planning.
4.Apply scripting language PERL to improve EDA tool flow
5.Specify layout techniques in IC.

UNIT-1	Introduction to Design Methodologies	6 HOURS

The VLSI Design Problem, Design Methods and Technologies, Layout Methodologies, Top-Down Approach: Routing: Fundamentals, Global Routing, Detailed Routing.

UNIT-2	Performance Issues in Circuit Layout	6 HOURS

Delay Models, Timing Driven Placement, Timing Driven Routing, Power Minimization.

UNIT-3	Single-Layer Routing and Applications	6 HOURS

Planar Subset Problem, Single-Layer Global Routing, Over-the-cell Routing, Multichip Modules, Wire-Length and Bend Minimization Techniques.

UNIT-4	Cell Generation and Programmable Structures.	6 HOURS

Programmable Logic Arrays, Transistor Chaining, Weinberger Arrays and Gate Matrix Layout.

UNIT-5	Compaction	6 HOURS

CMOS Cell Layout Styles Considering Performance Issues, Compaction: 1D Compaction, 2D Compaction	
TOTAL LECTURE HOURS:	**30 HOURS**

PRACTICAL EXERCISE:

1. Design XOR and XNOR gate using dynamic CMOS logic circuits and verify its characteristics.
2. Design NOR gate using Domino logic CMOS inverter and verify its characteristics.
3. Design XOR gate by using NAND and NOR gate. Perform transient analysis.
4. Design CMOS transmission gate and perform all the analysis to verify its characteristics.
5. Design Layout of CMOS inverter and perform post layout analysis, Monte Carlo analysis, Corner analysis
6. Design and verify the circuit (using 180 nm technology) using transient analysis.

TOTAL HOURS: 60

TEXT BOOK(S)

1.	Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, PHI
2.	“John F Wakerley,”Digital Design Principles and Practice”, PHI

REFERENCE BOOKS

1.	Advanced Digital Design with the Verilog HDL" by Michael D. Ciletti **Publisher:** Pearson

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLT603	**DESIGN FOR TESTABILITY**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the VLSI testing.
2. To introduce logic and fault simulation and testability measures
3. To study the test generation for combinational and sequential circuits
4. To study the design for testability.
5. To study the fault diagnosis

COURSE OUTCOME:

CO1: Understand VLSI Testing Process
CO2: Develop Logic Simulation and Fault Simulation
CO3: Develop Test for Combinational and Sequential Circuits
CO4: Understand the Design for Testability
CO5:Perform Fault Diagnosis.

UNIT-1	**INTRODUCTION TO TESTING**	**9 HOURS**

Role of testing in VLSI Design flow, Testing at different levels of abstraction, Fault, error, defect, diagnosis, yield, Types of testing, Rule of Ten, Defects in VLSI chip. Various types of faults, Fault equivalence and Fault dominance in combinational sequential circuits.VLSI Testing Process and Test Equipment – Challenges in VLSI Testing – Test Economics and Product Quality – Fault Modeling – Relationship Among Fault Models.		
UNIT-2	**LOGIC & FAULT SIMULATION & TESTABILITY MEASURES**	**9 HOURS**
Modelling basic concepts, Functional modelling at logic level and register level, structure models, delay models. Simulation for Design Verification and Test Evaluation – Modeling Circuits for Simulation –Algorithms for True Value and Fault Simulation – Scoap Controllability and Observability		
UNIT-3	**TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS**	**9 HOURS**
Algorithms and Representations – Redundancy Identification – Combinational ATPG Algorithms –Sequential ATPG Algorithms – Simulation Based ATPG – Genetic Algorithm Based ATPG		
UNIT-4	**DESIGN FOR TESTABILITY**	**9 HOURS**
Classical scan based design .Design for Testability Basics – Testability Analysis - Scan Cell Designs – Scan Architecture – Built-in Self-Test – Random Logic Bist – DFT for Other Test Objectives.		
UNIT-5	**FAULT DIAGNOSIS**	**9 HOURS**
Introduction and Basic Definitions – Fault Models for Diagnosis – Generation of Vectors for Diagnosis – Combinational Logic Diagnosis - Scan Chain Diagnosis – Logic BIST Diagnosis.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Laung-Terng Wang, Cheng-Wen Wu and Xiaoqing Wen, “VLSI Test Principles and Architectures”, Elsevier, 2017	
2.	Michael L. Bushnell and Vishwani D. Agrawal, “Essentials of Electronic Testing for Digital,Memory & Mixed-Signal VLSI Circuits” , Kluwer Academic Publishers, 2017.	
REFERENCE BOOKS		
1.	Niraj K. Jha and Sandeep Gupta, “Testing of Digital Systems”, Cambridge University Press,2017.	
2.	M. Abramovici, M. Breuer, and A. Friedman, “Digital Systems Testing and Testable Design, IEEE Press, 1990.	
3.	Stroud, “A Designer’s Guide to Built-in Self-Test”, Kluwer Academic Publishers, 2002	
4.	V. Agrawal and S.C. Seth, Test Generation for VLSI Chips, Computer Society Press.1989	

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NXP601	NCC Credit Course Level III*(NAVAL WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-I	NCC GENERAL	3 HOURS
NCC 1 Aims, Objectives & Organization of NCC/NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		
UNIT-II	**NATIONAL INTEGRATION AND AWARENESS**	**3 HOURS**
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-III	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		
UNIT-IV	**LEADERSHIP**	**2 HOURS**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-V	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL PRACTICAL HOURS	**15 HOURS**

Course Code	Course Title	L	T	P	J	C
22EEP601	**QUANTITATIVE APTITUDE AND LOGICAL REASONING – II**	**0**	**0**	**2**	**0**	**1**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

This module would train the students on the quick ways to solve quantitative aptitude problems and questions applying logical reasoning, within a short time span given during the placement drives.

COURSE OUTCOME:

1. Solve quantitative aptitude problems
2. Apply logical Reasoning
3. Developing quantitative literacy skills

LIST OF EXPERIMENTS:

1. Mock interviews on one-on-one basis 2. Quantitative aptitude 3. Time and Distance 4. Height and Distance 5. Problems on Ages, Trains 6. Pipes and Cistern Boats and Streams 7. Probability 8. Logical Reasoning 9. Direction Sense test 10. Venn diagrams 11. Seating arrangements 12. Cause and effect 13. Blood relation test 14. Dice 15. Logical verbal puzzles
TOTAL LECTURE HOURS: 30 Hours

Course Code	Course Title	L	T	P	J	C
22EEP602	COMPREHENSIVE ASSESSMENT	0	0	2	0	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To provide a thorough understanding of node and mesh analysis techniques and their applications in electrical circuits.

To Understanding Signal Processing Concepts.

To Understanding VLSI system and tools.

To Understanding Digital Logic and Circuit Design.

To Understanding Control Systems and Stability Analysis

COURSE OUTCOME:

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

CO1: Able to solve complex electrical circuits using different analysis.
CO2: Able to apply these concepts to analyze and process signals in both continuous and discrete domains.

CO3: Able to explain the basics of MOS transistors, CMOS operations and FPGA architecture.
CO 4: understand and apply the principles of digital logic and circuit design
CO5: Able to analyze and design control systems using principles of feedback, transfer functions, to evaluate the stability and performance of control systems

UNIT-1	**NETWORKS ANALYSIS**	**9 HOURS**
Node and mesh analysis - Superposition, Thevenin's theorem, Norton's theorem & reciprocity - Sinusoidal steady state analysis: phasors, complex power - Maximum power transfer -Time and frequency domain analysis of linear circuits such as RL, RC and RLC circuits - Solution of network equations using Laplace transform - Linear 2-port network parameters, wye-delta transformation.		
UNIT-2	**SIGNAL & SYSTEMS**	**9HOURS**
Fourier series - Fourier transform -Sampling theorem and applications -DTFT, DFT, z-transform - Discrete-time processing of continuous-time signals - LTI systems: definition and properties, causality & stability, their impulse response & convolution, poles & zeroes - Frequency response, group delay, phase delay.		
UNIT-3	**VLSI SYSTEM AND TOOLS**	**9 HOURS**
MOS transistor theory, MOSFET structure, CMOS fabrication technology, Combinational circuit design, sequential circuit design, ROM, SRAM, DRAM, flash memory, TTL, ECL, CMOS logic gates, noise margins, power dissipation, fan-out, propagation delay, VLSI design flow, ASIC design flow, CAD tools for VLSI design, FPGA architecture.		
UNIT-4	**DIGITAL CIRCUITS**	**9HOURS**
Binary Number system - Integer & floating-point- numbers - Boolean algebra - Minimization of Boolean functions using Boolean identities &Karnaugh map - Logic gates & their static CMOS implementations - Arithmetic circuits - Code converters - Multiplexers & decoders - Latches & flip-flops - Propagation delay & critical path delay - Setup and hold time.		
UNIT-5	**CONTROL SYSTEMS**	**9 HOURS**
Feedback principle - Transfer function -Block diagram representation - Signal flow graph Frequency response -Routh-Hurwitz &Nyquist stability criteria - Bode and root-locus plots - Lag, lead & lag lead compensation - State variable model - Solution of state equation of LTI systems.		
TOTAL LECTURE HOURS:		**45 HOURS**

TEXT BOOK(S)

1.	Circuit Theory and Design" by Robert L. Boylestad
2.	Neil H. E. Weste , David Money Harris -CMOS VLSI Design-A Circuits and Systems Perspective, Fourth Edition,2011.
3.	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011

REFERENCE BOOKS

1.	Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin
2.	Semiconductor Physics and Devices" by Donald A. Neamen

3.	Digital Design" by M. Morris Mano and Michael D. Ciletti
4.	Modern Control Engineering" by Katsuhiko Ogata
5.	Control Systems Engineering" by I.J. Nagrath and M. Gopal

Course Code	Course Title	L	T	P	J	C
22VLP601	RTL SYNTHESIS AND STATIC TIMING ANALYSIS LABORATORY	0	0	4	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Use programmable logic devices to implement a variety of digital circuits.
2. Create an understanding of RTL synthesis and optimization methods.
3. Create an RTL netlist for an electronic circuit.
4. Examine the performance
5. Using the KL method in an EDA setting

COURSE OUTCOME:

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

1. Implement various digital circuits using Programmable Logic Devices
2. Develop the concepts of RTL synthesis and optimization techniques
3. Generate RTL netlist for a digital circuit
4. Analyze the performance
5. Implementation of KL algorithm in EDA environment

List of Experiments

1. UART module design.
2. Go through for UART (Study experiment)
3. Develop Synopsis design constraints(read by timing constraints)
4.Perform RTL synthesis
5.Perform timing analysis
6.Perform Quality Analysis check

TEXT BOOKS

1.	Vaibbhav Taraate, Digital Logic Design Using Verilog Coding and RTL Synthesis, Springer , 2016
2.	Sunggu lee, Advanced Digital Logic Design Using VHDL, State Machines, and Synthesis for FPGA's, CL- Engineering, 2005

REFERENCE BOOKS

1.	Taraate, Vaibbhav. ASIC Design and Synthesis: RTL Design Using Verilog. Germany: Springer Singapore, 2021.

SEMESTER VII

Course Code	Course Title	L	T	P	J	C
22VLT701	Low Power VLSI Design	3	1	0	0	4
		Syllabus			v. 1.0	

		version	

COURSE OBJECTIVES:

- Identify sources of power in an IC.
- Identify the power reduction techniques based on technology independent and technology dependent
- Power dissipation mechanism in various MOS logic style.
- Identify suitable techniques to reduce the power dissipation.
- Design memory circuits with low power dissipation.

COURSE OUTCOME:

- The student will get to know the basics and advanced techniques in low power design which is a hot topic in today‟s market where the power plays major role.
- The reduction in power dissipation by an IC earns a lot including reduction in size, cost and etc.

UNIT-1	POWER DISSIPATION IN CMOS	12 HOURS

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design.

UNIT-2	POWER OPTIMIZATION	12 HOURS

Logic level power optimization – Circuit level low power design – Standard Adder Cells, CMOS Adders Architectures-BiCMOS adders - Low Voltage Low Power Design Techniques, Current Mode Adders -Types of Multiplier Architectures, Braun, Booth and Wallace Tree Multipliers and their performance comparison.

UNIT-3	DESIGN OF LOW POWER CMOS CIRCUITS	12 HOURS

Computer arithmetic techniques for low power system – low voltage low power static Random access and dynamic Random access memories – low power clock, Inter connect and layout design – Advanced techniques – Special techniques.

.

UNIT-4	POWER ESTIMATION	12 HOURS

Power Estimation techniques – logic power estimation – Simulation power analysis –Probabilistic power analysis.

UNIT-5	SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER	12 HOURS

Synthesis for low power – Behavioral level transform – software design for low power.

TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)

1.	Abdelatif Belaouar, Mohamed. I. Elmasry, “Low power digital VLSI design”, Kluwer, 1995.
2.	A.P. Chandrasekaran and R.W. Broadersen, “Low power digital CMOS design”, Kluwer,1995.
REFERENCE BOOKS	
1.	Dimitrios Soudris, C. Pignet, Costas Goutis, “Designing CMOS Circuits for Low Power” Kluwer, 2002.
2.	Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.
3.	James B. Kulo, Shih-Chia Lin, “Low voltage SOI CMOS VLSI devices and Circuits”, John Wiley and sons, inc. 2001.
4.	J.B. Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley 1999.
5.	Kaushik Roy and S.C. Prasad, “Low power CMOS VLSI circuit design”, Wiley, 2000.
6.	Kiat-send Yeo, Kaushik Roy “Low-Voltage, Low-power VLSI Subsystem”, Tata McGraw-Hill, 2009.

Course Code	Course Title	L	T	P	J	C
22VLJ701	PROJECT WORK - PHASE	0	0	0	2	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES: After completion of this course, the students should be able to

Upon successful completion of the course, the student will be able to

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL HOURS	**30 HOURS**

Course Code	Course Title	L	T	P	J	C
22EEP701	PRODUCT DESIGN AND DEVELOPMENT	0	0	0	4	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To train the students in

1. Identifying problem and developing the structured methodology to solve the identified problem in the industry or research problem at research Institution or college.
2. Conducting experiments, analyze and discuss the test results, and make conclusions.
3. Preparing project reports and presentation

COURSE OUTCOME:

At the end of the project, the student will be able to

CO1: Formulate and analyze problem / create a new product/ process.

CO2: Design and conduct experiments to find solution

CO3: Analyze the results and provide solution for the identified problem, prepare project report and make presentation.

The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

Course Code	Course Title	L	T	P	J	C
22EEP702	INTERNSHIP	0	0	0	0	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To enhance the knowledge of the students in professional engineering practice sought through industrial training on different current technologies.
2.To expose students to real work life situations and to equip them with abreast of new technology that intensify their job acumen.
3.To employ the students in industrial projects and strengthen the practical skills of the students.
4.To develop significant commitment in the students' profession and specialization.

COURSE OUTCOMES: After completion of this course, the students should be able to

1. Have an exposure to industrial practices and to work in teams
2. Communicate effectively
3. Understand the impact of engineering solutions in a global, economic, environmental and societal context
4. Develop the ability to engage in research and to involve in life-long learning
5. Extend the knowledge through research and development in the chosen fields of specialization.

1.Four weeks of work at industry site and Supervised by an expert at the industry.
2.Mode of Evaluation: Internship Report, Presentation and Project Review
3.The students individually undertake training in reputed Mechanical, Mechatronics and Automation engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 04 WEEKS

SEMESTER VIII

Course Code	Course Title	L	T	P	J	C
22VLJ801	PROJECT WORK - PHASE	0	0	0	16	8
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES: After completion of this course, the students should be able to

Upon successful completion of the course, the student will be able to

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL HOURS	**300 HOURS**

VERTICAL I
SEMICONDUCTOR CHIP DESIGN AND TESTING

Course Code	Course Title	L	T	P	J	C
22VLE001	SOLID STATE DEVICE MODELLING	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the operating principles of semiconductors.
2. To understand the principles of MOSFET devices physics.
3. To analyze various models and implementation in circuit simulators.
4. To understand the device scaling and variabity effects.

COURSE OUTCOME:

At the end of the course, the student will be able to:

CO1: Apply the semiconductor concepts of drift, diffusion, donors and acceptors, majority and minority carriers, and carrier mobility

CO2: Illustrate the physics and principles of operation of p-n junction diodes, MOS capacitors, and MOSFETs

CO3: Design and simulate MOSFET devices, taking into consideration of non-ideal and short channel effects

CO4: Develop compact models for short-channel MOSFETs suitable for SPICE simulators

CO5:Analyze the process variability and reliability effects of the nano-scaled MOSFETs and simulate the device lifetime.

UNIT-1	BASIC THEORY OF SEMICONDUCTORS	9 HOURS

Introduction, - direct and indirect semiconductors – Fermi-Dirac statistics - Quasi-Fermi Levels - Poisson's Equation, conduction in semiconductor, effect of temperature, doping, and high electric field on carrier mobility, PN junction at equilibrium - current-voltage characteristics-diode current model and its limitations

UNIT-2	MOSFET DEVICE PHYSICS	9 HOURS

MOS capacitor – potential balance and charge balance, the effect of gate-body voltage – MOSFET structures - qualitative description of MOS transistor operation – MOS transistor characteristics – Transistor regions of operations – CMOS fabrication process

UNIT-3	MOSFET STATIC MODELS	9 HOURS

Static drain current model – simple charge control model - Pao-Sah model - Pierret-Shields's model – charge sheet model – strong inversion model – weak inversion model – SPICE model, short channel effects, Quantum mechanical effects, modeling of lightly doped drain MOSFET and SOI MOSFET

UNIT-4	MODELING FOR CIRCUIT SIMULATORS	9 HOURS
Introduction, types of models, attributes for good compact models, model formulation, model implementation in circuit simulators, model testing, parameter extraction, simulation, and extraction for RF applications.		
UNIT-5	**DEVICE SCALING AND VARIABILITY EFFECTS**	**9 HOURS**
Introduction, classical scaling laws, process variability- global and local process variability, characterization of parametric variability in MOSFETs, Reliability of MOSFETs - high-field effects, hot carrier degradation, bias temperature instability, MOSFET breakdown, high-k dielectrics.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	Tsividis, Y. & McAndrew, C. Operation, and modeling of the MOS transistor. Third edition, Oxford University Press, USA: 2011
2.	AB Bhattacharyya, “Compact MOSFET models for VLSI design”, Wiley, New York, 2009. 3.

REFERENCE BOOKS

1.	J.J.Liou, A. Ortiz-Conde, F. Garcia-Sanchez, “Analysis and Design of MOSFETs: Modeling,
2.	K. Saha, “Compact models for integrated circuit design: Conventional transistors and beyond”, Taylor & Francis, 2015.
3.	T. Ytterdal, Y. Cheng, T. A. Fjeldly, “Device Modeling for Analog and RF CMOS Circuit Design”, John Wiley & Sons, New York 2003

Course Code	Course Title	L	T	P	J	C
22VLE002	RTL SYNTHESIS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. understand the High level methodology and coding skills to synthesis of logic circuits
2. Analyze coding skills for synthesis of logic circuits
3. Study about the libraries and design logic to meet the specification and optimization
4. Understand the design constraints of FSM

COURSE OUTCOME:

CO1. To learn High-Level Design Methodology and overview of design flow

CO2. To learn the coding skills relevant to synthesis of logic circuits.

CO3.To understand importance of libraries in synthesis flow

CO4. To design logic to meet specifications and optimization

CO5. To understand the design constrains related to FSM		
UNIT-1	High-Level Design Methodology Overview	**9 HOURS**
ASIC Design Flow Using Synthesis, HDL Coding, RTL Behavioral and Gate-Level Simulation, Logic Synthesis, Design for Testability, Design Re-Use, Behavioral Synthesis & Concepts. Design Analyzer and Design compiler, Target Library, Link Library, and Symbol Library, Cell names, Instance names, and VHDL Libraries in the Synthesis Environment, Synthesis		
UNIT-2	VHDL/Verilog Coding for Synthesis	**9 HOURS**
General HDL Coding Issues, VHDL vs. Verilog: The Language Issue, Finite State Machines, HDL Coding Examples, Classic Scenarios.		
UNIT-3	Links to Layout	**9 HOURS**
Motivation for Links to Layout Floor planning, Link to Layout Flow Using Floorplan Manager, Creating Wire Load Models After Back-Annotation Re-Optimizing Designs After P&R. Design for Testability: Introduction to Test Synthesis		
UNIT-4	Constraining and Optimizing Designs	**9 HOURS**
Synthesis Background, Clock Specification for Synthesis, Design Compiler Timing Reports, Commonly Used Design, Compiler Commands, Strategies for Compiling Designs, Typical Scenarios When Optimizing Designs		
UNIT-5	Constraining and Optimizing Designs for FSM	**9 HOURS**
: Finite State Machine (FSM) Synthesis, Fixing Min Delay Violations Technology Translation, Translating Designs with Black-Box Cells, Pad Synthesis, Classic		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Kurup Pran, Taher Abbasi, Logic Synthesis using Synopsys, 2/e, Pearson Education, 2007.	
2.	VHDL for Logic Synthesis, Third Edition. Andrew Rushton. © 2011 John Wiley & Sons, Ltd. Published 2011 by John Wiley & Sons, Ltd.	
REFERENCE BOOKS		
1.	Weng Fook Lee, VHDL Coding and Logic Synthesis with Synopsys, Academic Press, 2000	
2.	Morris Mano, Michael D. Ciletti, Digital Design , 4/e, Prentice Hall of India, 2008	
3.	Himanshu Bhatnagar, Advanced ASIC Chip Synthesis, Springer Science, 2013	

Course Code	Course Title	L	T	P	J	C
22VLE003	VALIDATION AND TESTING TECHNOLOGY	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Getting familiar with various IC technology.
2. Learn MOS theory and testing
3. Learn CMOS circuit theory and testing
4. Getting expertise on CMOS characterization.
5. Explore circuit and device level testing methods

COURSE OUTCOME:

CO1: Complete overview to CMOS fabrication process.
CO2: Understand the fundamental concept of MOS FET and testing.
CO3: Explain the concept of MOS theory and analysis.
CO4: To give the student an understanding of CMOS performance testing and estimation.
CO5: Explain the basics of Testing and Fault Modeling

UNIT-1	TECHNOLOGY INTRODUCTION	9 HOURS

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. VLSI Fabrication, Oxidation, Lithography, Diffusion, Ion Implantation, Metallization, Integrated Resistors and Capacitors

UNIT-2	MOS THEORY ANALYSIS-I	9 HOURS

Basic Electrical Properties of MOS Circuits: Ids-Vds Relationships, MOS Transistor Threshold Voltage Vth, gm, gds, Figure of Merit ωo, Short Channel and Narrow Channel Width Effects.

UNIT-3	MOS THEORY ANALYSIS- II	9 HOURS

Pass Transistor, Transmission Gate, NMOS Inverter, Various Pull-ups, CMOS Inverter Analysis and Design, Bi-CMOS Inverters, Latch up in CMOS Circuits.

UNIT-4	CMOS CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION	9 HOURS

Sheet Resistance RS, conductivity and its Concept to MOS, Area Capacitance Units, Calculations - Delays, Driving Large Capacitive Loads, Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Reliability.

UNIT-5	BASIC OF SILICON VALIDATION	9 HOURS

Need for Testing, testing at Various Levels, Objectives of Testing - VLSI Test process and Test Equipment - Types of Testing: Functionality Tests, Silicon Debug, Manufacturing Tests, Defect during manufacturing - Fault Modelling, Observability and Controllability, Fault Coverage, Fault Sampling - ATE, Test economics.

	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.	
2.	Neil H. E. Weste and David. Harris Ayan Banerjee,, “CMOS VLSI Design” - Pearson Education, 1999.	
REFERENCE BOOKS		
1.	M.L. Bushnell and V.D. Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2004	
2.	N.K. Jha and S.G. Gupta, “Testing of Digital Systems”, Cambridge University Press, 2003	
3.	Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22ECE006	**ANALOG IC DESIGN**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

The course is aimed to
1. Analyze and design single-ended and differential IC amplifiers.
2. Understand the relationships between devices, circuits and systems.
3. Emphasize the design of practical amplifiers, small systems and their design parameter trade-offs.

COURSE OUTCOME:

At the end of the course the student will be able to
1. analyze low-frequency characteristics of single-stage amplifiers and differential amplifiers.
2. analyze high-frequency response and noise of amplifiers.
3. Understand the feedback concepts.
4. analyze and Design of High Gain Amplifiers.
5. Understand stability analysis and frequency compensation techniques of amplifiers

UNIT-1	**CURRENT SOURCE AND AMPLIFIER DESIGN**	**9 HOURS**

MOS Device models, MOS Current Sources and Sinks, Current Mirror: Basic Current Mirrors, Cascode current Mirrors. Bandgap references. Single stage Amplifies: Basic concepts, Common Source stage, Common Gate stage, Cascode stage. Differential stage: Single ended and Differential operation. Basic Differential Pair

UNIT-2	**FREQUENCY RESPONSE AND NOISE ANALYSIS OF AMPLIFIERS**	**9 HOURS**

Miller effect, Frequency response of Common Source stage, Common Gate stage, Cascode stage and Differential pair. Noise in Amplifiers: Common Source stage, Common Gate stage, Cascode stage, Differential pair. Noise Bandwidth.		
UNIT-3	**FEEDBACK AMPLIFIERS**	**9 HOURS**
Ideal feedback equation, Gain sensitivity, Effect of Negative Feedback on Distortion, Types of Feedback Amplifiers. Feedback configurations: voltage-voltage, current-voltage, current-current, voltage-current feedback. Practical configurations and Effect of loading		
UNIT-4	**OPERATIONAL AMPLIFIER**	**9 HOURS**
Common mode Feedback circuits, Op Amp CMRR requirements, Need for Single and Multistage amplifiers, Effect of loading in Differential stage. Performance Analysis: DC gain, Frequency response, Noise, Mismatch, Slew rate of cascode and two stage Op Amps, Fully Differential Op Amps, Common-Mode feedback loop stability		
UNIT-5	**STABILITY ANALYSIS**	**9 HOURS**
Basic Concepts, Instability and the Nyquist Criterion, Stability Study for a Frequency-Selective Feedback Network, Effect of Pole Locations on Stability		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, Second Edition, 2017.	
2.	David Johns and Ken Martin, Analog Integrated Circuit Design, John Wiley & Sons, Inc., Second Edition, 2012	
REFERENCE BOOKS		
1.	Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, UK, Second Edition, 2010	
2.	R. Jacob Baker, CMOS Circuit Design, Layout and Simulation, IEEE Press Series on Microelectronic Systems, Wiley Publications, Third Edition, 2010.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22ECE005	**MIXED SIGNAL IC DESIGN TESTING**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- To know about mixed-signal devices and the need for testing these devices.
- To study the various techniques for testing.
- To learn about ADC and DAC based testing.
- To understand the Clock and Serial Data Communications Channels
- To study the general purpose measuring devices.

COURSE OUTCOME:

CO1: Learn the fundamentals of mixed signal circuits.
CO2: Define the various measurement terminologies.
CO3: Acquire knowledge of Analog to Digital Converters.

CO4: Learn testing of Analog to Digital Converters. **CO5:**Comprehend the attributes of a clock signal.		
UNIT-1	**MIXED – SIGNAL TESTING**	**9 HOURS**
Common Types of Analog and Mixed- Signal Circuits – Applications of Mixed-Signal Circuits - Post- Silicon Production Flow - Test and Packing – Characterization versus Production Testing - Test and Diagnostic Equipment - Automated Test Equipments – Wafer Probers – Handlers – E-Beam Probers – Focused Ion Beam Equipments – Forced –Temperature		
UNIT-2	**YIELD, MEASUREMENT ACCURACY, AND TEST TIME**	**9 HOURS**
Yield - Measurement Terminology - Repeatability, Bias, and Accuracy - Calibrations and Checkers - Tester Specifications - Reducing Measurement Error with Greater Measurement Time – Guardbands - Effects of Measurement Variability on Test Yield - Effects of Reproducibilty and Process Variation on Yield - Statistical Process Control		
UNIT-3	**DAC TESTING**	**9 HOURS**
Basics of Data Converters -Principles of DAC and ADC Conversion, Data Formats, Comparison of DACs and ADCs, DAC Failure Mechanisms - Basic DC Tests - Transfer Curve Tests - Dynamic DAC Tests - Tests for Common DAC Applications		
UNIT-4	**ADC TESTING**	**9 HOURS**
ADC Testing Versus DAC Testing - ADC Code Edge Measurements - Edge Code Testing Versus Center Code Testing, Step Search and Binary Search Methods, Servo Method, Linear Ramp Histogram Method, Histograms to Code Edge Transfer Curves, Rising Ramps Versus Falling Ramps, Sinusoidal Histogram Method - DC Tests and Transfer Curve Tests - Dynamic ADC Tests - Tests for Common ADC Applications		
UNIT-5	**CLOCK AND SERIAL DATA COMMUNICATIONS CHANNEL MEASUREMENT**	**9 HOURS**
Synchronous and Asynchronous Communications - Time-Domain Attributes of a Clock Signal - Frequency-Domain Attributes of a Clock Signal - Communicating Serially Over a Channel - Bit Error Rate Measurement - Methods to Speed Up BER Tests in Production - Deterministic Jitter Decomposition - Jitter Transmission Tests		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Gordon W.Roberts, Friedrich Taenzler, Mark Burns, “An Introduction to Mixed-signal IC Test and Measurement” Oxford University Press, Inc.2012 (Unit I - V)	
2.	M.L.Bushnell and V.D.Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2002. (Unit - III)	
REFERENCE BOOKS		
1.	BapirajuVinnakota, “Analog and mixed-signal test”, Prentice Hall, 1998.(Unit - II)	

2.	Digital and Analogue Instrumentation: Testing and Measurement by Nihal Kularatna

Course Code	Course Title	L	T	P	J	C
22VLE004	DESIGN VERIFICATION METHODOLOGIES	2	0	2	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To Familiarise of Front end design and verification techniques and create reusable test environments.
2. Verify increasingly complex designs more efficiently and effectively.
3. Understand various challenges in physical design.

COURSE OUTCOME:

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

1. Analyze various digital systems
2. Familiarity of Front end design and
3. Understand verification techniques and create reusable test environments.
4. Verify increasingly complex designs more efficiently and effectively.
5. Analyze various challenges in physical design.

UNIT-1	DIGITAL SYSTEMS	6 HOURS

Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Logic families Synchronous FSM and asynchronous design, Metastability, Clock distribution and issues, basic building blocks like PWM module, pre-fetch unit, programmable counter, FIFO, Booth's multiplier, ALU, Barrel shifter etc.

UNIT-2	VERILOG AND SIMULATION	6 HOURS

Verilog/VHDL Comparisons and Guidelines, Verilog: HDL fundamentals, simulation, and test- bench design, Examples of Verilog codes for combinational and sequential logic, Verilog AMS

UNIT-3	VERILOG AND VERIFICATION	6 HOURS

System Verilog and Verification: Verification guidelines, Data types, procedural statements and routines, connecting the test bench and design, Assertions, Basic OOP concepts, Randomization, Introduction to basic scripting language: Perl, Tcl/Tk

UNIT-4	VARIOUS CHALLENGES	6 HOURS

Current challenges in physical design: Roots of challenges, Delays: Wire load models Generic PD flow, Challenges in PD flow at different steps, SI Challenge - Noise & Crosstalk, IR Drop

UNIT-5	PLD AND FPGA	6 HOURS

Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's, FPGA with technology: Antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC Design Flows, Programmable Interconnections, Coarse grained reconfigurable devices	
TOTAL LECTURE HOURS:	**30 HOURS**
PRACTICAL EXERCISE: **1. Verification of UART Protocol by using UVM** **2. Verification of SPI Protocol by using UVM** **3. Verification of AMBA AXI Protocol by using UVM** **4. Design of UART Protocol by using Verilog** **5. Design of DMA by using Verilog**	**30 HOURS**
TOTAL HOURS: 60 HOURS	
TEXT BOOK(S)	
1.	Douglas Smith, “HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog”, Doone publications, 1998
2.	Samir Palnitkar, “Verilog HDL: A guide to Digital Design and Synthesis”, Prentice Hall, 2nd Edition, 2003.
REFERENCE BOOKS	
1.	Doug Amos, Austin Lesea, Rene Richter, “FPGA based Prototyping Methodology Manual”, Synopsys Press, 2011.
2.	Christophe Bobda, “Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications”, Springer, 2007.
3.	Janick Bergeron, “Writing Testbenches: Functional Verification of HDL Models”, Second Edition, Springer, 2003.

VERTICALS II
MULTICORE IMPLEMENTATION

Course Code	Course Title	L	T	P	J	C
22VLE005	Multi-core Architecture and planning	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To Optimize Multi-core Systems
To Analyze Cache Coherence and Memory Consistency
To Implement and Evaluate To Understand Multi-core Architectures
To Explore Parallel Processing
To Design and Optimize Multi-core Systems
To Design and Parallel Algorithms
To Explore Synchronization Mechanisms
To Examine Real-world Applications
To Develop Problem-solving Skills

COURSE OUTCOME:

- Identify the limitations of ILP and the need for multicore architectures
- Define fundamental concepts of parallel programming and its design issues
- Solve the issues related to multiprocessing and suggest solutions
- Make out the salient features of different multicore architectures and how they exploit parallelism
- Demonstrate the role of Open MP and programming concept

UNIT-1	UNIT-1 Introduction to Multi-core Architecture	9 HOURS

Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson‟s Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware.

UNIT-2	Fundamental Concepts of Parallel Programming	9 HOURS

Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges , Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features

UNIT-3	Threading APIs	9 HOURS

Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

UNIT-4	OpenMP	9 HOURS
A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to Open MP, Open MP Library Functions, Open MP Environment Variables, Compilation, Debugging, performance		
UNIT-5	**Solutions to Common Parallel Programming Problems**	**9 HOURS**
Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA32,Data Organization for High Performance.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006
2.	"Parallel Programming: Concepts and Practice" by Thomas Rauber and Gudula Rünger is published by Morgan Kaufmann.

REFERENCE BOOKS

1.	Yan Solihin, "Fundamentals of Parallel Multicore Architecture", 1st Edition, CRC Press/Taylor and Francis, 2015.
2.	Gerassimos Barlas, "Multicore and GPU Programming: An Integrated Approach Paperback", 1st Edition, Morgan Kaufmann, 2014
3.	Lyla B Das, " The x86 Microprocessors: 8086 to Pentium, Multicores, Atom and the 8051 Microcontroller: Architecture, Programming and Interfacing", 2nd Edition, Pearson Education India, 2014

Course Code	Course Title	L	T	P	J	C
22VLE006	ASIC Design	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1.To understand the concepts of design issue in system development, Architecture of 8051 µc and its description.
2.To understand Types of ASIC, ASIC cell library, CMOS logic, CMOS Process.
3.To understand the mechanism of ASIC library cell design
4.To understand Low level Design Entry, Schematic design Entry, Language, PLA, Tool, EDIF, Overview, Hardware descriptive language VHDL.,
5.To understand FPGA based system.

COURSE OUTCOME:

After completion of the course, a student will be able to		
1.Acquire basic knowledge on the Architecture of 8051µc		
2.Analyze Datapath logic cell, Sequential logic cell, I/O cell, cell compiler		
3.Develop analysis capability in Programmable ASIC Design, Antifuse, Static RAM, EPROM, EEPROM Technology		
4.Develop competence in Low level Design Entry, Schematic design Entry		
5. Identify functions of FPGA architecture		
UNIT-1	Basic knowledge on the working of Architecture of 8051 µc	**9 HOURS**
Introduction to embedded system design, Design issue in system development, Architecture of 8051 µc and its description, Pin diagram of 8051 µc and its description, addressing modes, instruction sets, Arithmetic and logical operation, Sub-router, Interrupt handling timing sub-router, Serial data transmission, Serial data communication.		
UNIT-2	**Analyze Data path logic cell, Sequential logic cell, I/O cell, cell compiler**	**9 HOURS**
Introduction to ASIC, Types of ASIC, ASIC cell library, CMOS logic, CMOS Process, CMOS Design rule, Combinational logics, Combinational logics, Data path logic cell, Sequential logic cell, I/O cell, cell compiler.		
UNIT-3	**Programmable ASIC Design Technology**	**9 HOURS**
ASIC library cell design: Transistor and resistors, Transistor parasitic capacitance, Logical Effort, Library cell design, Library architecture, Gate array design, standard cell design, Programmable ASIC Design, Anti fuse, Static RAM, EPROM, EEPROM Technology		
UNIT-4	**competence in Low level Design**	**9 HOURS**
Low level Design Entry, Schematic design Entry, Language, PLA, Tool, EDIF, Overview, Hardware descriptive language VHDL, Hardware descriptive language Verilog, Logic synthesis VHDL Simulation, Logic synthesis VHDL Simulation, Floor Planning.		
UNIT-5	**Identify functions of FPGA architecture**	**9 HOURS**
FPGA based system: Basic concept, Digital Design Digital Design and FPGA, FPGA Fabrics: FPGA architecture and its description Static RAM based FPGA, Permanent FPGA, Chip I/O, Circuit design of FPGA, Logic implementation of FPGA architecture.		
TOTAL LECTURE HOURS:		**45 HOURS**
TEXT BOOK(S)		
1.	M J S Smith/ Application Specific Integration Circuit. Pearson Edu 2005	
2.	"ASIC Design in the Silicon Sandbox: A Complete Guide to Building Mixed-Signal Integrated Circuits" by Keith Barr Publisher: McGraw-Hill Education	
REFERENCE BOOKS		
1.	K J Ayla/ 8051 microcontroller/ paperback 3rd Edition 2005	
2.	Principles of CMOS VLSI Design: A Systems Perspective" by Neil H.E. Weste and David Harris Publisher: Addison-Wesley	

3.	CMOS Digital Integrated Circuits: Analysis and Design" by Sung-Mo (Steve) Kang and Yusuf Leblebici Publisher: McGraw-Hill Education

Course Code	Course Title	L	T	P	J	C
22VLE007	PHYSICAL DESIGN	2	0	2	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To acquire knowledge on fundamentals of VLSI technology
2. To Rules of layout, partitioning, floor planning
3. To placement and routing algorithms
4. To placement and routing algorithms interconnects
5. To single layer& multichip module routing and compaction techniques

COURSE OUTCOME:

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

1. Explain the concepts of partitioning
2. Floor planning
2. Placement and routing of the cells as per the layout rules using the top down approach.
3. Report on delay modeling, delay minimization, examine single layer and over the cell Routing
4. Apply 1D and 2D compaction techniques

UNIT-1	INTRODUCTION TO VLSI TECHNOLOGY	6 HOURS

Layout Rules - Circuit abstraction Cell generation using programmable logic array transistor chaining -Wein Berger arrays and gate matrices - layout of standard cells gate arrays and sea of gates – Field Programmable Gate Array (FPGA) - layout methodologies Packaging - Computational Complexity -Algorithmic Paradigms.

UNIT-2	PLACEMENT USING TOP-DOWN APPROACH	6 HOURS

Partitioning: Approximation of Hyper Graphs with Graphs, Kernighan - Lin Heuristic Ratio cut partition with capacity and I/O constraints. Floor planning: Rectangular dual floor planning hierarchical approach - simulated annealing - Floor plan sizing. Placement: Cost function - force directed method – placement by simulated annealing partitioning placement - module placement on a resistive network – regular placement linear placement.

UNIT-3	ROUTING USING TOP DOWN APPROACH	6 HOURS

Fundamentals: Maze Running - line searching- Steiner trees Global Routing: Sequential Approaches -hierarchical approaches - multi commodity flow based techniques - Randomized Routing - One Step approach - Integer Linear Programming Detailed Routing: Channel Routing - Switch box routing. Routing in FPGA: Array based FPGA - Row based FPGAs.

UNIT-4	PERFORMANCE ISSUES IN CIRCUIT LAYOUT	6 HOURS

Delay Models: Gate Delay Models- Models for interconnected Delay- Delay in RC trees. Timing – Driven Placement: Zero Stack Algorithm- Weight based placement - Linear Programming Approach Timing riving Routing: Delay Minimization- Click Skew Problem - Buffered Clock Trees. Minimization: constrained via Minimization unconstrained via

Minimization- Other issues in minimization.		
UNIT-5	**SINGLE LAYER ROUTING, CELL GENERATION AND COMPACTION**	**6 HOURS**
Planar subset problem (PSP) - Single Layer Global Routing - Single Layer detailed Routing - Wire length and bend minimization technique - Over The Cell (OTC) Routing Multiple chip modules (MCM) - programmable Logic Arrays - Transistor chaining - Wein Burger Arrays - Gate matrix layout - 1D compaction - 2D compaction.		
TOTAL LECTURE HOURS:		**30 HOURS**
PRACTICAL EXERCISE: 1. RTL Design of Various Multiplier Architectures 2. RTL Design Of Various Memory Units 3. Single Port RAM Design In Read First Mode 4. Single Port Block RAM Design With Enable 5. RTL Design of PLAs **TOTAL HOURS: 60 HOURS**		

TEXT BOOK(S)	
1.	Majid Sarrafzadeh, C. K. Wong, "An Introduction to VLSI Physical Design", McGraw Hill, 1996
2.	Preas M. Lorenzatti, "Physical Design and Automation of VLSI systems", The Benjamin Cummins Publishers, 1998.
REFERENCE BOOKS	
1.	Sadiq M. Sait, ?Habib Youssef, "VLSI Physical Design Automation: Theory and Practice", World Scientific Publishers, 1999
2.	Sung Kyu Lim, "Practical Problems in VLSI Physical Design Automation", Springer Publications,2008.
3.	Andrew B. Kahng, Jens Lienig, Igor L. Markov, Jin Hu , "VLSI Physical Design: From Graph Partitioning to Timing Closure", Springer Publications, 2011.
4.	John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley and Sons, 2002

Course Code	Course Title	L	T	P	J	C
22VLE008	**POWER MANAGEMENT AND CLOCK DISTRIBUTION CIRCUITS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To design of reference circuits and low dropout regulators for desired specifications
2. To understand oscillators choice and requirements for clock generation circuits
3. To design clock generation and recovery in the context of high speed systems

COURSE OUTCOME:

CO1:Design band gap reference circuits and low drop out regulator for a given specification.
CO2: Understand specification related to supply and clock generation circuits of IC
CO3: Choose oscillator topology and design meeting the requirement of clock generation circuits.
CO4: Design clock generation circuits in the context of high speed I/Os, high speed broad band

communication circuits and data conversion circuits. CO5: Design clock distribution circuits		
UNIT-1	**V- C REFERENCES**	**9 HOURS**
supply independent biasing, temperature independent biasing, PTAT current generation, constant Gm biasing, self biased current reference, startup circuits, VBE based current reference, VT based current reference, band gap reference.		
UNIT-2	**LOW DROP OUT REGULATORS**	**9 HOURS**
Analog building blocks, negative feedback, performance metrics, AC design, stability, internal and external compensation, PSRR – internal and external compensation circuits		
UNIT-3	**OSCILLATOR FUNDAMENTALS**	**9 HOURS**
General considerations, ring oscillators, LC oscillators, Colpitts oscillator, jitter and phase noise in ring oscillators, impulse sensitivity function for LC & ring oscillators, phase noise in differential LC oscillators.		
UNIT-4	**CLOCK DISTRIBUTION CIRCUITS**	**9 HOURS**
PLL fundamental, PLL stability, noise performance, charge-pump PLL topology, CPPLL building blocks, jitter and phase noise performance, DLL fundamentals.		
UNIT-5	**CLOCK AND DATA RECOVERY CIRCUITS**	**9 HOURS**
CDR architectures, transimpedance amplifiers and limiters, CMOS interface, linear half rate CMOS CDR circuits, wide capture range CDR circuits.		
TOTAL LECTURE HOURS:		**45 HOURS**
TEXT BOOK(S)		
1.	Gabriel.a. Rincon-Mora, "Voltage References from Diode to Precision Higher Order Band gap circuits", John Wiley & Sons Inc, 2002.	
2.	Gabriel.a. Rincon-Mora, "Analog IC Design with Low-Dropout Regulators", Mcgraw-Hill Professional Pubication, 2009.	
REFERENCE BOOKS		
1.	Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata Mcgraw Hill, 2001	
2.	Floyd M. Gardner ,"Phase Lock Techniques" John Wiley& Sons, Inc 2005.	
3.	Michiel Steyaert, Arthur H.M. Van Roermund, Herman Casier, "Analog Circuit Design: High Speed Clock and Data Recovery, High-Performance Amplifiers Power Management", Springer, 2008.	
4.	Behzadrazavi, "Design of Integrated Circuits for Optical Communications", McGraw Hill, 2003.	

Course Code	Course Title	L	T	P	J	C
22VLE009	SYSTEM on CHIP	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To Introducing design, optimization, and programing a modern System-on-a-Chip.
2. To knowledge of designing SoCs.
3. To impart knowledge about the hardware-software design of a modest complexity chip
4. To All the way from specifications, modeling, synthesis and physical design.
5. To Detailing SoC design with on-chip memories and communication networks, I/O interfacing.
6. To understand about signal integrity aware SoC design and Scheduling algorithms.

COURSE OUTCOME:

CO1: Explain all important components of a System-on-Chip and an embedded system,
CO2: digital hardware and embedded software;
CO3: Outline the major design flows for digital hardware and embedded software;
CO4: Discuss the major architectures and trade-offs concerning performance, cost and power
CO5: consumption of single chip and embedded systems;

UNIT-1	INTRODUCTION AND SYSTEM ARCHITECTURE	9 HOURS

Architecture of the present-day SoC - Design issues of SoC- Hardware-Software Co design – Core Libraries – EDA Tools.Components of the system – Processor architectures – Memory and addressing – system Level interconnection – SoC design requirements and specifications – design integration – design complexity – cycle time, die area and cost, ideal and practical scaling, area-time-power tradeoff in processor design, Configurability.

UNIT-2	DESIGN METHODOLOGY FOR LOGIC, MEMORY AND ANALOG CORES	9 HOURS

SoC Design Flow – guidelines for design reuse – Introduction- Efficiency of application specific hardware- Target architectures for HW/SW partitioning -System Integration, Embedded memories – design methodology for embedded memories – Specification of analog cores.

UNIT-3	MEMORY DESIGN	9 HOURS

SoC external memory, SoC internal memory, Scratch pads and cache memory – cache organization and write policies – strategies for line replacement at miss time – split I- and Dcaches – multilevel caches – SoC memory systems – board based memory systems – simpleprocessor/memory interaction.

UNIT-4	INTERCONNECT ARCHITECTURES AND SOC CUSTOMIZATION	9 HOURS

Bus architectures – SoC standard buses – AMBA, Core Connect – Processor customization approaches – Reconfigurable technologies – mapping designs onto reconfigurable devices -		
UNIT-5	**FPGA BASED EMBEDDED PROCESSOR**	**9 HOURS**
Hardware software task partitioning – FPGA fabric Immersed Processors – Soft Processors andHard Processors – Tool flow for Hardware/Software Co-design – Interfacing Processor with memory and peripherals – Types of On-chip interfaces – Wishbone interface, Avalon Switch Matrix, OPB Bus Interface, Creating a Customized Microcontroller - FPGA-based Signal Interfacing and Conditioning.		
TOTAL LECTURE HOURS:		**45 HOURS**

TEXT BOOK(S)	
1.	Wayne Wolf, "Modern VLSI Design – System – on – Chip Design", Prentice Hall, 3rd Edition & 4th Edition,2008.
2.	Ahmed Jerraya and Wayne Wolf, Multiprocessor Systems-on-Chips (Systems on Silicon Series), Morgan Kaufmann, First Edition, 2010.
REFERENCE BOOKS	
1.	Michael J. Flynn, Wayne Luk,Computer System Design: System on chip,Wiley-Blackwell, First Edition, 2011.
2.	J. Bhasker, RakeshChadha,STA for Nanometer design – A practical approach, Springer, First Edition, 2010.
3.	Jose L. Ayala,Communication Architectures for Systems-on-Chip, CRC Press, First Edition, 2011.
4.	Laung-Terng Wang, Charles E. Stroud, Nur A. Touba, System-on-Chip Test Architectures: Nanometer Design for Testability, Morgan Kaufmann, First Edition, 2010.

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE010	**NETWORK ON CHIP**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

The students should be made to:
1. Able to acquire knowledge on fundamentals of 3D Network-on chip
2. Security, verification and monitoring of NoC
3. Types and architecture of routers for NoC
4. Types and architecture of routers for NoC 3D architecture

COURSE OUTCOME:

CO1 : Explain the need for 3D NOC, concepts used in testing and fault tolerance
CO2 : Describe the energy and power issues, architecture and working of routers in 3D NOC
CO3:Test and design fault tolerant NOC

CO4:Design three dimensional architectures of NOC		
UNIT-1	**INTRODUCTION TO THREE DIMENSIONAL NOC**	**9 HOURS**
Three-Dimensional Networks-on-Chips - Architectures - Resource Allocation for QoS - On-Chip Communication - Networks-on-Chip - Protocols-On-Chip Processor Traffic Modeling for Networks-on-Chip.		
UNIT-2	**TEST AND FAULT TOLERANCE OF NOC**	**9 HOURS**
Design - Security in Networks-on-Chips - Formal Verification of Communications in Networks-on-Chips -Test and Fault Tolerance for Networks-on-Chip Infrastructures - Monitoring Services for Networks-on-Chips.		
UNIT-3	**TEST AND FAULT TOLERANCE OF NOC**	**9 HOURS**
Design - Security in Networks-on-Chips - Formal Verification of Communications in Networks-on-Chips -Test and Fault Tolerance for Networks-on-Chip Infrastructures - Monitoring Services for Networks-on-Chips.		
UNIT-4	**ENERGY AND POWER ISSUES OF NOC**	**9 HOURS**
Energy and Power Issues in Networks-on-Chips-The CHAIN works Tool Suite: A Complete Industrial Design Flow for Networks-on-Chips		
UNIT-5	**MICRO-ARCHITECTURE OF NOC ROUTER AND DIMDE ROUTER FOR 3D NOC**	**9 HOURS**
Baseline NoC Architecture - MICRO-Architecture Exploration ViChaR: A Dynamic Virtual Channel Regulator for NoC Routers - RoCo: The Row-Column Decoupled Router - A Gracefully Degrading and Energy-Efficient Modular Router Architecture for On-Chip Networks. Exploring Fault Tolerant Networks-on-Chip Architectures. A Novel Dimensionally - Decomposed Router for On-Chip Communication in 3D Architectures		
TOTAL LECTURE HOURS:		**45 HOURS**
TEXT BOOK(S)		
1.	Chrysostomos Nicopoulos, Vijaykrishnan Narayanan, Chita.R.Das, "Networks-on-Chip Architectures: A Holistic Design Exploration", Springer, 2009.	
2.	Fayezgebali, Haythamelmiligi, Hqhahed Watheq E1-Kharashi, "Networks-on-Chips: Theory and Practice", CRC press, 2009.	
REFERENCE BOOKS		
1.	Axel Jantsch, Hannu Tenhunen, "Networks on Chip", Springer, 2003.	
2.	Giovanni De Micheli, Luca Benini, "Networks on Chips: Technology and Tools (Systems on Silicon)",Morgan Kaufmann, 2006.	
3.	Jose Flich , Davide Bertozzi, "Designing Network On-Chip Architectures in the Nanoscale Era",CRC Press, 2010.	

VERTICAL III
SIGNAL/ IMAGE PROCESSING

Course Code	Course Title	L	T	P	J	C
22VLE011	VLSI SIGNAL PROCESSING	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- To introduce techniques for altering the existing DSP structures to suit VLSI implementations.
- To introduce efficient design of DSP architectures suitable for VLSI.

COURSE OUTCOME:

- Ability to modify the existing or new DSP architectures suitable for VLSI.

UNIT-1	PIPELINING AND PARALLEL PROCESSING OF DIGITAL FILTERS	9 HOURS

Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs – critical path, Loop bound, iteration bound, Longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

UNIT-2	ALGORITHMIC STRENGTH REDUCTION TECHNIQUE I	9 HOURS

Retiming – definitions and properties, unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even merge-sort architecture, parallel rank-order filters.

UNIT-3	ALGORITHIMIC STRENGTH REDUCTION -II	9 HOURS

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Pipelined and parallel recursive filters – Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with powerof-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

.

UNIT-4	BIT-LEVEL ARITHMETIC ARCHITECTURES	9 HOURS

Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon‟s bit-serial multipliers using Horner‟s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner‟s rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters.

UNIT-5	NUMERICAL STRENGTH REDUCTION, WAVE AND ASYNCHRONOUS PIPELINING	9 HOURS

Numerical strength reduction – subexpression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase clocking, two-phase clocking, wave pipelining. Asynchronous

pipelining bundled data versus dual rail protocol.	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)	
1.	Keshab K. Parhi, " VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
REFERENCE BOOKS	
1.	U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004.

Course Code	Course Title	L	T	P	J	C
22VLE012	**ADAPTIVE SIGNAL PROCESSING TECHNIQUES**	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- To understand the basic principles of discrete random signal processing
- To understand the principles of spectral estimation
- To learn about the weiner and adaptive filters
- To understand the different signal detection and estimation methods
- To acquire skills to design synchronization methods for proper functioning of the system

COURSE OUTCOME:

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

- Analyze the basic principles of discrete random signal processing
- Analyze the principles of spectral estimation
- Analyze the weiner and adaptive filters
- Analyze the different signal detection and estimation methods
- Design the synchronization methods for proper functioning of the system

UNIT-1	DISCRETE RANDOM SIGNAL PROCESSING	9 HOURS

Discrete Random Processes, Random variables, Parseval's theorem, Wiener-Khintchine relation, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes.

UNIT-2	SPECTRAL ESTIMATION	9 HOURS

Introduction, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.		
UNIT-3	**WEINER AND ADAPTIVE FILTERS**	**9 HOURS**
Weiner Filter: FIR wiener filter, IIR wiener filter, Adaptive Filter: FIR adaptive filters – Steepest descent method- LMS algorithm, RLS adaptive algorithm, Applications.		
UNIT-4	**DETECTION AND ESTIMATION**	**9 HOURS**
Bayes detection techniques, MAP, ML,– detection of M-ary signals, NeymanPeason, minimax decision criteria. kalman filter- Discrete kalman filter, The Extended kalman filter, Application.		
UNIT-5	**SYNCHRONIZATION**	**9 HOURS**
Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.		
		45 HOURS

TEXT BOOK(S)	
1.	Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2009.
2.	John G. Proakis., "Digital Communication", 4 th edition, McGraw Hill Publication, 2001.
REFERENCE BOOKS	
1.	Simon Haykin, "Adaptive Filter Theory", Pearson Education, Fourth Edition, 2003.
2.	Bernard Sklar and Pabitra Kumar Roy, "Digital Communications: Fundamentals and Applications", 2/E, Pearson Education India, 2009
3.	Paulo S. R. Diniz, "Adaptive Filtering Algorithms and Practical Implementation", Springer, 2011.

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22ECE008	**IMAGE PROCESSING**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1.To become familiar with digital image fundamentals

2.To get exposed to simple image enhancement techniques in Spatial and Frequency domain.

3.To learn concepts of degradation function and restoration techniques.

4.To study the image segmentation and representation techniques.

5.To become familiar with image compression and recognition methods

COURSE OUTCOME:		
1.Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms. 2. Operate on images using the techniques of smoothing, sharpening and enhancement. 3.Understand the restoration concepts and filtering techniques 4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models. 5.Comprehend image compression concepts		
UNIT-1	**DIGITAL IMAGE FUNDAMENTALS**	**9 HOURS**
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.		
UNIT-2	**IMAGE ENHANCEMENT**	**9 HOURS**
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.		
UNIT-3	**IMAGE RESTORATION**	**9 HOURS**
Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering		
UNIT-4	**IMAGE SEGMENTATION**	**9 HOURS**
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.		
UNIT-5	**IMAGE COMPRESSION AND RECOGNITION**	**9 HOURS**
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition,2010.	
2.	Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.	

REFERENCE BOOKS	
1.	Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2.	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3.	D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4.	William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002 .

Course Code	Course Title	L	T	P	J	C
22VLE013	Image Analysis and Computer Vision	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image-based rendering and recognition

COURSE OUTCOME:

- To understand basic knowledge, theories and methods in image processing and computer vision.
- To implement basic and some advanced image processing techniques in OpenCV.
- To apply 2D a feature-based based image alignment, segmentation and motion estimations.
- To apply 3D image reconstruction techniques
- To design and develop innovative image processing and computer vision applications.

UNIT-1	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	9 HOURS

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT-2	FEATURE DETECTION, MATCHING AND SEGMENTATION	9 HOURS

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.		
UNIT-3	**FEATURE-BASED ALIGNMENT & MOTION ESTIMATION**	**9 HOURS**
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.		
UNIT-4	**3D RECONSTRUCTION**	**9 HOURS**
Shape from X - Active rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.		
UNIT-5	**IMAGE-BASED RENDERING AND RECOGNITION**	**9 HOURS**
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.		
		45 HOURS

TEXT BOOK(S)

1.	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCE BOOKS

1.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2.	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3.	E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

Course Code	Course Title	L	T	P	J	C
22ECE008	IMAGE PROCESSING	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1.To become familiar with digital image fundamentals

2.To get exposed to simple image enhancement techniques in Spatial and Frequency domain.

3.To learn concepts of degradation function and restoration techniques.

4.To study the image segmentation and representation techniques.

5.To become familiar with image compression and recognition methods

COURSE OUTCOME:

1.Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

2. Operate on images using the techniques of smoothing, sharpening and enhancement.

3.Understand the restoration concepts and filtering techniques

4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

5.Comprehend image compression concepts

UNIT-1	DIGITAL IMAGE FUNDAMENTALS	9 HOURS

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT-2	IMAGE ENHANCEMENT	9 HOURS

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT-3	IMAGE RESTORATION	9 HOURS

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

.

UNIT-4	IMAGE SEGMENTATION	9 HOURS

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT-5	IMAGE COMPRESSION AND RECOGNITION	9 HOURS

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition,2010.	
2.	Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.	
REFERENCE BOOKS		
1.	Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.	
2.	Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.	
3.	D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.	
4.	William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002 .	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE013	**IMAGE ANALYSIS AND COMPUTER VISION**	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image-based rendering and recognition

COURSE OUTCOME:

- To understand basic knowledge, theories and methods in image processing and computer vision.
- To implement basic and some advanced image processing techniques in OpenCV.
- To apply 2D a feature-based based image alignment, segmentation and motion estimations.

- To apply 3D image reconstruction techniques
- To design and develop innovative image processing and computer vision applications.

UNIT-1	INTRODUCTION TO IMAGE FORMATION AND PROCESSING	9 HOURS
Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.		
UNIT-2	**FEATURE DETECTION, MATCHING AND SEGMENTATION**	**9 HOURS**
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.		
UNIT-3	**FEATURE-BASED ALIGNMENT & MOTION ESTIMATION**	**9 HOURS**
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.		
UNIT-4	**3D RECONSTRUCTION**	**9 HOURS**
Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.		
UNIT-5	**IMAGE-BASED RENDERING AND RECOGNITION**	**9 HOURS**
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.		
		45 HOURS

TEXT BOOK(S)

1.	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCE BOOKS

1.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2.	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3.	E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

Course Code	Course Title	L	T	P	J	C
22VLE014	PATTERN RECOGNITION AND MACHINE	3	0	0	0	3

	LEARNING	Syllabus version	v. 1.0

COURSE OBJECTIVES:

To develop the mathematical tools required for the pattern recognition.

COURSE OUTCOME:

On the successful completion of this course Student are able

CO1: Summarize the various techniques involved in pattern recognition

CO2: Categorize the various pattern recognition techniques into supervised and unsupervised.

CO3: Illustrate the artificial neural network based pattern recognition

CO4: Discuss the applications of pattern recognition in various applications

UNIT-1	INTRODUCTION	9 HOURS

Fundamental concepts and blocks of a typical pattern recognition system. Decision functions- role and types, pattern and weight space, properties and implementation of decision functions.

UNIT-2	CLUSTERING IN FEATURE IDENTIFICATION	9 HOURS

Feature identification, selection and extraction. Distance measures, clustering transformation and feature ordering, clustering in feature selection, feature selection through maximization and approximations.

UNIT-3	PATTERN RECOGNITION TECHNIQUES	9 HOURS

Pattern classification by distance functions. Clusters and cluster seeking algorithms. Pattern classification by likelihood functions. Baye's classifier and performance measures.

.

UNIT-4	ARTIFICIAL NEURAL NETWORK	9 HOURS

Artificial neural network model, Neural network-based pattern associators, Feed forward networks and training by back-propagation- ART networks.

UNIT-5	APPLICATIONS	9 HOURS

Applications of statistical and neural network – based pattern classifiers in speech recognition, image recognition and target recognition.

	TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S)

1.	J.I. Tou & R.C. Gonzalez, Pattern Recognition Priciples, Addition-Wesley.
2.	R. Schalkoff, Pattern Recognition - Statistiucal, Structural and Neural Approaches, John Wiley, 1992.

REFERENCE BOOKS

1.	P.A. Devijer & J. Kittler, Pattern Recognition - A Statistical Approach, Prentice-Hall.

2.	Christopher. M. Bishop, 'Pattern recognition and machine learning, Springer, 2006.

Course Code	Course Title	L	T	P	J	C
22VLE015	FPGA	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

- This course will introduce the features, programming and applications of programmable logic devices.
- Provide VLSI system design experience using FSM.
- Discuss the various implementation strategies with FPGA.

COURSE OUTCOME:

- Be able to make the system level designs using FSM and analyze the performance with FPGA.

UNIT-1	PROGRAMMABLE LOGIC	9 HOURS

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design.

UNIT-2	FPGAS: FIELD PROGRAMMABLE GATE ARRAYS	9 HOURS

Logic blocks, routing architecture, Design flow, Technology Mapping for FPGAs, Case studies – Xilinx Virtex-6, Spartan-6 FPGAs, ALTERA's FLEX 8000/10000 FPGAs, NIOS II Embedded Processor, ACTEL's IGLOO series, ProASIC3 series FPGAs.

UNIT-3	FINITE STATE MACHINES (FSM)	9 HOURS

Top Down Design – State Transition Table, state assignments for FPGAs. Problem of initial state assignment for one hot encoding. Derivations of state machine charges. Realization of state machine charts with a PAL. Alternative realization for state machine chart using microprogramming. Linked state machines. One – Hot state machine, Petrinetes for state machines – basic concepts, properties. Extended petrinets for parallel controllers. Finite State Machine – Case Study, Meta Stability, Synchronization - Clock and reset domain crossing.

.

UNIT-4	FSM ARCHITECTURES AND SYSTEMS LEVEL DESIGN	9 HOURS

Architectures centered around non-registered PLDs. State machine design centered around shift registers. One – Hot design method. Use of ASMs in One – Hot design. K Application of One – Hot method. System level design – controller, data path and functional partition.

UNIT-5	IMPLEMENTING APPLICATIONS WITH FPGAS	9 HOURS

Strengths and Weaknesses of FPGAs, Application and computational Characteristics and Performance - General Implementation Strategies for FPGA-based Systems - Configure-once Runtime Reconfiguration Design Flow –.Implementing Arithmetic - Fixed-point, Floating- point, Block Floating Point number Representation - CORDIC Architectures for FPGA Computing.	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)	
1.	P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte), 1994.
2.	S.Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.
REFERENCE BOOKS	
1.	J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
2.	S.Brown, R.Francis, J.Rose, Z.Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.
3.	Scott Hauck and Andre DeHon, "Reconfigurable Computing The Theory and Practice of FPGA based Computation", Morgan Kaufmann Publishers, 2008.

VERTICAL IV
RF TECHNOLOGIES

Course Code	Course Title	L	T	P	J	C
22ECE013	RF TRANSCEIVERS	2	0	2	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1.To understand the fundamentals of RF system design

2.To acquaint with the various components of RF system for wireless communications

3.To know the basic techniques needed for analysis of RF systems

4.To enable the students to verify the basic principles and design aspects involved in RF systems components

5.To conduct experiments to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts

COURSE OUTCOME:

CO1: Interpret the nonlinear effects in RF circuits

CO2: Design RF circuits

CO3: Analyze the performance of RF circuits

CO4: Apply knowledge to identify a suitable architecture and systematically design an RF System

CO5: Comprehensively record and report the measured data, and would be capable analyzing, interpreting the experimentally measured data and produce the conclusions

UNIT-1	**CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES**	**6 HOURS**

CMOS: Introduction to MOSFET Physics - Noise: Thermal, shot, flicker, popcorn noise Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR - Phase noise - Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low-IF Architectures - Transmitter: Direct-up conversion, Two-step up conversion schemes.

UNIT-2	**IMPEDANCE MATCHING NETWORKS AND AMPLIFIERS**	**6 HOURS**

Review of S-parameters and Smith chart - Passive IC components - Impedance matching networks - Amplifiers: Common Gate, Common Source Amplifiers - OC Time constants in bandwidth estimation and enhancement - High frequency amplifier design - Low Noise Amplifiers: Power match and Noise match, single-ended and differential LNAs.

UNIT-3	**FEEDBACK SYSTEMS AND POWER AMPLIFIERS**	**6 HOURS**

Feedback Systems: Stability of feedback systems, Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations, Compensation - Power Amplifiers: General model - Class A, AB, B, C, D, E and F amplifiers - Linearization Techniques - Efficiency boosting techniques - ACPR metric.

UNIT-4	**FILTERS, OSCILLATORS AND MIXERS**	**6 HOURS**

Overview - basic resonator and filter configuration, special filter realizations, filter implementation - Basic oscillator model, high-frequency oscillator configuration, Colpitt's oscillator – basic characteristics of mixers, single and double-balanced mixers.

UNIT-5	**PLL AND FREQUENCY SYNTHESIZERS**	**6 HOURS**

PLL: Linearized Model, Noise properties, Phase detectors, Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers - Direct Digital Frequency Synthesizers.

TOTAL LECTURE HOURS:	**30 HOURS**

PRACTICAL EXERCISES: **30 PERIODS**

1. Measurement of S-parameters for impedance matching circuits, and RF filters using network analyzer
2. Design of RF inductor and capacitor
3. Design and characterization of LNA
4. Design of impedance matching network
5. Design of low-pass and band-pass filter at RF
6. Design and characterization of mixer

	TOTAL CONTACT HOURS: 60 HOURS
TEXT BOOK(S)	
1.	Lee T, Design of CMOS RF Integrated Circuits, Cambridge, Second Edition, 2004
2.	Razavi B, RF Microelectronics, Pearson Education, Second Edition, 2012
REFERENCE BOOKS	
1.	Ludwig R, and Bretchko P, RF Circuit Design Theory and Applications, Prentice Hall,2000
2.	Razavi B, Design of Analog CMOS Integrated Circuits, McGraw Hill, Second Edition, 2017
3.	Kyung-WhanYeom, Microwave Circuit Design - A Practical Approach using ADS, Pearson Education, 2015

Course Code	Course Title	L	T	P	J	C
22VLE016	RF SYSTEM DESIGN	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the principle of operation of radio frequency devices and circuits
2. To study the device performance using scattering parameters
3. To understand the concepts of wireless communication systems
4. To expose the RF technologies used in various applications

COURSE OUTCOME:

CO1: Able to design and analyse basic resonators and RF Filters

CO2: Able to study the operation and device characteristics of RF Active components.

CO3: Able to design and analyze RF transistor amplifier.

CO4: Able to understand the operation of Oscillators and mixers used in RF design

UNIT-1	RESONATORS	9 HOURS
Basic resonator and filter configurations-special filter realization-filter implementation coupled filter.		
UNIT-2	**RF DIODE AND BJT**	**9HOURS**
RF diodes-bipolar junction transistor - RF field effect transistor-high electron mobility transistors-diode models-transistor models-measurement of active devices-scattering parameter device characterization.		
UNIT-3	**IMPEDANCE MATCHING**	**9 HOURS**
Impedance matching using discrete components-microstrip line matching networks amplifier classes of operation and biasing networks.		
UNIT-4	**CHARACTERISTICS OF AMPLIFIERS**	**9HOURS**
Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers.		
UNIT-5	**HIGH FREQUENCY OSCILLATORS**	**9 HOURS**
Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	David M. Pozar, “Microwave Engineering”, Wiley India Limited, Fourth Edition, 2012.
2.	Samuel. Y. Liao, “Microwave Devices and Circuits”, Pearson Education, Third Edition, 2004.

REFERENCE BOOKS

1.	Ludwig R, Bogdanov G, RF Circuit Design, Theory and Applications, Pearson Education Inc, Second Edition, 2013.
2.	Reinhold Ludwig, Gene Bogdanov, "RF circuit design, theory and applications", Pearson Asia Education, 2nd edition, 2009.
3.	Bahil and P. Bhartia, "Microwave Solid State Circuit Design", WileyInterscience, 2003.

Course Code	Course Title	L	T	P	J	C
22VLE017	SIGNAL INTEGRITY FOR HIGH SPEED DESIGN	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To identify sources affecting the speed of digital circuits.
2. To introduce methods to improve the signal transmission characteristics.

COURSE OUTCOME:

CO1: Ability to identify sources affecting the speed of digital circuits.

CO2: Able to improve the signal transmission characteristics.

UNIT-1	SIGNAL PROPAGATION ON TRANSMISSION LINES	9 HOURS

Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance , wave propagation, reflection, and bounce diagrams Reactive terminations – L, C , static field maps of micro strip and strip line cross-sections, per unit length parameters, PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching , input impedance into a transmission-line section, reflection coefficient, skin-effect, dispersion

UNIT-2	MULTI-CONDUCTOR TRANSMISSION LINES AND CROSS-TALK	9HOURS

Multi-conductor transmission-lines, coupling physics, per unit length parameters ,Near and far-end cross-talk, minimizing cross-talk (stripline and microstrip) Differential signalling, termination, balanced circuits ,S-parameters, Lossy and Lossles models

UNIT-3	NON-IDEAL EFFECTS	9 HOURS

Non-ideal signal return paths – gaps, BGA fields, via transitions , Parasitic inductance and capacitance , Transmission line losses – Rs, tanδ , routing parasitic, Common-mode current, differential-mode current , Connectors

UNIT-4	POWER CONSIDERATIONS AND SYSTEM DESIGN	9HOURS

SSN/SSO , DC power bus design , layer stack up, SMT decoupling ,, Logic families, power consumption, and system power delivery , Logic families and speed Package types and parasitic ,SPICE, IBIS models ,Bit streams, PRBS and filtering functions of link-path components , Eye diagrams , jitter , inter-symbol interference Bit-error rate ,Timing analysis

UNIT-5	CLOCK DISTRIBUTION AND CLOCK OSCILLATORS	9 HOURS

Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter.

	TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S)

1.	Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall PTR, 2003.

2.	Eric Bogatin , Signal Integrity – Simplified , Prentice Hall PTR, 2003.
REFERENCE BOOKS	
1.	H. W. Johnson and M. Graham, High-Speed Digital Design: A Handbook of Black Magic, Prentice Hall, 1993.
2.	S. Hall, G. Hall, and J. McCall, High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices, Wiley-Inter science, 2000.

Course Code	Course Title	L	T	P	J	C
22VLE018	EMI AND EMC IN SYSTEM DESIGN	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To understand the concepts related to Electromagnetic interference in PCBs.

1. To provide solutions for minimizing EMI in PCBs.
2. To learn various EMI coupling principles.
3. To indulge knowledge on EMI control techniques and design procedures to make EMI compatible PCBs.
4. To learn electromagnetic compatibility issues with regard to the design of PCBS.
5. To learn, EMI standards and measurements in the design of PCBs.

COURSE OUTCOME:

CO1: Gain enough knowledge to understand the concept of EMI / EMC related to product design & development.

CO2: To analyze the different EM coupling principles and its impact on performance of electronic system.

CO3: Analyze electromagnetic interference, highlighting the concepts of both susceptibility and immunity

CO4: Interpret various EM compatibility issues with regard to the design of pcbs and ways to improve the overall system performance

CO5: To obtain broad knowledge of various EM radiation measurement techniques and the present leading edge industry standards in different countries

UNIT-1	EMI/EMC CONCEPTS	9 HOURS

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

UNIT-2	EMI COUPLING PRINCIPLES	9HOURS

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.		
UNIT-3	**EMI CONTROL TECHNIQUES**	**9 HOURS**
Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.		
UNIT-4	**EMC DESIGN OF PCBS**	**9HOURS**
Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations		
UNIT-5	**EMI MEASUREMENTS AND STANDARDS**	**9 HOURS**
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, Newyork, 1996.	
2.	Henry W.Ott.,”Noise Reduction Techniques in Electronic Systems”, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.	
REFERENCE BOOKS		
1.	Bemhard Keiser, “Principles of Electromagnetic Compatibility”, Artech house, Norwood, 3rd Edition, 1986.	
2.	C.R.Paul,”Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992.	
3.	Don R.J.White Consultant Incorporate, “Handbook of EMI/EMC” , Vol I-V, 1988.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE019	**RF IC DESIGN**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To study the various impedance matching techniques used in RF circuit design.
2. To understand the functional design aspects of LNAs, Mixers, PLLs and VCO.
3. To understand frequency synthesis.

COURSE OUTCOME:

CO1: To understand the principles of operation of an RF receiver front end.

CO2: Able to design and apply constraints for LNAs.

CO3: Able to design and apply constraints for Mixers.

CO4: Able to design and apply constraints for Frequency synthesizers.

UNIT-1	**IMPEDANCE MATCHING IN AMPLIFIERS**	**9 HOURS**

Definition of „Q", series parallel transformations of lossy circuits, impedance matching using „L", „PI" and T networks, Integrated inductors, resistors, Capacitors, tunable inductors, transformers

UNIT-2	**AMPLIFIER DESIGN**	**9HOURS**

Noise characteristics of MOS devices, Design of CG LNA and inductor degenerated LNAs. Principles of RF Power Amplifiers design.

UNIT-3	**ACTIVE AND PASSIVE MIXERS**	**9 HOURS**

Qualitative Description of the Gilbert Mixer - Conversion Gain, and distortion and noise , analysis of Gilbert Mixer – Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer.

UNIT-4	**OSCILLATORS**	**9HOURS**

LC Oscillators, Voltage Controlled Oscillators, Ring oscillators, Delay Cells, tuning range in ring oscillators, Tuning in LC oscillators, Tuning sensitivity, Phase Noise in oscillators, sources of phase noise

UNIT-5	**PLL AND FREQUENCY SYNTHESIZERS**	**9 HOURS**

Phase Detector/Charge Pump, Analog Phase Detectors, Digital Phase Detectors, Frequency Dividers, Loop Filter Design, Phase Locked Loops, Phase noise in PLL, Loop Bandwidth, Basic Integer-N frequency synthesizer, Basic Fractional-N frequency synthesizer

	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	B.Razavi ,"RF Microelectronics" , Prentice-Hall ,1998
2.	Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002

REFERENCE BOOKS

1.	Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 1999
2.	Jia-sheng Hong, "Microstrip filters for RF/Microwave applications", Wiley, 2001

3.	Thomas H.Lee, “The Design of CMOS Radio –Frequency Integrated Circuits", Cambridge University Press ,2003

Course Code	Course Title	L	T	P	J	C
22ECE018	RF ID SYSTEM DESIGN AND TESTING	2	0	2	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To discuss the fundamentals of near field and far field RFID communications
2. To articulate the standards and protocols used in RFID systems
3. To describe the operating principles of RFID tag and reader
4. To introduce the security aspects and system architecture of RFID systems
5. To illustrate the industrial and scientific applications of RFID systems

COURSE OUTCOME:

CO1: Classify RFID systems based on frequency, architecture and performance
CO2: Define standards for RFID technology
CO3: Illustrate the operation of various components of RFID systems
CO4: Describe the privacy and security issues in RFID Systems
CO5:Discuss the construction and applications of RFID enabled sensor

UNIT-1	INTRODUCTION	6 HOURS

RFID Principles: Near-field based RFID – Properties of Magnetic field – Far-field based RFID – Properties of Backscatter RF Systems – Modulation techniques – Frequency based property comparison of RFID Systems

UNIT-2	RFID STANDARDS AND PROTOCOLS	6 HOURS

RFID Industry standards: EPC global – ISO15693 Vicinity cards and RFID – ISO14443 Proximity cards and RFID – The NFC forum – Reading collocated RFID tags: Query Tree protocol – Query Slot protocol

UNIT-3	OPERATING PRINCIPLES	6 HOURS

RFID Tag components: RFID tag types – the 1-Bit Transponder and Chipless Tags – RFID readers and middleware component – Communication fundamentals: Coupling, Data encoding, multi-path effect – Tag, Reader and sensor communication.

UNIT-4	DATA INTEGRITY AND SECURITY	6 HOURS

The checksum procedure – Multiaccess procedures – Attacks on RFID Systems – Protection by Cryptographic measures.

UNIT-5	RFID ENABLED SENSORS AND APPLICATIONS	6 HOURS
RFID enabled Sensors: Antenna design challenges – IC design – Integration of sensors and RFID – Power consumption and Link budget, Applications: Contactless smart cards – Access control – Electronic passport – Industrial Automation – Medical applications – Challenges and opportunities.		
	TOTAL LECTURE HOURS:	**30 HOURS**

PRACTICAL EXERCISES: **30 PERIODS**

1. Design of a passive RFID Tag Antenna
2. Design of an RFID reader antenna
3. Determination of read range of the RFID tag at UHF and Microwave frequencies
4. Determination of RFID tag performance for different standards

TOTAL CONTACT HOURS: 60

TEXT BOOK(S)

1.	Roy Want, RFID Explained, Springer 2022.
2.	Amin Rida, Li Yang, Manos M. Tentzeris, RFID Enabled Sensor Applications, Artech House, 2010

REFERENCE BOOKS

1.	Klaus Finkenzeller, RFID Handbook, 3rd Edition, Wiley, 2010
2.	Syed Ahson, Mohammad Ilyas, RFID Handbook, CRC Press, 2008
3.	Paris Kitsos, Security in RFID and Sensor Networks, CRC Press, 2016.

VERTICAL V
EMBEDDED AND IOT

Course Code	Course Title	L	T	P	J	C
22VLE020	DISTRIBUTED EMBEDDED COMPUTING	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To expose the students to the fundamentals of Network communication technologies.
2. To teach the fundamentals of Internet
3. To study on Java based Networking
4. To introduce network routing Agents
5. To study the basis for network on-chip technologies

COURSE OUTCOME:

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

Explain the fundamentals of Network communication technologies, internet, and Javabased networking.

Analyze the analog/digital co-design of distributed embedded computing architecture.

UNIT-1	THE HARDWARE INFRASTRUCTURE	9 HOURS

Broad Band Transmission facilities – Open Interconnection standards – Local Area Networks – Wide Area Networks – Network management – Network Security – Cluster computers.

UNIT-2	INTERNET CONCEPTS	9 HOURS
Capabilities and limitations of the internet — Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.		
UNIT-3	**DISTRIBUTED COMPUTING USING JAVA**	**9 HOURS**
IO streaming – Object serialization – Networking – Threading – RMI – multicasting – distributed databases – embedded java concepts – case studies.		
UNIT-4	**EMBEDDED AGENT**	**9 HOURS**
Introduction to the embedded agents – Embedded agent design criteria – Behaviour based, Functionality based embedded agents – Agent co-ordination mechanisms and benchmarks embedded-agent. Case study: Mobile robots.		
UNIT-5	**EMBEDDED COMPUTING ARCHITECTURE**	**9 HOURS**
Synthesis of the information technologies of distributed embedded systems – analog/digital co- design – optimizing functional distribution in complex system design – validation and fast prototyping of multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	Dietel & Dietel, “JAVA how to program”, Prentice Hall, 1999.
2.	Sape Mullender, “Distributed Systems”, Addison-Wesley, 1993.

REFERENCE BOOKS

1.	George Coulouris and Jean Dollimore, “Distributed Systems — concepts and design”,Addison –Wesley, 1988
2.	“Architecture and Design of Distributed Embedded Systems”, Bernd Kleinjohann C- lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, 2001.

Course Code	Course Title	L	T	P	J	C
22VLE021	REAL TIME OPERATING SYSTEM	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To expose the students to the fundamentals of interaction of OS with a computer and Usercomputation.
2. To teach the fundamental concepts of how process are created and controlled with OS.
3. To study on programming logic of modeling Process based on range of OS features
4. To compare types and Functionalities in commercial OS, application development using RTOS
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

COURSE OUTCOME:

At the end of this course, the students will have the ability to

- Outline Operating System structures and types.
- Insight into scheduling, disciplining of various processes execution.
- Illustrate knowledge on various RTOS support modelling
- Demonstrate commercial RTOS Suite features to work on real time processes design.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation onrecent trends in RTOS and embedded automation design.

UNIT-1	REVIEW OF OPERATING SYSTEMS	9 HOURS

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system — Embedded operating systems

UNIT-2	OVERVIEW OF RTOS	9 HOURS

RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks

UNIT-3	REALTIME MODELS AND LANGUAGES	9 HOURS

Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements

UNIT-4	REALTIME KERNEL	9 HOURS

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.		
UNIT-5	**APPLICATION DEVELOPMENT**	**9 HOURS**
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application — Case study		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003	
2.	Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997	
REFERENCE BOOKS		
1.	Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGrawHill,2006.	
2.	Karim Yaghmour,Building Embedded Linux System",O'reilly Pub,2003	
3.	MukeshSighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill,2000	

Course Code	Course Title	L	T	P	J	C
22VLE022	HARDWARE SOFTWARE CO DESIGN OF EMBEDDED SYSTEM	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the key concepts of hardware/software communication to make trade-offs between the flexibility and the performance of a digital system.
2. To learn the concept of integration of custom hardware components with software.
3. Students will gain design and implementation experience with case studies.

COURSE OUTCOME:

- To analyze and apply design methodologies.
- To appreciate the fundamental building blocks of the using hardware and software co-design.
- To related implementation and testing environments and techniques and their interrelationships.
- To be familiar with modern hardware/software tools for building prototypes.
- To be able todemonstrate practical competence in these areas.

UNIT-1	NATURE OF HARDWARE AND SOFTWARE	9 HOURS

Hardware, Software, Definition of Hardware/Software Co-Design – Driving factors Platform design space – Application mapping – Dualism of Hardware design and software design – Concurrency and parallelism, Data flow modeling and Transformation – Data Flow Graph – Tokens, actors and queues, Firing rates, firing rules and Schedules – Synchronous data flow graph – control flow modeling – Adding time and resources – Trandformations.

UNIT-2	DATA FLOW IMPLEMENTATION IN SOFTWARE AND HARDWARE	9 HOURS

Software Implementation of Data Flow – Converting queues and actors into software, Dynamic Scheduler – Hardware Implementation of Data Flow – single rate SDF graphs into hardware, Pipelining – Analysis of control flow and data flow – construction of control and data flow graph – Translating C into hardware – Designing data path and controller.

UNIT-3	DESIGN SPACE OF CUSTOM ARCHITECTURES	9 HOURS

Finite state machines with datapath – FSMD design example, Limitations – Microprogrammed Architecture – Microprogrammed control, microinstruction encoding, Microprogrammed data path, microprogrammed machine – General purpose Embedded Core – RISC pipeline, Program organization – SoC interfaces for custom hardware – Design Principles in SoC Architecture

UNIT-4	HARDWARE/ SOFTWARE INTERFACES	9 HOURS

Principles of Hardware/software communication – synchronization schemes, communication constrained versus Computation constrained, Tight and Loose coupling - On-chip buses – Memory mapped interfaces — coprocessor interfaces — custom instruction interfaces — Coprocessor hardware interface – Data and control design, programmer's model		
UNIT-5	**CASE STUDIES**	**9 HOURS**
Trivium Cripto coprocessor – Trivium stream cipher algorithm, Trivium for 8-bit platforms – AEScoprocessor, CORDIC coprocessor – algorithm and implementation.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)	
1.	Ralf Niemann, "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems",Kluwer Academic Pub, 1998.
2.	Jorgen Staunstrup, Wayne Wolf, "Hardware/Software Co-Design: Principles and Practice",Kluwer Academic Pub, 1997.
REFERENCE BOOKS	
1.	Giovanni De Micheli, Rolf Ernst Morgon, "Reading in Hardware/Software Co-Design"Kaufmann Publishers, 2001.
2.	Patrick Schaumont, A Practical Introduction to Hardware/Software Codesign, Springer, 2nd Edition, 2010

Course Code	Course Title	L	T	P	J	C
22VLE023	Embedded Automotive System	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To expose the students to the fundamentals and building of Electronic Engine Control systems.
2. To teach on functional components and circuits for vehicles
3. To discuss on programmable controllers for vehicles management systems.
4. To teach logics of automation & commercial techniques for vehicle communication.
5. To introduce the embedded systems concepts for E-vehicle system development.

COURSE OUTCOME:

At the end of this course, the students will have the ability in

- Insight into the significance of the role of embedded system for automotive applications.
- Illustrate the need, selection of sensors and actuators and interfacing with ECU
- Develop the Embedded concepts for vehicle management and control systems.
- Demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

UNIT-1	BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS	9 HOURS

Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection and requirements for Automotive applications – open source ECU- RTOS - Concept for Engine management- Standards; Introduction to AUTOSAR and Introduction to Society SAE- Functional safety ISO 26262- Simulation and modeling of automotive system components.

UNIT-2	SENSORS AND ACTUATORS FOR AUTOMOTIVES	9 HOURS

Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications

UNIT-3	VEHICLE MANAGEMENT SYSTEMS	9 HOURS

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition- Adaptive cruise control - speed control- anti-locking braking system-electronic suspension - electronic steering , Automatic wiper control- body control system ; Vehicle system schematic for interfacing with EMS, ECU. Energy Management system for electric vehicles- Battery management system , power management system-electrically assisted power steering system- Adaptive lighting system- Safety and Collision Avoidance.

UNIT-4	ONBOARD DIAGONSTICS AND TELEMATICS	9 HOURS
On board diagnosis of vehicles -System diagnostic standards and regulation requirements Vehicle communication protocols Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 and recent trends in vehicle communications- Navigation- Connected Cars technology – Tracking- Security for data communication- dashboard display and Virtual Instrumentation, multimedia electronics- Role of IOT in Automotive systems		
UNIT-5	**ELECTRIC VEHICLES**	**9 HOURS**
Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuel cells/Solar powered vehicles- Autonomous vehicles		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	William B. Ribbens ,"Understanding Automotive Electronics", Elseiver,2012
2.	Ali Emedi, Mehrdedehsani, John M Miller , "Vehicular Electric power system- land, Sea, Air and Space Vehicles" Marcel Decker, 2004.

REFERENCE BOOKS

1.	Jack Erjavec,JeffArias,"Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles",Cengage ,2012.
2.	Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection – Ford.
3.	Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 4 2004.

Course Code	Course Title	L	T	P	J	C
22VLE024	SOC DESIGN FOR EMBEDDED SYSTEM	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce architecture and design concepts underlying system on chips.
2. Students can gain knowledge of designing SoCs.
3. To impart knowledge about the hardware-software design of a modest complexity chip all the way from specifications, modeling, synthesis and physical design.

COURSE OUTCOME:

Upon successful completion of the program the students shall

- Explain all important components of a System-on-Chip and an embedded system, i.e. digital hardware and embedded software;
- Outline the major design flows for digital hardware and embedded software;
- Discuss the major architectures and trade-offs concerning performance, cost and power consumption of single chip and embedded systems;

UNIT-1	SYSTEM ARCHITECTURE: OVERVIEW	9 HOURS

Components of the system – Processor architectures – Memory and addressing – system level interconnection – SoC design requirements and specifications – design integration – design complexity – cycle time, die area and cost, ideal and practical scaling, area-time-power tradeoff in processor design, Configurability.

UNIT-2	PROCESSOR SELECTION FOR SOC	9 HOURS

Overview – soft processors, processor core selection. Basic concepts – instruction set, branches, interrupts and exceptions. Basic elements in instruction handling – Minimizing pipeline delays – reducing the cost of branches – Robust processors – Vector processors, VLIW processors, Superscalar processors

UNIT-3	MEMORY DESIGN	9 HOURS

SoC external memory, SoC internal memory, Scratch pads and cache memory – cache organization and write policies – strategies for line replacement at miss time – split I- and Dcaches – multilevel caches – SoC memory systems – board based memory systems – simple processor/memory interaction

UNIT-4	INTERCONNECT ARCHITECTURES AND SOC CUSTOMIZATION	9 HOURS

Bus architectures – SoC standard buses – AMBA, CoreConnect – Processor customization approaches – Reconfigurable technologies – mapping designs onto reconfigurable devices - FPGA based design – Architecture of FPGA, FPGA interconnect

technology, FPGA memory, Floor plan and routing.		
UNIT-5	**FPGA BASED EMBEDDED PROCESSOR**	**9 HOURS**
Hardware software task partitioning – FPGA fabric Immersed Processors – Soft Processors and Hard Processors – Tool flow for Hardware/Software Co-design – Interfacing Processor with memory and peripherals – Types of On-chip interfaces – Wishbone interface, Avalon Switch Matrix, OPB Bus Interface, Creating a Customized Microcontroller - FPGA-based Signal Interfacing and Conditioning.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Michael J. Flynn and Wayne Luk, “Computer System Design: System-on-Chip”, John Wiley and sons, 2011.	
2.	Rahul Dubey, “Introduction to Embedded System Design Using Field Programmable Gate Arrays”, Springer Verlag London Ltd., 2009.	
REFERENCE BOOKS		
1.	Sudeep Pasricha and Nikil Dutt, On-Chip Communication Architectures - System on Chip Interconnect, Elsevier, 2008.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22ECE028	**INDUSTRIAL IOT AND INDUSTRY 4.0**	**2**	**0**	**2**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. IoT Nodes & Sensors
2. IoT Gateways
3. IoT Cloud Systems
4. IoT Cloud Dashboards
5. Challenges in Iot system Design – Hardware & Software

COURSE OUTCOME:

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

- Understand the building blocks of IoT technology and explore the vast spectrum of IoT applications
- Use processors & peripherals to design & build IoT hardware
- Assess, select and customize technologies for IoT applications

Connect numerous IOT applications with the physical world of humans and real life problem solving.

- Design and implement IOT applications that manage big data

UNIT-1	**UNDERSTANDING IOT CONCEPT AND DEVELOPMENT PLATFORM**	**9 HOURS**

IOT Definition, Importance of IoT, Applications of IOT, IoT architecture, Understanding working of Sensors, Actuators, Sensor calibration, Study of Different sensors and their characteristics

UNIT-2	**ANALYZING & DECODING OF COMMUNICATION PROTOCOL USED IN IOT DEVELOPMENT PLATFORM**	**9 HOURS**

UART Communication Protocol, I2C Protocol device interfacing and decoding of signal, SPI Protocol device interfacing and decoding of signal, WIFI and Router interfacing, Ethernet Configuration, Bluetooth study and analysis of data flow, Zigbee Interfacing and study of signal flow

UNIT-3	**IOT PHYSICAL DEVICES AND ENDPOINTS AND CONTROLLING HARDWARE AND SENSORS**	**9 HOURS**

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi-Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors; Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors,Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor.

UNIT-4	**CLOUD SERVICES USED IN IOT DEVELOPMENT PLATFORM**	**9 HOURS**

Configuration of the cloud platform, Sending data from the IOT nodes to the gateways using different communication options; Transferring data from gateway to the cloud; Exploring the web services like mail, Messaging (SMS) and Twitter etc.;Tracking of cloud data as per the requirement; Google Cloud service architect; AWS clod Services architect; Microsoft Azure cloud services Architect; OEN source Cloud Services; Initial State Iot Dashboard & Cloud Services

UNIT-5	**CHALLENGES IN IOT SYSTEM DESIGN – HARDWARE & SOFTWARE**	**9 HOURS**

Antenna design and placement, Chip-package system development, Power electronics, electromagnetic interference/compatibility (EMI/EMC), Electronics reliability; Battery simulation.

TOTAL LECTURE HOURS:	**45 HOURS**
PRACTICAL EXERCISE:	**30 HOURS**

1. Study and Program different Sensors for IoT applications
- LDR sensor, IR sensor, Temperature Sensor, Ultrasound Sensor, Gas sensor
- Write a program using IR sensor for working morning alarm and night lamp
- Write a program using sensors for water level indicator and overflow detection

2. Designing and debugging complex mixed signal devices (analog, digital, and RF) • Write a program to control LEDs using Alexa Echo Dot.
- Write a program to control Buzzer using Alexa Echo Dot.
- Write a program to control Stepper motor using Google Assistance

3.Understanding battery requirements
- Determining ultra-low deep sleep current of Node
- Measuring Transmit and Receive current signals of Node
- Capturing short transients and fast transients signals of node

4. Understanding Modulation techniques –
- Understanding of ASK, FSK Modulation and measurements
- Capturing the live ASK Signal and decoding it.

TOTAL HOURS: 60 HOURS

TEXT BOOK(S)

1.	BOOKS 1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2.	Universities Press, 2015, ISBN: 9788173719547 2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCE BOOKS

1.	Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
2.	N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014
3.	Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan

VERTICAL VI
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	Course Title	L	T	P	J	C
22CST401	FOUNDATIONS OF DATA SCIENCE	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the data science fundamentals and process.
2. To learn to describe the data for the data science process.
3. To learn to describe the relationship between data.
4. To utilize the Python libraries for Data Wrangling.
5. To present and interpret data using visualization libraries in Python

COURSE OUTCOME:

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

1. Define the data science process.
2. Understand different types of data description for data science process.
3. Gain knowledge on relationships between data.
4. Use the Python Libraries for Data Wranglin.
5. Apply visualization Libraries in Python to interpret and explore data

UNIT-1	INTRODUCTION	9 HOURS

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing –BasicStatistical descriptions of Data

UNIT-2	DESCRIBING DATA	9 HOURS

Types of Data - Types of Variables -Describing Data with Tables and Graphs – Describing Data withAverages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT-3	DESCRIBING RELATIONSHIPS	9 HOURS

Correlation –Scatter plots –correlation coefficient for quantitative data – computational formula for correlation coefficient – Regression –regression line – least squares regression line – Standard error of estimate – interpretation of r2 – multiple regression equations –regression towards the mean

UNIT-4	PYTHON LIBRARIES FOR DATA WRANGLING	9 HOURS

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing andselection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT-5	**DATA VISUALIZATION**	**9 HOURS**
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science",Manning Publications, 2016.
2.	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3.	Jake Vander Plas, "Python Data Science Handbook", O'Reilly, 2016.

References

1.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE026	**NANO ELECTRONICS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

To introduce the basics of nano electronics

1. To understand the basics of semiconductor materials
2. To understand the basics of MOSFETS and its application in nano electronics
3. To learn the advanced nanoscale devices
4. To explore about Biosensors

COURSE OUTCOME:

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

CO1: Understand the basic concepts of nano electronics and various aspects of nano electronics.

CO2: Summarize the basic knowledge of Semiconductor materials and carbon nano tubes.

CO3: Understand the basic concepts of MOS scaling.

CO4: understand the advanced nanoscale devices

CO5: Understand the Bio sensor devices.

UNIT-1	**INTRODUCTION TO NANOELECTRONICS**	**9 HOURS**

Introduction to nanoelectronics, Limitations of conventional microelectronics. Classical Particles, Classical Waves and Quantum Particles-Quantum Mechanics of Electronics - Schrödinger wave equation.		
UNIT-2	**MATERIALS FOR NANOELECTRONICS**	**9 HOURS**
Introduction- Semiconductors, Crystal lattices: Bonding in crystals- Electron energy bandsSemiconductor heterostructures-Lattice-matched and pseudomorphic heterostructures-Carbon nanomaterials: nanotubes and fullerenes.		
UNIT-3	**SHRINK-DOWN APPROACHES**	**9 HOURS**
Moore's Law- Technology Scaling and Reliability Challenges.Basic MOS Transistor-Types, Modes of operation, n-MOS operation, Drain Current, Threshold Voltage, Energy band diagram of MOSFET, nanoscale MOSFET, SCEs-limits to scaling, system integration limits.		
UNIT-4	**ADVANCED NANOSCALE DEVICES**	**9 HOURS**
Double Gate MOSFETs, Tri-Gate MOSFETs, Tunnel FETs-Multi-Gate TFETs and Heterojunction TFETs- Graphene and Carbon Nanotube Transistors.		
UNIT-5	**FET BASED BIOSENSORS**	**9 HOURS**
Principles- Components of biosensor-Classification of Biosensors based on transducers, FET based Biosensor- ion-sensitive field effect transistor-operation and fabrication-Characteristics and Performance.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009	
2.	Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011.	
References		
1.	Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011.	
2.	Donald A. Neamen, "Semiconductor Physics and Devices Basic Principles", Third Edition, McGraw-Hill Higher- Education, 2003.	

Course Code	Course Title	L	T	P	J	C
22VLE027	COMPUTATIONAL INTELLIGENCE	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the basics of Computational concepts
2. To learn and understand in-depth about theories, methods and algorithms
3. To know about the various problem solving techniques
4. To compare the traditional and nature in spired algorithms

COURSE OUTCOME:

After completing the course student should be able to:

1. Describe in-depth about theories, methods, and algorithms in computation Intelligence.
2. Compare and contrast traditional algorithms with nature inspired algorithms.
3. Examine the nature of a problem at hand and determine whether a computation intelligent technique/algorithm can solve it efficiently enough.
4. Design and implement Computation Intelligence algorithms and approaches for solving real-life problems.

UNIT-1	Introduction to Computational Intelligence	9 HOURS

types of Computational Intelligence, components of Computational Intelligence. Concept of Learning/Training model. Parametric Models, Nonparametric Models. Multilayer Networks: Feed Forward network, Feedback network.

UNIT-2	Fuzzy Systems	9 HOURS

Fuzzy sets and operations, Membership Functions, Concept of Fuzzy relations and their composition, Concept of Fuzzy Measures; Fuzzy Logic: Fuzzy Rules, Inferencing; Fuzzy Control - Selection of Membership Functions, Fuzzyfication, Rule Based Design & Inferencing, Defuzzyfication.

UNIT-3	Genetic Algorithms	9 HOURS

Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits

UNIT-4	Rough Set Theory	9 HOURS

Introduction, Fundamental Concepts, Set approximation, Rough membership, Attributes, Optimization. Hidden Markov Models, Decision tree model.

UNIT-5	**Introduction to Swarm Intelligence, Swarm Intelligence Techniques**	**9 HOURS**
Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc. Applications of Computational Intelligence.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and Swarm Intelligence Algorithms, Springer Publishing, 2019.
2.	6. S. Rajeskaran, G.A. VijaylakshmiPai, "Neural Networks, Fuzzy Logic, GeneticAlgorithms Synthesis and Applications". 7

References

1.	J.S. Roger Jang, C.T.Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning & Machine Intelligence", PHI, 2002.
2.	Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
3.	Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing.

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE028	**INTRODUCTION TO GENERATIVE AI**	**2**	**0**	**2**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

The main objectives of this course are to:

1. To understand the basic concepts of Generative AI.
2. To build Generative AI systems to generate images.
3. To understand the concept used in Generative AI Models.
4. To use various Generative AI models.
5. To compare and use the various Large Language Models.
6. To understand the basics of Prompt Engineering.

COURSE OUTCOME:

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

CO1: Elaborate the basic concepts of Generative AI.
CO2: Build Generative AI systems to generate images.
CO3: Apply the concepts used in Generative AI Models.
CO4: Use various Generative AI models.
CO5: Compare and use the various Large Language Models.

UNIT-1	**INTRODUCTION**	**6 HOURS**
Generative Models – Image transformation – Challenges - Deep Neural Networks – Perceptron – back propagation – CNN – RNN – Optimizer.		

UNIT-2	**IMAGE GENERATION**	**6 HOURS**
Creating encodings of images – variational objective – Inverse Autoregressive flow – Importing CIFAR – Creating the network from TensorFlow 2.		
UNIT-3	**GENERATIVE ADVERSARIAL NETWORKS**	**6 HOURS**
Generative Adversarial Networks – Vanilla GAN – Improved GANs – Progressive GAN – Challenges – Paired style transfer – Unpaired style transfer – Deepfakes – Modes of operation – key feature set – High level flow – Replacement – Re-enactment.		
UNIT-4	**LARGE LANGUAGE MODELS**	**6 HOURS**
Overview of LLMs - Transformers – GPT – Types of LLMs – Key concepts – other Transformers – T5 – Generative Pre-Training Models – Multi-modal Models – DALL.E 2		
UNIT-5	**PROMPT ENGINEERING**	**6 HOURS**
Basics – In-Context Learning – In-Context Prompting – Techniques – Image Prompting – Prompt Hijacking – Challenges.		
	TOTAL LECTURE HOURS:	**30 HOURS**

PRACTICAL EXERCISES: **30 HOURS**

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement Bayesian Networks
4. Build Regression models
5. Build SVM models
6. Implement clustering algorithms
7. Build simple NN models
8. Build deep learning NN models

TOTAL HOURS: 60 HOURS

TEXT BOOK(S)

1.	Ben Auffarth, Generative AI with LangChain, Packt Publishing, 2023.
2.	Amit Bahree, Generative AI in Action, Manning Publication, First Edition, 2023

References

1.	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007 2
2.	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3.	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006

Course Code	Course Title	L	T	P	J	C
22VLE029	ROBOTICS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To Introduce the concepts of Robotic systems
2. To understand the concepts of Instrumentation and control related to Robotics
3. To understand the kinematics and dynamics of robotics
4. To explore robotics in Industrial applications

COURSE OUTCOME:

At the end of the course the student will be able to

CO1: Describe the fundamentals of robotics

CO2: Understand the concept of kinematics and dynamics in robotics.

CO3: Discuss the robot control techniques

CO4: Explain the basis of intelligence in robotics and task planning

CO5: Discuss the industrial applications of robotics

UNIT-1	INTRODUCTION TO ROBOTICS	9 HOURS

Robotics -History - Classification and Structure of Robotic Systems - Basic components -Degrees of freedom - Robot joints coordinates- Reference frames - workspace- Robot languages- Robotic sensors- proximity and range sensors, ultrasonic sensor, touch and slip sensor.

UNIT-2	ROBOT KINEMATICS AND DYNAMICS	9 HOURS

Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler formulation.

UNIT-3	ROBOTICS CONTROL	9 HOURS

Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis -problem solving -robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics

UNIT-4	ROBOT INTELLIGENCE AND TASK PLANNING	9 HOURS

Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis -problem solving -robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics		
UNIT-5	**INDUSTRIAL ROBOTICS**	**9 HOURS**
Robot cell design and control - cell layouts - multiple robots and machine interference - work cell design - work cell control - interlocks – error detection deduction and recovery - work cell controller - robot cycle time analysis. Safety in robotics, Applications of robot and future scope.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	John J. Craig, 'Introduction to Robotics (Mechanics and Control)', Addison-Wesley, 2nd Edition, 2004.	
2.	Richard D. Klafter, Thomas A. Chmielewski, Michael Negin, 'Robotics Engineering: An Integrated Approach', PHI Learning, New Delhi, 2009.	
References		
1.	K.S.Fu, R.C.Gonzalez and C.S.G.Lee, 'Robotics Control, Sensing, Vision and Intelligence', Tata McGraw Hill, 2nd Reprint,2008.	
2.	Reza N.Jazar, 'Theory of Applied Robotics Kinematics, Dynamics and Control', Springer, 1 st Indian Reprint, 2010.	
3.	Mikell. P. Groover, Michell Weis, Roger. N. Nagel, Nicolous G.Odrey, 'Industrial Robotics Technology, Programming and Applications ', McGraw Hill, Int 2012.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22VLE030	**DRONES AND AUTONOMOUS SYSTEMS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the basics of drone concepts
2. To learn and understand the fundaments of design, fabrication and programming of drone
3. To impart the knowledge of a flying and operation of drone
4. To know about the various applications of drone
5. To understand the safety risks and guidelines of fly safely

COURSE OUTCOME:

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

CO1: Know about a various type of drone technology, drone fabrication and programming. CO2: Execute the suitable operating procedures for functioning a drone CO3: Select appropriate sensors and actuators for Drones CO4: Develop a drone mechanism for specific applications CO5: Create the programs for various drones		
UNIT-1	**INTRODUCTION TO DRONE TECHNOLOGY**	**9 HOURS**
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability		
UNIT-2	**DRONE DESIGN, FABRICATION AND PROGRAMMING**	**9 HOURS**
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.		
UNIT-3	**DRONE FLYING AND OPERATION**	**9 HOURS**
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool – Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications		
UNIT-4	**DRONE COMMERCIAL APPLICATIONS**	**9 HOURS**
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing		
UNIT-5	**FUTURE DRONES AND SAFETY**	**9 HOURS**
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	Daniel Tal and John Altschuld, “Drone Technology in Architecture,	

	Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc.
2.	Terry Kilby and Belinda Kilby, "Make:Getting Started with Drones ",Maker Media, Inc,2016
REFERENCE BOOKS	
1.	John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
2.	Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

MANAGEMENT ELECTIVE (VII SEMESTER)

Course Code	Course Title	L	T	P	J	C
22EMT001	PRINCIPLES OF MANAGEMENT	3	0	0	0	3
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. To sketch the Evolution of Management.
2. To extract the functions and principles of management.
3. To learn the application of the principles in an organization.
4. To study the various HR related activities.
5. To analyse the position of self and company goals towards business.

COURSE OUTCOMES:

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

CO1. Understand managerial functions like planning, organizing, staffing, leading & controlling.
CO2. Have same basic knowledge on international aspect of management.
CO3. Ability to understand management concept of organizing.
CO4. Ability to understand management concept of directing.
CO5. Ability to understand management concept of controlling.

UNIT-1	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9 HOURS

Definition of Management — Science or Art — Manager Vs Entrepreneur- types of managers- managerial roles and skills — Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment — Current trends and issues in Management

UNIT-2	PLANNING	9 HOURS

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process

UNIT-3	ORGANISING	9 HOURS

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT-4	DIRECTING	9 HOURS

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT-5	CONTROLLING	9 HOURS
System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.		
	TOTAL HOURS:	**45 HOURS**

TEXT BOOK(S):	
1	Harold Koontz and Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998
2	Stephen P. Robbins and Mary Coulter, “ Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
REFERENCE BOOKS:	
1	Robert Kreitner and MamataMohapatra, “ Management”, Biztantra, 2008.
2	Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011
3	Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999

Course Code	Course Title	L	T	P	J	C
22EMT002	TOTAL QUALITY MANAGEMENT	3	0	0	0	3
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
2. Explain the TQM Principles for application.
3. Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
4. Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
5. Illustrate and apply QMS and EMS in any organization

COURSE OUTCOMES:

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

CO1. Ability to apply TQM concepts in a selected enterprise.

CO2. Ability to apply TQM principles in a selected enterprise.

CO3. Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.

CO4. Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.

CO5. Ability to apply QMS and EMS in any organization.

UNIT-1	INTRODUCTION	9 HOURS

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.		
UNIT-2	**TQM PRINCIPLES**	**9 HOURS**
Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.		
UNIT-3	**TQM TOOLS & TECHNIQUES I**	**9 HOURS**
The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.		
UNIT-4	**TQM TOOLS & TECHNIQUES II**	**9 HOURS**
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.		
UNIT-5	**QUALITY MANAGEMENT SYSTEM**	**9 HOURS**
Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.		
	TOTAL HOURS:	**45 HOURS**
TEXT BOOK(S):		
1	Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,Mary B.Sacre, Hemant Urdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.	
REFERENCE BOOKS:		
1	Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.	
2	Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth Heinemann Ltd, 2016.	
3	Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.	
4	Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.	

Course Code	Course Title	L	T	P	J	C
22EMT003	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	3	0	0	0	3
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. Understanding the concept of Engineering Economics.
2. Implement various micro economics concept in real life.
3. Gaining knowledge in the field of macro economics to enable the students to have better
4. understanding of various components of macro economics.
5. Understanding the different procedures of pricing.

COURSE OUTCOMES:

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

CO1. Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions

CO2. Evaluate the economic theories, cost concepts and pricing policies

CO3. Understand the market structures and integration concepts

CO4. Understand the measures of national income, the functions of banks and concepts of globalization

CO5. Apply the concepts of financial management for project appraisal

UNIT-1	DEMAND & SUPPLY ANALYSIS	9 HOURS

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity

UNIT-2	PRODUCTION AND COST ANALYSIS	9 HOURS

Production function - Returns to scale - Production optimization - Least cost input – Isoquants Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.

UNIT-3	PRICING	9 HOURS

Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT-4	FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT)	9 HOURS

Balance sheet and related concepts - Profit & Loss Statement and related concepts - - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.

UNIT-5	CAPITAL BUDGETING (ELEMENTARY TREATMENT)	9 HOURS

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.	
TOTAL HOURS:	**45 HOURS**
TEXT BOOK(S):	
1	Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi,2001.
2	Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2007.
REFERENCE BOOKS:	
1	Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011
2	Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3	Zahid A khan: Engineering EconoDonald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
4	my, "Engineering Economy", Dorling Kindersley, 2012
5	Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009

Course Code	Course Title	L	T	P	J	C
22EMT004	HUMAN RESOURCE MANAGEMENT	3	0	0	0	3
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. To provide knowledge about management issues related to staffing,
2. To provide knowledge about management issues related to training,
3. To provide knowledge about management issues related to performance
4. To provide knowledge about management issues related to compensation
5. To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements

COURSE OUTCOMES:

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

CO1. Students would have gained knowledge on the various aspects of HRM

CO2. Students will gain knowledge needed for success as a human resources professional.

CO3. Students will develop the skills needed for a successful HR manager.

CO4. Students would be prepared to implement the concepts learned in the workplace.

CO5. Students would be aware of the emerging concepts in the field of HRM

UNIT-1	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT	9 HOURS

The importance of human resources – Objective of Human Resource Management - Human resource policies - Role of human resource manager.

UNIT-2	HUMAN RESOURCE PLANNING	9 HOURS

Importance of Human Resource Planning – Internal and External sources of Human Resources - Recruitment - Selection – Socialization.		
UNIT-3	**TRAINING AND EXECUTIVE DEVELOPMENT**	**9 HOURS**
Types of training and Executive development methods – purpose – benefits.		
UNIT-4	**EMPLOYEE COMPENSATION**	**9 HOURS**
Compensation plan — Reward — Motivation — Career Development - Mentor — Protege relationships		
UNIT-5	**PERFORMANCE EVALUATION AND CONTROL**	**9 HOURS**
Performance evaluation – Feedback - The control process – Importance – Methods – grievances – Causes – Redressal methods		
	TOTAL HOURS:	**45 HOURS**

TEXT BOOK(S):

1	Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2	John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition, Tata McGraw Hill, 2013, New Delhi.

REFERENCE BOOKS:

1	Luis R,. Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, “Managing Human Resources", 7th Edition, PHI, 2012.
2	Dessler, "Human Resource Management", Pearson Education Limited, 2007.
3	Luis R,. Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, “Managing Human Resources", 7th Edition, PHI, 2012.

Course Code	Course Title	L	T	P	J	C
22EMT005	**KNOWLEDGE MANAGEMENT**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. To understand the process of acquiry knowledge from experts
2. To understand the learning organization.
3. To use the knowledge management tools.
4. To develop knowledge management Applications.
5. To design and develop enterprise applications

COURSE OUTCOMES:

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

CO1. Understand the process of acquiry knowledge from experts

CO2. Understand the learning organization.

CO3. Use the knowledge management tools.

CO4. Develop knowledge management Applications.

CO5. Design and develop enterprise applications

UNIT-1	INTRODUCTION	9 HOURS

The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT-2	CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING	9 HOURS

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT-3	KNOWLEDGE MANAGEMENT-THE TOOLS	9 HOURS

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information

UNIT-4	KNOWLEDGE MANAGEMENT APPLICATION	9 HOURS

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT-5	FUTURE TRENDS AND CASE STUDIES	9 HOURS

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

	TOTAL HOURS:	45 HOURS

TEXT BOOK(S):

1	Srikantaiah, T.K., Koenig, M., “Knowledge Management for the Information Professional” Information Today, Inc., 2000.

REFERENCE BOOKS:

1	Nonaka, I., Takeuchi, H., “The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation”, Oxford University Press, 1995.

Course Code	Course Title	L	T	P	J	C
22EMT006	INDUSTRIAL MANAGEMENT	3	0	0	0	3
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. To study the planning; organizing and staffing functions of management in professional organization.
3. To study the leading; controlling and decision making functions of management in professional organization.
4. To learn the organizational theory in professional organization.
5. To learn the principles of productivity and modern concepts in management in professional organization.

COURSE OUTCOME:

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

CO1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

CO2. Discuss the planning; organizing and staffing functions of management in professional organization.

CO3. Apply the leading; controlling and decision making functions of management in professional organization.

CO4. Discuss the organizational theory in professional organization.

CO5. Apply principles of productivity and modern concepts in management in professional organization.

UNIT-1	INTRODUCTION	9 HOURS

Technology Management - Definition - Functions - Evolution of Modern Management - Scientific Management Development of Management Thought. Approaches to the study of Management, Forms of Organization -Individual Ownership - Partnership - Joint Stock Companies - Co-operative Enterprises - Public Sector Undertakings, Corporate Frame Work- Share Holders - Board of Directors - Committees - Chief Executive Line and Functional Managers,-Financial-Legal-Trade Union

UNIT-2	FUNCTIONS OF MANAGEMENT	9 HOURS

Planning - Nature and Purpose - Objectives - Strategies – Policies and Planning Premises - Decision Making - Organizing - Nature and Process - Premises - Departmentalization - Line and staff - Decentralization -Organizational culture, Staffing - selection and training .Placement - Performance appraisal - Career Strategy – Organizational Development. Leading - Managing human factor - Leadership .Communication, Controlling - Process of Controlling - Controlling techniques, productivity and operations management - Preventive control, Industrial Safety.

UNIT-3	ORGANIZATIONAL BEHAVIOUR	9 HOURS

Definition - Organization - Managerial Role and functions -Organizational approaches, Individual behaviour - causes - Environmental Effect - Behaviour and Performance, Perception - Organizational Implications. Personality - Contributing factors - Dimension – Need Theories - Process Theories - Job Satisfaction, Learning and Behaviour-Learning Curves, Work Design and approaches.		
UNIT-4	**GROUP DYNAMICS**	**9 HOURS**
Group Behaviour - Groups - Contributing factors - Group Norms, Communication - Process - Barriers to communication - Effective communication, leadership - formal and informal characteristics – Managerial Grid - Leadership styles - Group Decision Making - Leadership Role in Group Decision, Group Conflicts - Types -Causes - Conflict Resolution -Inter group relations and conflict, Organization centralization and decentralization - Formal and informal - Organizational Structures Organizational Change and Development -Change Process – Resistance to Change - Culture and Ethics.		
UNIT-5	**MODERN CONCEPTS**	**9 HOURS**
Management by Objectives (MBO) - Management by Exception (MBE),Strategic Management - Planning for Future direction - SWOT Analysis -Evolving development strategies, information technology in management Decisions support system-Management Games Business Process Re- engineering(BPR) –Enterprises Resource Planning (ERP) - Supply Chain Management (SCM) - Activity Based Management (AM) - Global Perspective - Principles and Steps Advantages and disadvantage		
	TOTAL HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	M. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India, NewDelhi, 2009.	
2.	Koontz. H. and Weihrich. H., “Essentials of Management: An International Perspective”, 8th Edition, Tata McGrawhill, New Delhi, 2010.	
REFERENCE BOOKS:		
1	Maynard H.B, “Industrial Engineering Hand book”, McGraw-Hill, sixth 2008	

MANDATORY COURSE I (NON CREDIT COURSE)

Course Code	Course Title	L	T	P	J	C
22MCT001	INTRODUCTION TO WOMEN AND GENDER STUDIES	3	0	0	0	0
		Syllabus version	v. 1.0			

COURSE OBJECTIVES: After studying this course, you should be able to:

To study in detail about the introduction to women and gender studies.

COURSE OUTCOMES: After completion of this course, the students should be able to

1.Will be able to understand the concept of the woman and gender studies.
2.Have in-depth knowledge of feminist theory.
3.Able to understand the women's motivation.
4.Able to know about the gender and language.
5.Able to know about the gender and representation.

UNIT-I	CONCEPTS	9 HOURS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT-II	FEMINIST THEORY	9 HOURS

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT-III	WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL	9 HOURS

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT-IV	GENDER AND LANGUAGE	9 HOURS

Linguistic Forms and Gender. Gender and narratives.

UNIT-V	GENDER AND REPRESENTATION	9 HOURS

Advertising and popular visual media.

TOTAL LECTURE HOURS:	45 HOURS

Course Code	Course Title	L	T	P	J	C
22MCT002	ELEMENTS OF LITERATURE	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

COURSE OUTCOMES: After completion of this course, the students should be able to

Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

UNIT-I	COURSE CONTENTS	9 HOURS

Introduction to Elements of Literature
1. Relevance of literature

a) Enhances Reading, thinking, discussing and writing skills.
b) Develops finer sensibility for better human relationship.
c) Increases understanding of the problem of humanity without bias.
d) Providing space to reconcile and get a cathartic effect.
2. Elements of fiction
a) Fiction, fact and literary truth.
b) Fictional modes and patterns.
c) Plot character and perspective.
3. Elements of poetry
a) Emotions and imaginations.
b) Figurative language.
c) (Simile, metaphor, conceit, symbol, pun and irony).
d) Personification and animation. e) Rhetoric and trend.

UNIT-II	ELEMENTS OF DRAMA	9 HOURS

Elements of drama a) Drama as representational art. b) Content mode and elements. c) Theatrical performance. d) Drama as narration, mediation and persuasion. e) Features of tragedy, comedy and satire.

UNIT-III	READINGS:	9 HOURS

1.1 Textbook:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

1.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

UNIT-IV	OTHER SESSION:	9 HOURS

4.1*Tutorials:
4.2*Laboratory:
4.3*Project: The students will write a term paper to show their understanding of a particular piece of literature

UNIT-V	ASSESSMENT:	9 HOURS

5.1 HA:
5.2 Quizzes-HA:
5.3 Periodical Examination: one
5.4 Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.
5.5 Final Exam:

TOTAL LECTURE HOURS:	45 HOURS

Course Code	Course Title	L	T	P	J	C
22MCT003	FILM APPRECIATION	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century.

COURSE OUTCOMES: After completion of this course, the students should be able to

The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

UNIT-I	Theme - A: The Component of Films	9 HOURS

A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making… structure of a film

UNIT-II	Theme - B: Evolution of Film Language	9 HOURS

B-1: Film language, form, movement etc.
B-2: Early cinema… silent film (Particularly French)
B-3: The emergence of feature films: Birth of a Nation
B-4: Talkies

UNIT-III	Theme - C: Film Theories and Criticism/Appreciation	9 HOURS

C-1: Realist theory; Auteurists
C-2: Psychoanalytic, Ideological, Feminists
C-3: How to read films?
C-4: Film Criticism / Appreciation

UNIT-IV	Theme – D: Development of Films	9 HOURS

D-1: Representative Soviet films
D-2: Representative Japanese films
D-3: Representative Italian films
D-4: Representative Hollywood film and the studio system

UNIT-V	Theme - E: Indian Films	9 HOURS

E-1: The early era
E-2: The important films made by the directors
E-3: The regional films
E-4: The documentaries in India

TOTAL LECTURE HOURS:	45 HOURS

Course Code	Course Title	L	T	P	J	C
22MCT004	WELL BEING WITH TRADITIONAL PRACTICES (YOGA,AYURVEDA AND SIDDHA)	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To enjoy life happily with fun filled new style activities that help to maintain health also
2.To adapt a few lifestyle changes that will prevent many health disorders
3.To be cool and handbill every emotion very smoothly in every walk of life
4.To learn to eat cost effective but healthy foods that are rich in essential nutrients
5.To develop immunity naturally that will improve resistance against many health disorders

COURSE OUTCOMES: After completion of this course, the students should be able to

1.Learn the importance of different components of health
2.Gain confidence to lead a healthy life
3.Learn new techniques to prevent lifestyle health disorders
4.Understand the importance of diet and workouts in maintaining health
5. Learn new techniques of yoga.

UNIT-I	HEALTH AND ITS IMPORTANCE	9 HOURS

Health: Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.

Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.

Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes - Cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.

Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken

UNIT-II	DIET	9 HOURS

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.

UNIT-III	ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH	9 HOURS

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social

Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (TriDosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT-IV	**MENTAL WELLNESS**	**9 HOURS**

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

UNIT-V	**YOGA**	**9 HOURS**

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):

1.	Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2.	Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCE BOOKS:

1.	WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D.Roberts
2.	A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

Course Code	Course Title	L	T	P	J	C
22MCT005	INDIAN CONSTITUTION	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

In this course on Indian Constitution, the students will be known about the Indian constitution and government structures and government systems.

COURSE OUTCOMES: After completion of this course, the students should be able to

CO1: Understand the functions of the Indian government
CO2: Understand and abide the rules of the Indian constitution
CO3: Understand and appreciate different government structures.
CO3: Understand and appreciate different structures and courts.
CO3: Understand the functions of government systems.

UNIT-I	INTRODUCTION	09 HOURS

Historical Background – Constituent Assembly of India – Philosophical Foundations Of The Indian Constitution – Preamble.

UNIT-II	INDIAN CONSTITUTION	09 HOURS

Fundamental Rights – Directive Principles Of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies For Citizens.

UNIT-III	GOVERNMENT STRUCTURES	09 HOURS

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister.

UNIT-IV	STRUCTURES AND COURTS	09 HOURS

Cabinet – Parliament – Supreme Court of India – Judicial Review-High Courts and other Subordinate Courts.

UNIT-V	GOVERNMENT SYSTEMS	09 HOURS

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States.

TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S):

1.	Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2.	R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.

REFERENCE BOOKS:

1.	Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi.

Course Code	Course Title	L	T	P	J	C
22MCT006	INDUSTRIAL SAFETY	3	0	0	0	0
		Syllabus version				v. 1.0

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To Understand the Introduction and basic Terminologies safety.
2.To enable the students to learn about the Important Statutory Regulations and standards.
3.To enable students to Conduct and participate the various Safety activities in the Industry.
4.To have knowledge about Workplace Exposures and Hazards.
5.To assess the various Hazards and consequences through various Risk Assessment Techniques.

COURSE OUTCOMES: After completion of this course, the students should be able to

1.Understand the basic concept of safety.
2.Obtain knowledge of Statutory Regulations and standards.
3.Know about the safety Activities of the Working Place.
4.Analyze on the impact of Occupational Exposures and their Remedies
5.Obtain knowledge of Risk Assessment Techniques.

UNIT-I	SAFETY TERMINOLOGIES	9 HOURS

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects-Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT-II	STANDARDS AND REGULATIONS	9 HOURS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT-III	SAFETY ACTIVITIES	9 HOURS

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan-Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT-IV	WORKPLACE HEALTH AND SAFETY	9 HOURS

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety Toxic gas Release

UNIT-V	HAZARD IDENTIFICATION TECHNIQUES	9 HOURS

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S):	
1.	R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2.	L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education
REFERENCE BOOKS:	
1.	Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2.	Alan Waring.(1996).Safety management system: Chapman &Hall,England
3.	Society of Safety Engineers, USA

MANDATORY COURSE II (NON CREDIT COURSE)

Course Code	Course Title	L	T	P	J	C
22MCT007	ETHICS AND VALUES	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To understand and appreciate the ethical issues faced by an individual in profession, society and polity
2.To understand the negative health impacts of certain unhealthy behaviors
3.To appreciate the need and importance of physical, emotional health and social health

COURSE OUTCOMES: After completion of this course, the students should be able to

1.Follow sound morals and ethical values scrupulously to prove as good citizens
2.Understand various social problems and learn to act ethically
3.Understand the concept of addiction and how it will affect the physical and mental health
4.Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
5.Identify the main typologies, characteristics, activities, actors and forms of cybercrime

UNIT-I	BEING GOOD AND RESPONSIBLE	9 HOURS

Gandhian values such as truth and non-violence – Comparative analysis on leaders of past and present – Society's interests versus self-interests - Personal Social Responsibility: Helping the needy, charity and serving the society

UNIT-II	ADDICTION AND HEALTH	9 HOURS

Peer pressure - Alcoholism: Ethical values, causes, impact, laws, prevention – Ill effects of smoking - Prevention of Suicides; Sexual Health: Prevention and impact of pre-marital pregnancy and Sexually Transmitted Diseases

UNIT-III	DRUG ABUSE AND TECHNOLOGIES	9 HOURS

Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention Hacking and other cyber crimes, Addiction to mobile phone usage, Video games and Social networking websites

UNIT-IV	SOCIAL ISSUES 2	9 HOURS

Corruption: Ethical values, causes, impact, laws, prevention – Electoral malpractices; White collar crimes - Tax evasions – Unfair trade practices

UNIT-V	PERSONAL AND PROFESSIONAL ETHICS	9 HOURS

Dishonesty - Stealing - Malpractices in Examinations – Plagiarism

TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S):

1. Dhaliwal, K.K (2016), "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts, Writers Choice, New Delhi, India.
2. Vittal, N (2012), "Ending Corruption? - How to Clean up India?", Penguin Publishers, UK.

REFERENCE BOOKS:

1. Pandey, P. K (2012), "Sexual Harassment and Law in India", Lambert Publishers, Germany.
2. Pagliaro, L.A. and Pagliaro, A.M (2012), "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological , Developmental and Clinical Considerations", Wiley Publishers, U.S.A.

Course Code	Course Title	L	T	P	J	C
22MCT008	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

1.To understand the concepts and perspectives in India.
2.To understand the historiography of science in India.
3.To understand the science and technology in ancient, Medieval and colonial India

COURSE OUTCOMES: After completion of this course, the students should be able to

1. Understand various concepts and perspective history of science in India.
2.Understand historiography of science and technology in India
3. Understand the science and technology in ancient India.
4. Understand the science and technology in medieval India.
5. Understand the science and technology in colonial India.

UNIT-I	CONCEPTS AND PERSPECTIVES	9 HOURS

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT-II	HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA	9 HOURS

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT-III	SCIENCE AND TECHNOLOGY IN ANCIENT INDIA	9 HOURS

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT-IV	SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA	9 HOURS

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT-V	SCIENCE AND TECHNOLOGY IN COLONIAL INDIA	9 HOURS

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

TOTAL LECTURE HOURS:	45 HOURS

Course Code	Course Title	L	T	P	J	C
22MCT009	POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

COURSE OUTCOMES: After completion of this course, the students should be able to

The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

UNIT-I	INTRODUCTION	9 HOURS

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems.

UNIT-II	CAPITALISM	9 HOURS

Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. Fascism and totalitarianism. World war I and II and cold war.

UNIT-III	COMMUNISM	9 HOURS

Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

UNIT-IV	WELFARE STATE	9 HOURS

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)
Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature.

UNIT-V	CICILIZATION	9 HOURS

Essential elements of Indian civilization, Technology as driver of society, Role of education in shaping of society. Future directions.

TOTAL LECTURE HOURS:	45 HOURS

Course Code	Course Title	L	T	P	J	C
22MCT010	STATE, NATION BUILDING AND POLITICS IN INDIA	3	0	0	0	0
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System.

COURSE OUTCOMES: After completion of this course, the students should be able to		
It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.		
UNIT-I	**INTRODUCTION**	**9 HOURS**
Understanding the need and role of State and politics. Introduction to the state, nation building and politics in India.		
UNIT-II	**ORGANS OF STATE**	**9 HOURS**
Development of Nation-State, sovereignty, sovereignty in a globalized world. Organs of State – Executive, Legislature, Judiciary.		
UNIT-III	**NATION BUILDING IN INDIA**	**9 HOURS**
Separation of powers, forms of government unitary-federal, Presidential-Parliamentary, The idea of India. 1857 and the national awakening. 1885 Indian National Congress and development of national movement – its legacies.		
UNIT-IV	**FEDERAL SYSTEM**	**9 HOURS**
Constitution making and the Constitution of India. Goals, objective and philosophy. Why a federal system? National integration and nation-building.		
UNIT-V	**POLITICS IN INDIA**	**9 HOURS**
Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?		
	TOTAL LECTURE HOURS:	**45 HOURS**

Course Code	Course Title	L	T	P	J	C
22MCT011	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**0**	**0**
		Syllabus version			**v. 1.0**	
COURSE OBJECTIVES: After studying this course, you should be able to:						
1.To provide students an exposure to disasters, their significance and types. 2.To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction 3.To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) 4.To enhance awareness of institutional processes in the country and 5.To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity						
COURSE OUTCOMES: After completion of this course, the students should be able to						

1.Differentiate the types of disasters, causes and their impact on environment and society
2.Assess vulnerability and various methods of risk reduction measures as well as mitigation.
3.Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.
4.Know about the disaster risk management in India.
5.understand the applications and case studies and of works of disaster management.

UNIT-I	INTRODUCTION TO DISASTERS	9 HOURS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT-II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9 HOURS

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT-III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9 HOURS

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-IV	DISASTER RISK MANAGEMENT IN INDIA	9 HOURS

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes 106 and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment

UNIT-V	DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9 HOURS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):

1.	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN13: 978-9380386423

2.	Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
REFERENCE BOOKS:	
1.	Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2.	Government of India, National Disaster Management Policy,2009.